DDR 2012

2nd INTERNATIONAL CONFERENCE ON DESIGN, DEVELOMENT & RESEARCH

HOSTED BY FACULTY OF INFORMATICS & DESIGN

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY (CPUT), CAPE TOWN, SOUTH AFRICA

September 4- 5, 2012

Editor
Edward Appiah

First published 2012

ISBN: 978-0-620-52128-4

Published by
Design, Development & Research Conference
C/o Faculty of Informatics & Desiagn
Cape Peninsula University of Technology (CPUT),
Cape Town,
South Africa
Website: www.design-development-research.co.za

The copyright for papers in this publication belongs to the authors of the papers

Correspondence

All correspondence relating to the DDR Conference should be addressed to:
Ms Munira Allie,
Faculty of Informatics & Design,
Cape Peninsula University of Technology,
Cape Town,
South Africa
Email: alliem@cput.co.za
Office: +27 (021) 469 1051
Fax: +27 (021) 469 1002

Declaration

All papers in this publication have been peer-reviewed involving initial screening of abstracts, review by at least two referees, modifications of papers by authors and re-evaluation of re-submitted papers to ensure quality of content.

WELCOMING MESSAGE FROM THE DEAN OF FID

The Faculty of Informatics and design is proud to host its 2nd Design, Development and Research conference! With this conference we wish to further contribute to the growth of design and development as research disciplines. Too often design and developments are regarded as means to an end, and too seldom do we concentrate on the theories that underpin what we do.

As was the case last year, this year we once again have a conference which is of an interdisciplinary nature, with topics ranging from engineering and planning through to fine arts. It is indeed pleasing to note how cross-disciplinary papers use input from various disciplines to develop unique solutions. Then of course the "Dilemma" track which encourages "out-of-the-box" thinking.

In line with our vision to be "at the heart of design, technology, education and innovation in Africa" this conference has given us the opportunity to bring together some of the most important experts in the field of design for development, and design education in the world, and we welcome each one of you to the fairest Cape.

I will like to thank each and everyone involved in the arrangements of the conference, and to express the hope that we continue to grow from strength to strength with the future DDR conferences.

SPECIAL THANKS

Mrs Leigh Desai, for the DDR brand material and all designs
Mrs Amanda Moris, for her assistance with the conference booklet
Mr Jan Myburgh for his assintance with exhibition
Mr. Edward Appiah for his assistance in editing the abstracts;
Mr Jacques Newman and Mr Edwin peacock for their assistance
Ms Marian Pike and Ms Raisa hatley for their contributions during the initial planning phase
Megadigital for printing

SPONSORS

Cape Town Partnership
The Fringe
Extended Curriculum Programme: Graphic Design
WTF Media Conference
Earthworks Magazine

CONFERENCE ORGANISING COMMITTEE

- Mr. Colin Daniels (Conference Chair)
- Prof. Johannes Cronje
- Mr. Bruce Snaddon
- Ms Jolanda Morkel
- Prof. Nhlanla Mlitwa
- Dr. Eunice Avala
- Prof. Pieter van Brakel
- Mr. Edward Appiah
- Ms. Veda Naidoo
- Mr. Rael Futerman
- Prof. Jorn Messeter
- Ms. Andrea Broom
- Ms Edwine Simon
- Mr Bonniface Kabaso
- Mr Francois de Flamingh
- Mrs. Munira Allie
- Mr Adrian Mandy
- Mr. Roux Rossouw
- Ms. Wardah Peck

DDR 2012 EDITORIAL POLICY

The Editorial committee of the Conference on Design, Development and Research (DDR 2012), upheld the following principles and editorial procedures:

- The Editorial committee consists of invited senior subject specialists from a broad spectrum of local and international universities and research institutions
- In order to ensure a high standard, all manuscripts of the proposed conference papers are sent for evaluation to those members of the Editorial Committee, who are specialists in a particular area of the conference theme
- The Evaluation Form‘ is completed by the evaluators and forwarded to the track directors of the Editorial Committee, reflecting the rating on a 10-point scale of the quality and contents of the intended paper; how well it fit into the theme and subject of the conference.
- Upon receipts of at least 2 evaluators the evaluations are compared. If the reviews of the evaluators differ substantially, the paper is sent for review to additional evaluators
- After considering the evaluation of all reviewers the paper is either accepted, or rejected or sent back to the author for improvements in line with the recommendations made by the reviewers. The track directors later check for the approval according to the reviewers recommendations after resubmission. The final peer-evaluated and refereed papers are collated in this proceedings document.

Review Committee Members

Abhishk Shrivastava	Industrial Design Centre, Indian Institute of Tech., Bombay
Annadine Vlok	Cape Peninsula University of Technology, South Africa
Andrew Smith	CSIR Meraka Institute, UNISA, South Africa
Andrea Broom	Cape Peninsula University of Technology, South Africa
Anton Delen	Cape Peninsula University of Technology, South Africa
Bhavin Kothari	National Institute of Design, India
Bruce Snaddon	Cape Peninsula University of Technology, South Africa
Catherine Newman	KAUST, Saudi Arabia
Cheryl Brown	University of Cape Town, South Africa
Eddie Appiah	Cape Peninsula University of Technology, South Africa
Edwine Simon	Cape Peninsula University of Technology, South Africa
Elsabe Pepler	Vegas School of Branding, Cape Town
Eric Francis Eshun	Kwame Nkrumah University of Science & Tech., Ghana
Eunice Avala	Cape Peninsula University of Technology, South Africa
Fatima Cassim	University of Pretoria, South Africa
Gwendolyn Kulick	Beaconhouse National University Sch of Visual Arts
HÃ¥kan Edeholt	The Oslo School of Architecture and Design, Norway
Hermie Voulgarelis	Cape Peninsula University of Technology, South Africa
Hillar Addo	Accra Institute of Technology, Ghana
Ifeoma Ebo	American Institute of Architects, USA
JAnet Van Graan	Cape Peninsula University of Technology, South Africa
Jared Donovan	Queensland University of Technology, Australia
Jianhua Shao	University of Nottingham, UK
Johann van der Merwe	Cape Peninsula University of Technology, South Africa
Johannes Cronje	Cape Peninsula University of Technology, South Africa
Jolanda Morkel	Cape Peninsula University of Technology, South Africa
Jorn Messeter	Cape Peninsula University of Technology, South Africa
Joshua Singer	San Francisco State University, USA
Ken Badley	George Fox University, USA
Keneilwe Munyai	Cape Peninsula University of Technology, South Africa
Keri Valentine	University of Georgia, USA
Kwasi Opoku Amankwa	Kwame Nkrumah University of Science & Tech., Ghana
Laurie Lynn Barusse	Senior Director of Education, South Africa
Lynette Nagel	Cape Peninsula University of Technology, South Africa
Mugendi M'Rithaa	Cape Peninsula University of Technology, South Africa
Nhlanhla Mlitwa	Cape Peninsula University of Technology, South Africa
Nor Alias	Universiti Teknologi MARA
Patabi Raman	Cape Peninsula University of Technology, South Africa
Rejoice Nsibande	University of Pretoria, South Africa
Rael Futerman	Cape Peninsula University of Technology, South Africa
Richie Moalosi	University of Botswana
Rob Branch	University of Georgia, USA
Rodrigo Santos	Instituto Federal de Santa Catarina - IFSC
Roux Rossouw	Cape Peninsula University of Technology, South Africa

Travis Noakes	University of Cape Town, South Africa
Vasudha Gokhale	College of Architecture, Pune, India
Vikki du Preez	Cape Peninsula University of Technology, South Africa
Zeundjua Tjiparuro	Rural Industries Promotions Company, Botswana

Table of Contents

WELCOMING MESSAGE FROM THE DEAN OF FID iii

The information architecture of transdisciplinary design practice: rethinking Nathan Shedroff's Continuum of Understanding
Terrence Fenn and Jason Hobbs 1

Indigenous knowledge and design: humanising the story behind the aesthetic facade
Keneilwe Munyai and Mugendi M'Rithaa 17

Information and communication technology and the turbulence of the ideation phase of graphic design
Edward Appiah and Johannes Cronjé 11

Process modelling as an evolutionary systemisation for design in a demanding situation .....
Complexity and chaos .....
Shohre Shahnood and Andy (A. A. J. F.) van den Dobbeisteen 23

Design through storytelling .....
Richie Moalosi, Mugendi M'Rithaa and Boikenyo Morekoo 33

Considered spontaneity: the new role of the product designer .....
Shritha Gunyana and Mugendi M'Rithaa 46

Is ICT eating up our design pedagogy? .....
Edward Appiah and Johannes Cronjé 58

The Role of Creative Problem Solving Skills among the Youth as a vehicle for Industrial Transformation in Kenya .....
Rose Oduho and Raphael Ogutu 67

Reflecting on the need for inclusion of interior designers to the multi disciplinary retail design discourse in South Africa .....
Ilse Prinsioo 77

Television Identity as a complex sign: moving images, sound and texts increasing the effectiveness of communication .....
Raquel Ponte 86

Evaluation of some indigenous tree species for street planting in the city of Kumasi, Ghana .....
Sam Sarkodie Mensah and Hannah Vic Adzraku 98

Setting up a curriculum-integrated design-build research studio: planning and lessons learnt so far .....
Rudolf Perold and Hermie Voulgarelis 108

Mapping ADDIE to the entrepreneurial process: a teaching approach for design students in a business studies programme .....
Michelle barnes and Jay Barnes 116

Engineering and Technology Students Cognitive and Learning Styles .....
Oanthata J. Seeletsa and Richie Moalosi 129

Relevance and philosophical views of design science research 141
Christian Sita Mampuya

Design research and research design - bringing the two together 150
Johannes Cronjé and Ilze Oberholze

The relevance of constructivism as an epistemological approach in design research: a case study 161
Marinda Pretorius and Ria van Zyl

Urbanity, design and inclusion: Mediating the physical and social bases ofurban planning through density and diversity lenses and sensibilities 169
Nigel Tapela and Anzabeth Tonkin

A case for establishing an incubator as a catalyst to develop sustainable fashion SMMEs 181
Shamil Isaac

DESIS-Africa: Design Thinking For Social Innovation and Development 192
Lorraine Amoro Ambole, Mugendi M'Rithaa, Richie Moalosi and Shorn Molokwani

Linking classroom and community: an exploration of the similarities between service learning and a human-centered design methodology in contemporary design education 201
Fatima Cassim and Anneli Bowle

Encouraging engagement. 214
Vikki du Preez and Veronica Barnes

A student-grown Facebook forum in an architecture class: seed or weed? 226
Lynette Nagel and Mia Vester

Digital storytelling and authentic learning: A case study in Industrial Design 236
Veronica Barnes, Daniela Gachago and Eunice Ivala

Innovative business models: the ambush of disruptive technologies on business. 246
Errol Francke and Bennett Alexander

Towards Contextual Alignment of an Undergraduate ICT Curriculum for Universities of Technology in South Africa 259
Denise Lakay and Bennett Alexander

Online portfolio appropriation: Visual Arts classroom changes and conversations 266
Travis M Noakes

The information architecture of transdisciplinary design practice: rethinking Nathan Shedroff's Continuum of Understanding.

Terence Fenn and Jason Hobbs
Department of Multimedia,
University of Johannesburg,
South Africa
tfenn@uj.ac.za

Abstract

Transdisciplinary design practice requires different approaches and different subject to the teaching of traditional discipline-orientated design. It is the authors' contention that the field of Information Architecture Design contains many of the cognitive decision making tools required for a transdisciplinary design practice and that the effectiveness of IA's cognitive tools in the teaching of broader design practice is a rich and relevant focus for design research.

In this paper, Nathan Shedroff's Continuum of Understanding is used as a conceptual model to firstly identify and then discuss aspects of transdisciplinary design practice such as problem locating, synthetic solutioning and the role of subjectivity in design. Aspects and dispositions that tend to hinder the development of transdisciplinary practice in design education are briefly introduced. The outcome of the discussion is an amended model representing the synthetic development of design solutioning and a set of heuristics to guide practice. The presented heuristics are further unpacked in an analysis that explains to what extent and in which forms they exist in the practice of Information architecture.

Keywords

Transdisciplinary design practice, information Architecture, data and information, analysis and synthesis, meaning-making, design thinking.

Introduction

In the decade since the publication of Robert Jacobson's *Information Design* (1999) the practice of design has undergone a radical conceptual shift that tertiary design educational institutes are only beginning to contemplate. In this time design has transformed from a practice that emphasised aesthetic and product to a discipline that's primary identity is formed around transdisciplinary[1] problem solving that effectively, empathetically and sustainably seeks to improve the life experience of people.

Over the last ten years many of the positions articulated in *Information Design* have proven to be highly accurate and exemplified in many of the emerging fields of design such as Human Computer Interactions, User Experience, Service Design and Ubiquitous Computing. Featured in *Information Design*, Nathan Shedroff's *Continuum of Understanding* served as a fundamental conceptual model for a conceptualisation of design as an act of meaning making within which, the designer and users share agency. In this paper, as a departure point, the authors present an amended *Continuum of Understanding* that reflects the shift over last two decades towards an understanding of design as a transdiciplinary practice rather than a field specific one. These amendments to the conceptual model are informed and explained in reference to a range of

[1] **The term *transdisciplinary* is used in this paper to describe a design practice that incorporates the fundamental characteristics of a transdisciplinary practice also evident in transdisciplinary research as described by Wickson, Carew and Russell (2006). The key features of a transdisciplinary practice would include an explicit intent to solve problems that are complex, multidimensional and not confined to a single disciplinary framework (1048); contain a evolving methodology and epistemologies (1049-1050); and involves collaboration that considers and includes people affected by the research [design] (1051).**

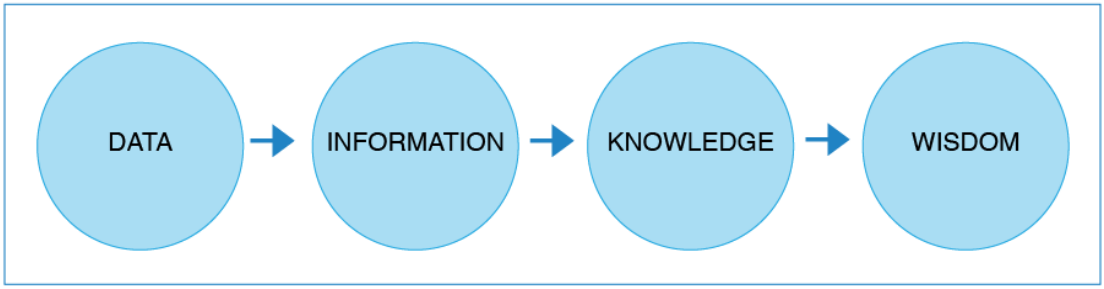
descriptions of design cognition articulated by design theorists that include Nigel Cross (2006), Richard Buchanan (1992), Neil Brown (2000), Hans Rittel and Mervin Webber (1973) and Johann van der Merwe (2010). The presented theories introduce design as a field of practice embedded in the complexity of social reality and primarily disposed towards transdisciplinary modes of practice in order to solve indeterminate problems in radically innovative ways, through the reductive remediation of contextual data generated by the problem whilst simultaneously and iteratively synthesising the formation of meaning that evolves into the design solutions.

Transdisciplinary practice, as this paper will discuss, requires different approaches and different subject to the teaching of traditional discipline-orientated design. It is the authors' contention that the field of Information Architecture Design contains many of the cognitive decision making tools required for a transdisciplinary design practice and that the effectiveness of IA's cognitive tools in the teaching of broader design practice is a rich and relevant focus for design research.

Part 1, Section 1: A conceptual model for cognitive synthesis in design.

In *Interaction Design: A Unified Field Theory of Design*, Nathan Shedroff (1992: 271) provides a diagrammatic model titled the *Continuum of Understanding* (see, Figure 1) that is a representation of what Shedroff has identified as the four stages of understanding. The core concepts represented in Shedroff's continuum model is that information is a meaningful formation constructed by a designer from an assortment of data. However the value of the information presented is reliant on the extent, to which the direct and underlying concepts that inform the 'meaning' in the formation can be understood, contextualized and applied by the end- user (1992: 271).

Figure 1. Nathan Shedroff's Continuum of Understanding (adapted)



In this paper, Shedfroff's model is amended to create a new conceptual model, which will be used throughout the first section of this paper to represent fundamental principles of transdisciplinary problem solving. Although the focus of our amendment and the scope of our discussion will be the first two stages of continuum, namely *Data* and *Information* they are discussed in reference to the human- centered notions embedded in the latter two stages.

Data, as described by Shedroff (1994: 3) is the raw material used to create or build communication with and is the "*the product of discovery, research, gathering, and creation*". In this paper, the term *Data* is used in a more inclusive sense then Shedroff may have intended as we include all the raw materials of design, physical or abstract, under the definition. In this view, the patina of a piece of Yellow Wood is just as much data as an interviewed user's response.

Part 1, Section 2: Design problems are embedded in social practice.

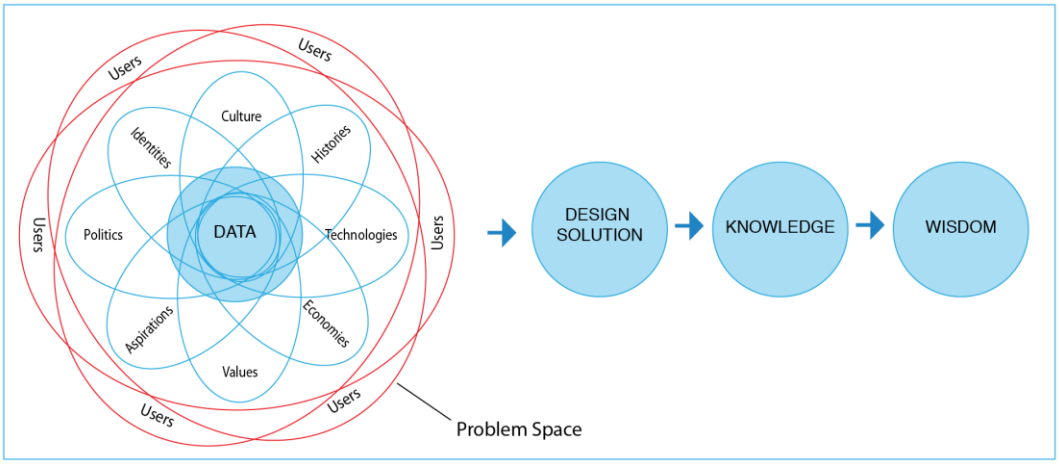
In *Dilemmas in a General Theory of Planning*, Rittel & Webber (1973: 159) describe the complexity of solving design problems as a socially relevant matter:

"We have been learning to see social processes as the links tying up open systems into large and interconnected network of systems, such that outputs of one become inputs of another. In that structural

framework it has become less apparent where problem centers lie, and less apparent where and how we should intervene even if we know what aims we seek"

In this sense, the data of a design process can be considered to be the raw information existing within the structural framework of the social reality of the end- users, designers, and other agents affected by the problem and any potential solution and is *the complexity of the problem*. Figure 2 illustrates a range of the categories from within which relevant data may emerge.

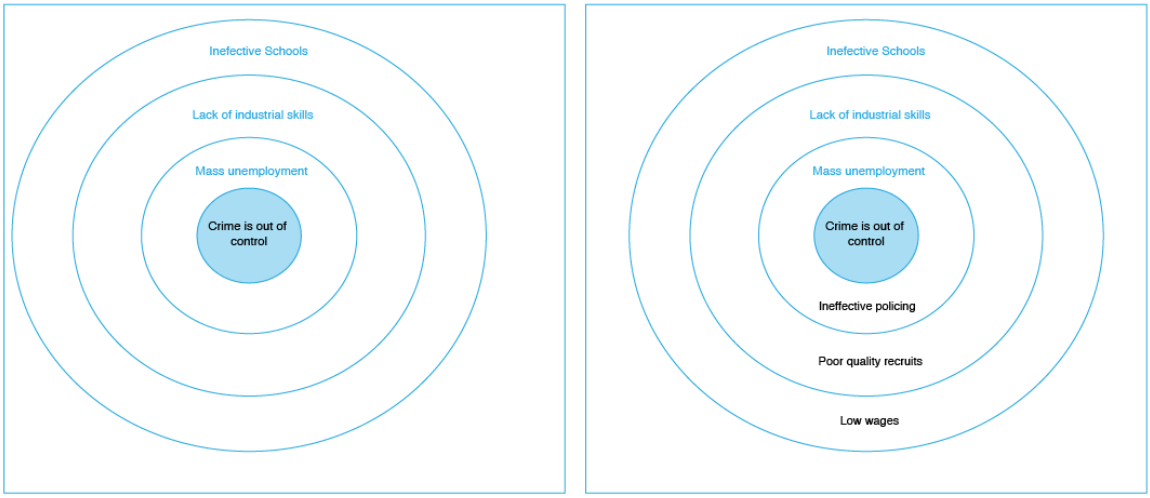
Figure 2: The social complexities of the Data stage.



Rittel & Webber (1973:153,160) describe the process of understanding the problem, which can be consider as defining the data set most applicable to the design process, as ill- defined and reliant on subjective agreement. Defining social problems, Rittel & Webber continue, can in itself be a difficult task as the nature of societal problem are often elusive (Rittel & Webber, 1973: 165), since what initially may appear to be the problem to solve may actually be a result of a different problem at a higher problem level. For example, as shown in Figure 3[2], a spiraling inner city crime problem may actually be the result of a legacy of poor schooling in the area. Furthermore, Rittel and Webber (1973: 161) describe these societal problems as indeterminate in nature, as having any number of potential solutions and many different possible solutions as illustrated in Figure 4.

Figure 3: Different levels of a problem and Figure 4: The alternative understanding of a problem levels

[2] **The Authors whish to acknowledge that the example shown in Figures 3 & 4 is loosely based on an example described by Richard Buchanan in *Wicked Problems* (1992).**



Subsequently, the process of recognising the relevancy of data moves beyond mere identification to involve subjective decision-making activities such as selection, prioritizing and strategizing, as in reality, the complexity involved in the understanding of social systems, as represented in Figure 2, would be impossible to consider in its entirety.

Part 1, Section 3: Solving indeterminate problems

Designers solve complex social problems through synthesis

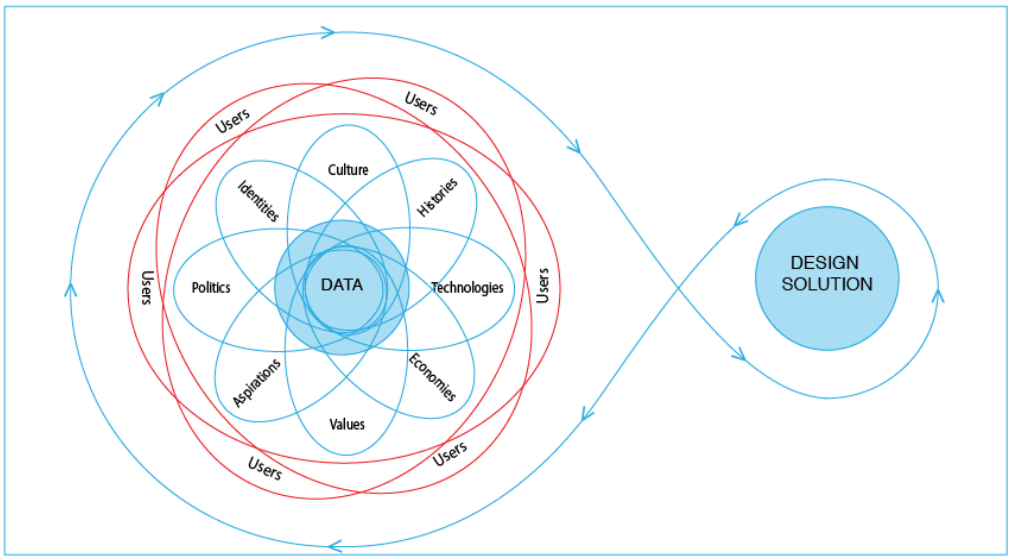
Returning to Shedroff and his continuum, *Information* can be understood as a considered interface, formed by and representative of the designer's cognitive intention that the end- user is presented with. This paper applies this interpretation but also broaden the use of the term to not only include information design but all forms of design interface[3] or *touch points*. Therefore our conceptual model as shown in Figure 5 conveys the notion, that all design solutions are the interfaces of the designers' synthesis of selective data into, conceptual, organizational or physical formations.

Rittel and Webber emphasise the relationship of understanding the contexts of design problems (i.e. the Data) and the formation of a design solutions however they place both the context of the problem and any potential solution within an iterative loop that cyclically edits the understanding of both. They (1973: 161) describe the requirements of design problem solving as follows:

"One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve."

Figure 5: A representation of a problem and solution pairing

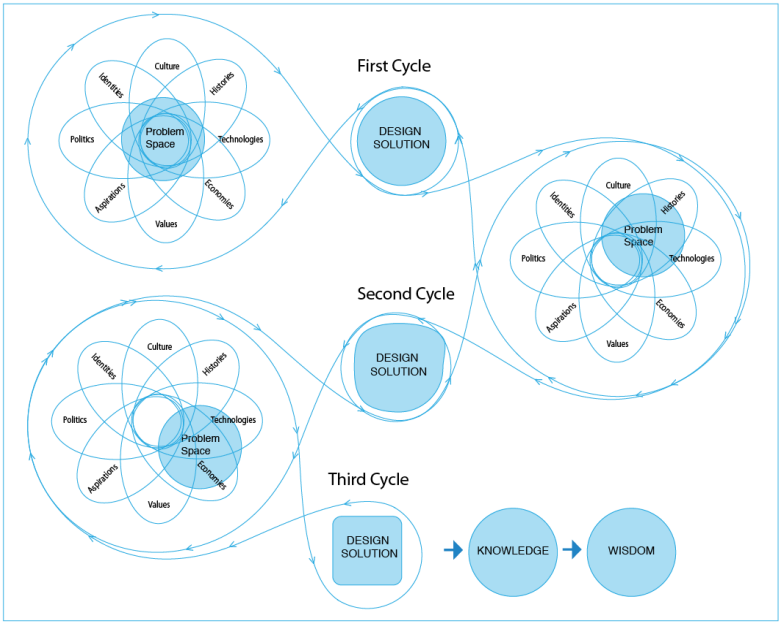
[3] **Elzbieta Kazmierczak in *Design as Meaning Making: From making things to the design of thinking* (2003) refers to design as *cognitive interfaces* in a very similar approach to the one advocated in this paper. Interesting, although focused on Communication Design Specifically and what would be in our interpretation the last two nodes of Shedroff's model, Kazmierczak arrives at similar outcomes. I.e. that Design is foremost about meaning making not objects, that diagrammatic reasoning is important in design thinking that is not about product making, and lastly that there are *'inadequate rational tools'* to bridge this gap (45).**



Nigel Cross (2006: 79) observes that this type of problem/solution conjecture as typical of the thinking employed by designers, as designers are 'solution- focused'. The relationship between the problem and that of the solution aids in radically reducing the data range of wicked problems. Cross and Kies Dorst (in, Cross, 2006: 79), describe the stages of defining mutual problems and solutions as:

"The designer starts by exploring the [problem space], and find, discover, or recognize a partial structure. That partial structure is then used to provide them also with a partial structuring of the [solution space]. They consider the implication of the partial structure within the solution space, use it to generate some initial ideas for the form of a design concept, and so extend the partial structuring… They transfer the developed partial structure back into the [problem space] and again consider implications and extending the structuring of the [problem space]. Their goal…. Is to create a matching problem-solution pair

Figure 6: Amended model showing three iterations of a problem solution matching. The iterative cycles could in reality be many more (or less) the three illustrated



The formulation of matching problem-solutions is a cognitive process that creates design solutions by iteratively reducing the range of relevancy though analysis while simultaneously forming meaning (the solution) through synthetic construction as represented in Figure 6. Reduction in this sense does not entail a simplification or discarding of aspects of the base of data but rather a lessening the complexity load through categorization, organization and prioritizing.

Importantly, problem-solutions can also be viewed in less binary way then Cross's 'pairs'. Often there can often be multiple problems centres that can be addressed simultaneously for example, referring back to Figures 3 and 4, the problem of crime could be solved by finding solutions for problems that occur across the various levels. Problems can also have different solutions within in the same design as seen in any website with more than one approach to navigation or the various ways that one can save a file in Microsoft word (Icon, Menu Tab, keyboard shortcut, etc.).

The final solution is most often comprised of multiple sub-solutions with enormous dependencies in the larger networked system, composed into one new harmonious structure; a new solution-ecology.

Part 1, Section 4: Towards transdisciplinary practice

Although, the introduction of problem and solution matching limits the data existing in a problem ecology to only that which is relevant, it also introduces an additional layer of complexity derived from the agency of the designer. As Rittel and Webber declare, "*The information needed to understand the problem depends upon one's idea for solving it"* (1973: 161), thus the influence of the designer is integral in the determination of '*elusive political judgments'* (Rittel and Webber, 1973: 160) that define the strategy and tactics of the design solution.

While students of design naturally have a deep and meaningful experience of the world, their experience of design is primarily informed by their exposure to design education. Therefore how they are taught design and what they are taught design is, forms a large part of their 'unconscious knowledge' of design and their subsequent ability to formulate new design knowledge. Therefore the disposition of their design education enforces the student's ability to formulate design solutions that in turn assist in formulating and understanding the design problem.

Students, in our experience, struggle to solve complex social problems in innovative ways. Principally, we believe this is because they have limited exposure to any form of design education that is disposed towards radical innovation or complexity. Exposing students only to modes of thinking that support continuous innovation may be useful when apprenticing the student to a discipline falls short in providing the student with abilities to solve problems that originate from society.

The subsequent section of this argument discusses a number of the theoretical concerns of design thinking that question the dispositions of design education with regards to developing radical innovation design solutions, as opposed to merely generative solutions.

In *Wicked Problems* (1992), Richard Buchanan re-emphasises the importance of the principles introduced by Rittel and Webber for treating design problems and solution as iterative and systemic due to their indeterminate nature. Buchannan advocates these design principles in order to stimulate radical innovation by negating the temptations of applying assumptive design solutions (1992:10) to complex problems. In addition to these principles, Buchannan questions the designer who relies on predetermined discipline orientated design solutions, describing the results of this dependence as '*mannered imitations of an earlier invention that are no longer relevant to the discovery of specific possibilities in a new situation*' (1992:12). Buchanan, terms this approach to design as *categorical* design[4]. A design category in this sense can be considered a default design product or service. They are generic built-in discipline solutions such as posters, websites or chairs for example.

Applying *categories* of design automatically in response to design problems, without a rigorous investigation into the nature of the problem, implies that design problems all share the same problem data set and are consistently alike.

[4] **Nigel Cross (2006: 82) similarly describes what he terms the 'fixation' effect, a phenomenon that limits particularly inexperienced designers to "*reuse features of existing designs rather then explore the problem and generate new features*" as problematic**

The crux of Buchannan's (1992:12) thinking is that the conceptualisation of design practice is fundamentally flawed. Rather than a collection of different fields of practice that have their own built in product solutions, design is a field of practice within which, the fundamental activity is the conceptualisation and development of solutions purely in response to the contexts of the particular problem at hand. Johann van der Merwe[5] in a *Natural Death is Announced* (2010) similarly describes design as a discipline-neutral groundless field of knowledge that constantly sources knowledge, skills, practices and contexts from other fields of knowledge as dictated by the location of *the 'specific design problem'* (2010: 8). Design, we suggest can therefore be considered a field of practice that is inherently transdisciplinary in nature as each design problem is situated within its own constructed discipline that is uniquely different to any other constructed discipline.

Therefore as reflected in the amended continuum (Figure 6) the locating of the design problem as specific insures that the data set is always unique. Analyzing the data of the problem allows for decision-making. However although design decision-making is curated through an understanding of what is, the subjectivity of the designer coupled with the indeterminate nature of design problems requires a cognitive leap to what will be, and what will be accepted. Solutions therefore are synthetically formed through an understanding of a problem rather than generically applied to problems. At a certain level all design is therefore an act of meaning making.

This view of design is often absent in tertiary design education. Neil Brown (2002) speculates that this is because of the difficulty of re-purposing design education as a systemic enquiry and conceptualisation of design problems. Brown declares: *"This problematizes practical education insofar as practices present curriculum with no step-wise structure."* however he maintains that there is no alternative to conceptualizing design as a transdisciplinary, socially constructed activity as in reality there can be no functional separation between design practice and the cultural consumption of the design (Brown, 2002).

To re-contextualise design as a primarily trans-disciplinary, socially relevant approach to problem solving that is disposed towards radically original innovative solutions requires an awareness of a number of fundamental principles that orientate the design decision making process. These principles and the subsequent modes of cognition that are required to support them include:

Design problems are embedded in social practice. Design problems are therefore evasive and complex as opposed to closed and capable of having discipline specific pre-fabricated solutions. Understanding the characteristics of a design problem involves an analytical analysis of the social structures, agents and contexts.

Designers solve complex social problems through synthesis. Design solutions are synthetically constructed formations informed by the analytical understanding of the design problem.

A transdisciplinary approach is required for solving indeterminate problems
Design is not a discipline specific field of practice but is rather a field of practice that combines all forms of creativity to solve the problems of people in appropriate and meaningful ways. Consequently, design can be understood as an act of *meaning–making* in which, data derived from the complexity of the world through analyses is synthesized in reference to and in connection with the complexities that exist in the field of design. This process of restructuring of the data into new knowledge formations (be they textual, ecological, organizational or artefactual), that people can use in a manner consistent with their experience of the world is inherently what the practice of design is fundamentally concerned with.

Part 2, Section 1: The field of information architecture
The term information architecture (and information architecture design) is being used in this paper in the sense first outlined by Richard Saul Wurman in his book 'Information Architects' where he described an

information architect as *"…someone who enables data to be transformed into understandable information.*" (1996). Wurman uses the term to cover the design of information across a variety of media (predominantly print) where the practices of information architecture and information design overlap greatly.

The term, and the practice of information architecture design (IA), has developed substantially with later texts such as 'Information Architecture for the World Wide Web' (Rosenfeld and Morville 2002) which emerged from the growing need for a set of skills that relate directly to design in information spaces of a digital nature including but not limited to websites, software and mobile applications. In their book, Rosenfeld and Morville defined information architecture as "the structural design of shared information environments".

In the design industry, it is probably fair to say that today the term has come to be most closely related to design in and for digital environments, within the larger umbrella practice of user experience design[6], because of the proliferation of the Web and the devices, technology and infrastructure that have become accessible to so many. As a practice, information architecture design has also grown so substantially because of the need for those skills in solving indeterminate design problems[7] that proliferate in the digital domain.

IA may be viewed as having three distinct but mutually inclusive dimensions (amongst potential others), which we will term bounded, cross-channel and poetic IA:

Bounded IA tends to address single spaces of interaction and experience (for example a website, a mobile application or an intranet). It may derive its content and functionality from one or more sets of data however they manifest in that single space and the (IA) design is intended for that environment. In these circumstances the use and purpose of the IA intervention is clear and the design is outcomes-based.

Cross-channel IA offers models of structure and organisation that endures across multiple environments and data sets be they digital or non-digital.[8] For example, a business requiring a pervasive IA across call centres, physical retail stores, a website and mobile application.
Poetic IA is unbounded, without physical or digital context and abstract in the sense that it is interested in the pure structure of data (potentially abstracted from a distinct outcomes based objective). It is principally concerned with composing meaning as an end in itself, in an undirected yet structural, semantic and ontological way. It is rare that one will find examples of poetic IA in a stand-alone manner and yet the shift it provides to one's experience of new formations, and the meaning they hold, is profound enough to warrant identification and categorization here. An example of poetic IA could be the creation of a taxonomy that breaks from conventions within an industry sector for instance.

As applied in this paper, these three dimensions can operate in isolation or in part or whole together. In designing a solution for a bounded IA project (for example a mobile application) one may be required or will appeal to pre-existent structures that already pervade related media (cross-channel IA), where a significant

[6] The term 'information architecture' is still associated with print media in information design communities of practice and is also applied in the fields of IT and Application Architecture however for a different role, practice and set of skills. Our use of the term does not span the latter

[7] Indeterminate, complex or wicked problems are understood in this paper to refer to problems that have multiple stakeholders and multiple users (people who experience the problem as part of their attempt at goal achievement), large amounts of data related to the system where the same system lacks predictability.

[8] Resmini and Risoti have recently published what to date is the definitive text of pervasive IA and although the use of the term above does recall some concepts in their book it in now way is attempting to use the term as they may. For a full account of their definition read their book. At WIAD Johannesburg 2012 Mini Conference held at the University of Johannesburg 0n 11/02/2012, Resmini used the analogy of the rules of chess pervading although the experience is radically different when played on a board between two people, on a computer, against a computerized opponent and played in a park with a life-sized board.

shift in 'poetic' meaning could occur nonetheless just in that bounded instance. Or one may be required just to create a pervasive IA solution that can be used by other designers to inform bounded projects.

Part 2, Section 2: Indeterminacy and the role of IA

IA shares with design thinking,[9] a view of problems as systemic and being rooted in social realities. IA, when practiced, is most often goal driven and applies models of research, organization and feedback to understand and explore the system or systems in which the problem exists. IA solutions are understood to be transient, iterative and evolving, as users and context are better understood and change over time.

The discovery and analysis of problem-ecologies in information architecture design

Although many IA briefs are product-led in the first instance, the practice is problem-led, where solutions often result in displaying limitations in the product-led approach. Client briefs for websites for instance, often fail to recognize the integrated nature of media or the manner in which user's experience products and services across channels, resulting in on-brief, product-led solutions that are not aligned to a continuous experience across channels and touch points.

In conducting design research the information architect will often intentionally extend the scope of bounded IA briefs so as to reconsider the given (product-led) brief: organisational, and problem legacy will be explored; all stakeholders will be interviewed (so as to understand the problem from multiple, internal, dimensions); the marketplace will be explored (including competitor analysis, best practice, benchmarking, related trends and macro-conditions related to the problem); the organizational backstage[10] is analysed; and end-users of the product, service or environment are investigated in their context of use.

In this way information architects attempt to gain an understanding of the problem-ecology in which their brief is presented. Thus, from the outset it is often understood in IA that although the requirement may appear closed such as the redesign of a website interface, the success of the design can have dependencies that span business processes, product considerations, distribution mechanisms, human resourcing, training and capability development, pricing, marketing communications, etc., and thus render it in fact as a complex indeterminate problem.

Part 2, Section 3: Synthesis and solutioning in information architecture design

In the case of indeterminate problems there are a very large number of considerations and, as previously noted it is often difficult to locate the exact cause of the problem. So the process of exploring the context of the problem introduces new data that begin to form the 'big picture' or total context of the problem. The designer is now working with the known or inherent parts of the problem in addition to the discovered, contextual parts of the problem. This creates a very rich environment of data and information to work from. However when presented with a complex problem, analysis of the problem alone will not provide a solution; an additional step is required of the IA, one where the designer subjectively formulates the solution through synthesis

Key characteristics of indeterminate problem-ecologies include, amongst other things, paradox, conflict and contradiction and this is where a traditionally analytic approach to solutioning falls short as do often purely discipline-led approaches as they fail to grasp the larger complexities of the problem wherein paradox, conflict and contraction often reside.

---

[9] The term design thinking, as applied here, is akin to Cyberdesign (coined by Johan van Der Merwe), which describes a theoretical field of design thinking that applies aspects of systems theory and cybernetics within a constructivist design paradigm. Van der Merwe (2009:3) describes the flexibility of cybernetics as appreciative of "*the necessity of selecting from a wide range of approaches, plus a range of tools and corresponding methods, that best fit—the type of system, the purpose and nature of the inquiry, and the specific problem situation*".

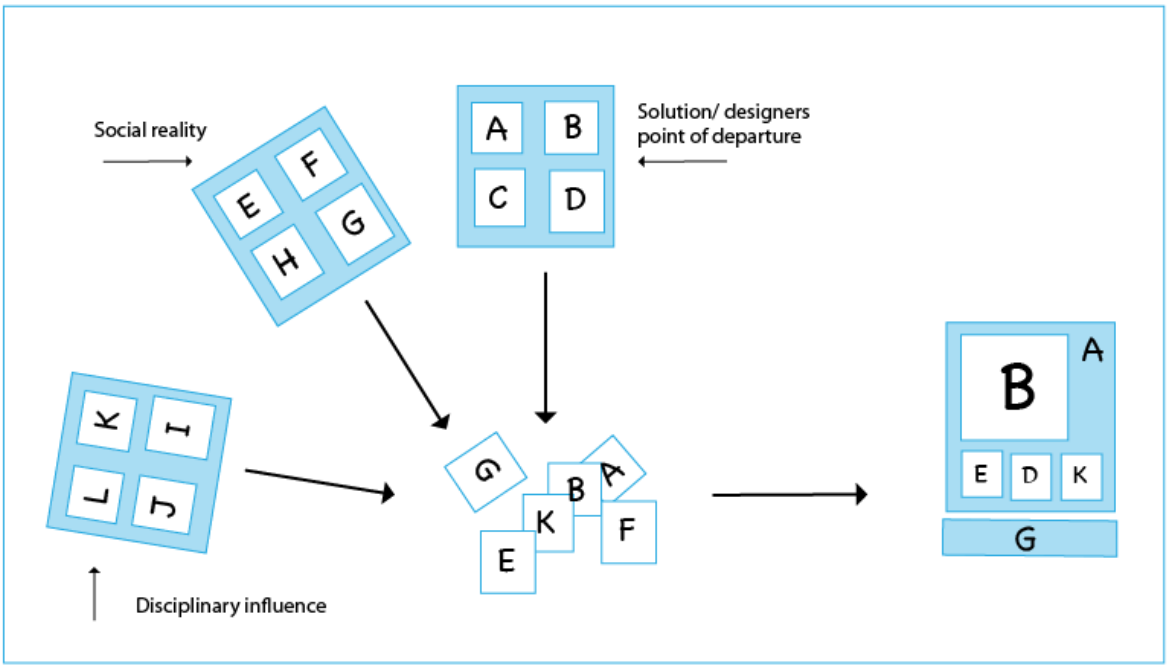
[10] In service design the term "backstage" has come to represent all operations, resources and processes within an organisation that facilitate the running of the organisation and the provision of the service experience to customers

Unpacking the problem-ecology into parts provides clarity, new perspectives and creates opportunities to reconfigure the parts to discover a solution by restructuring the problem.

The process of analytical deconstruction is followed by synthetic reconstruction: a reformulation of the parts both in terms of how they are perceived and understood, their meaning in isolation and their meaning in relation to one another. Having unearthed all relevant data and insight that constitute an understanding of the current dysfunctional problem-ecology, the IA designer will endeavor to re-organise the parts into a new solution.

It is in reconstruction that complex problems, often with complex solutions, are re-formulated, where a key aspect of the artistry of the designer is in the presentation of a complex solution as a simple one to the end user.

Figure 7: This diagram attempts to describe the process of analyzing the influences and sources of context and data (institutional, social and the designers' subjective reality), their decontextualisation, synthesis and the resultant reformulation of parts through restructuring, which provides new meaning.

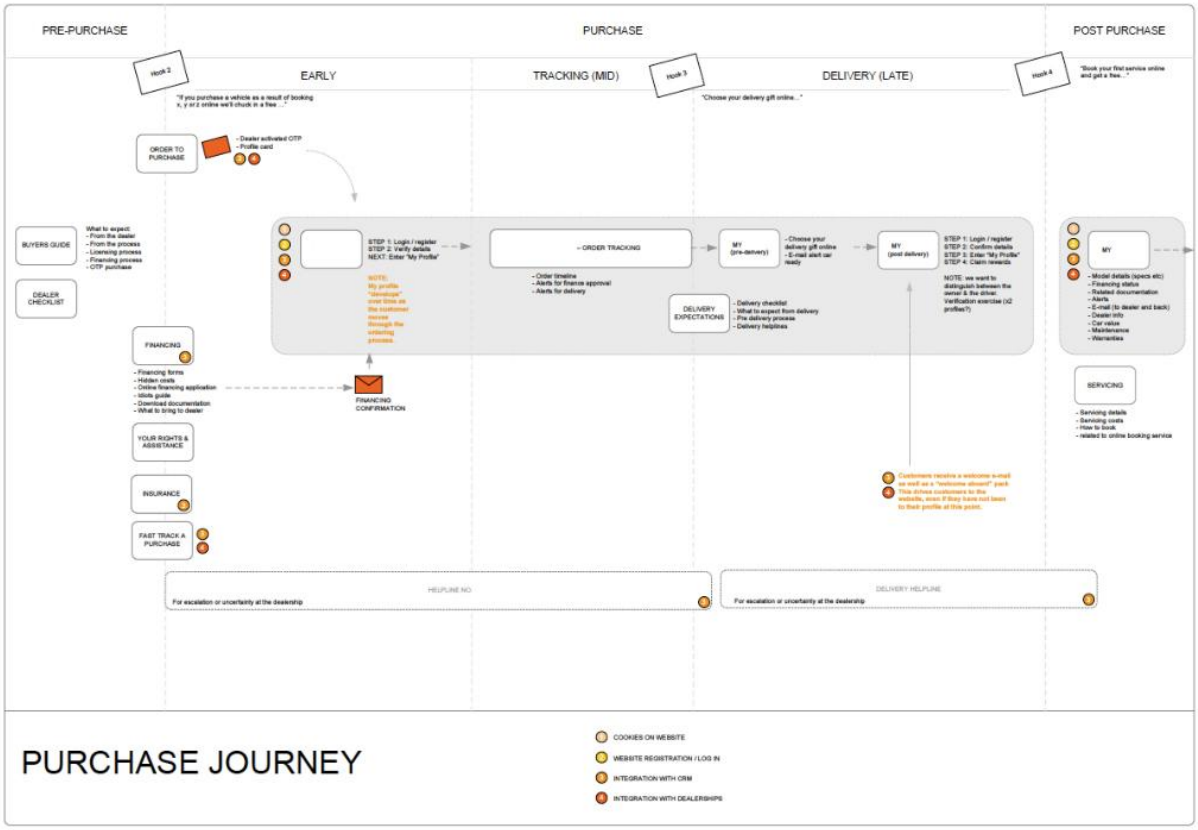


IA designers thus require a variety of techniques and explicit deliverables that assist in the process of synthesizing and in testing solutions.

Two examples of techniques used by IA's for synthesis are user journeys and card sorting. In the case of the former, user and business / organizational needs, content and functionality are mapped into engagement or relationship models that allow problems and related data from disparate sources (regions within problem ecologies) to come together in models that start to provide harmonies and solutions in paradox and conflict driven ecologies **(**see Figure 9 for an example of a user journey). The latter, card sorting, takes elements of content and functionality from the problem-ecology and presents them (as keywords on library cards or post-it notes) in no particular order to end-users of the system (where the users are representative of a cross-section of different user-types and profiles in the system). Users are then asked to organize (categorise or group) elements of content and functionality in ways that are meaningful to them. Through this collaborative design process IA designers are able to understand the conceptual-models used by users when they interact with the system and thus synthesise solutions in a manner freed from the pre-conceptions of the inherent structures of the problem-ecology held either by the designer or the internal stakeholders of the problem.

Figure 8: A photograph of a user organizing content and functionality in a card sorting exercise.

Figure 9: An example of a single lifecycle stage in a user journey created for an automotive website



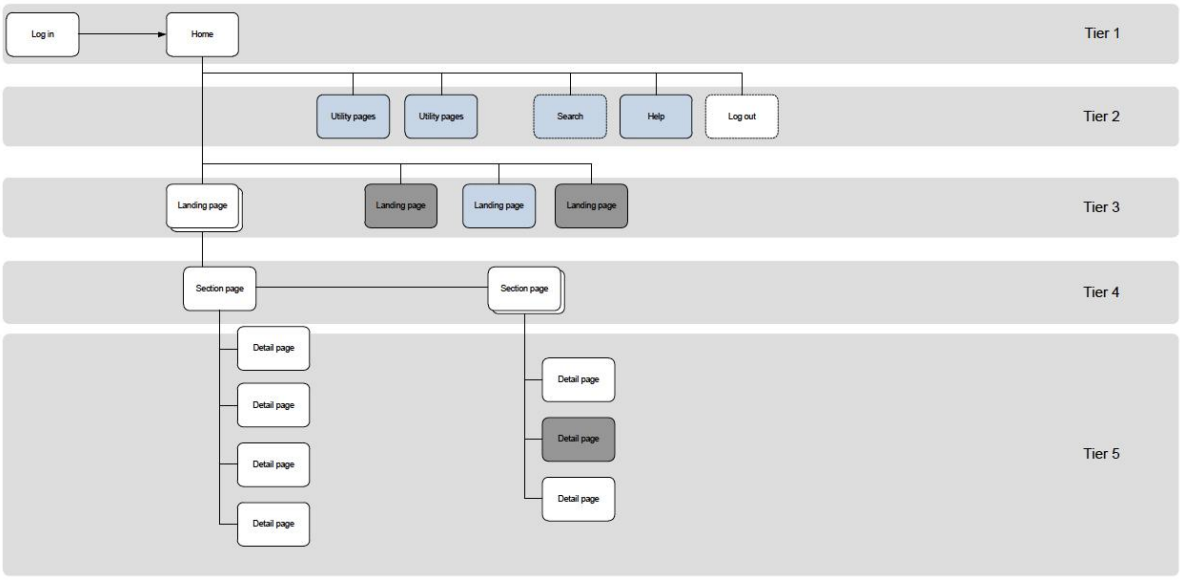
Part 2, Section 4: The transdisciplinary nature of information architecture design

Information architecture design provides the foundational structural solution to problems, however in the end- product, the 'artifact experienced by the end-user'; the information architecture is often hidden[11].

The IA is not the final, experienced artifact. In the case of a website, the graphic design, navigation design, functionality and content tend to be the explicit elements that make-up the user experience: they are directly experienced. The underlying structure that allows all these parts to sit harmoniously (or inharmoniously) together is the information architecture[12].

This is most clearly observed in the deliverables of IA. In website design site maps are used to show how content and functionality will be categorized into hierarchies that the end-user ultimately will click through (using hyperlinks), through the design of navigation and code programmed by a coder (see Figure 10). Task-flows reveal how pages should be linked, in what order, with what content and functionality within, so that the end-user can have an optimal experience in attempting to complete a task through their interaction with functionality, for example a log in process (see Figure 11). The information architect will also define the layout of navigation, content and functionality in pages and define different page-types that contain the rules for the display and behavior of pages at different levels of the hierarchy (see Figure 12) however it is the code used to build the webpages and the graphic design and content in the pages that the end-user will directly perceive and interact with.

Figure 10: A site map for a website. The tiers at right reveal how content and functionality will be displayed in navigation at different levels of the website. Note that each item of content and functionality has an associated code that references the page type and wireframe for that page.



[11] **The popular community-based and practice-led website of IA "Boxes and Arrows" has used the tag line 'The design behind the design' for many years. See www.boxesand arrows.com**

[12] **It is worth noting that the IA that exists may not ever have been explicitly designed or have been created by someone that self-identifies with the role of IA. This is often the case when an original IA design has morphed over time into something that no longer holds the original principles and objectives of the design or when a programmer, graphic designer or even project manager has been tasked with designing a website when no skilled information architect is present to contribute to the thinking.**

Figure 11 is an example of a task flow. Each block represents a page in a website (and flow).

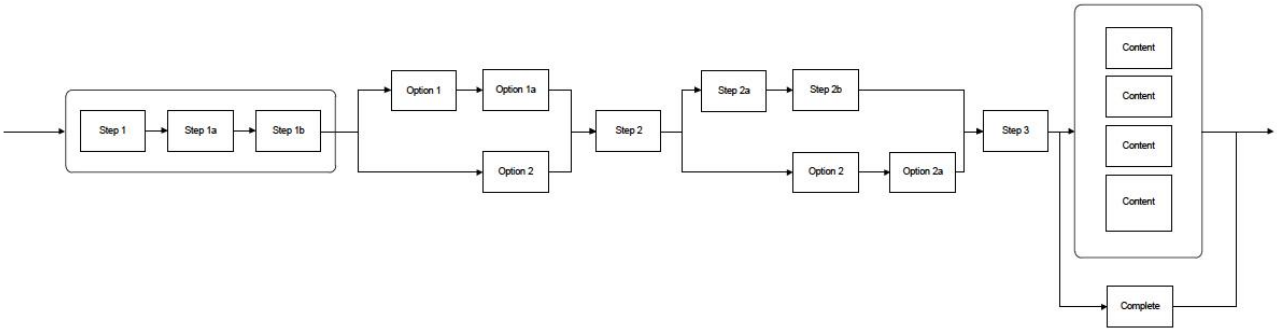
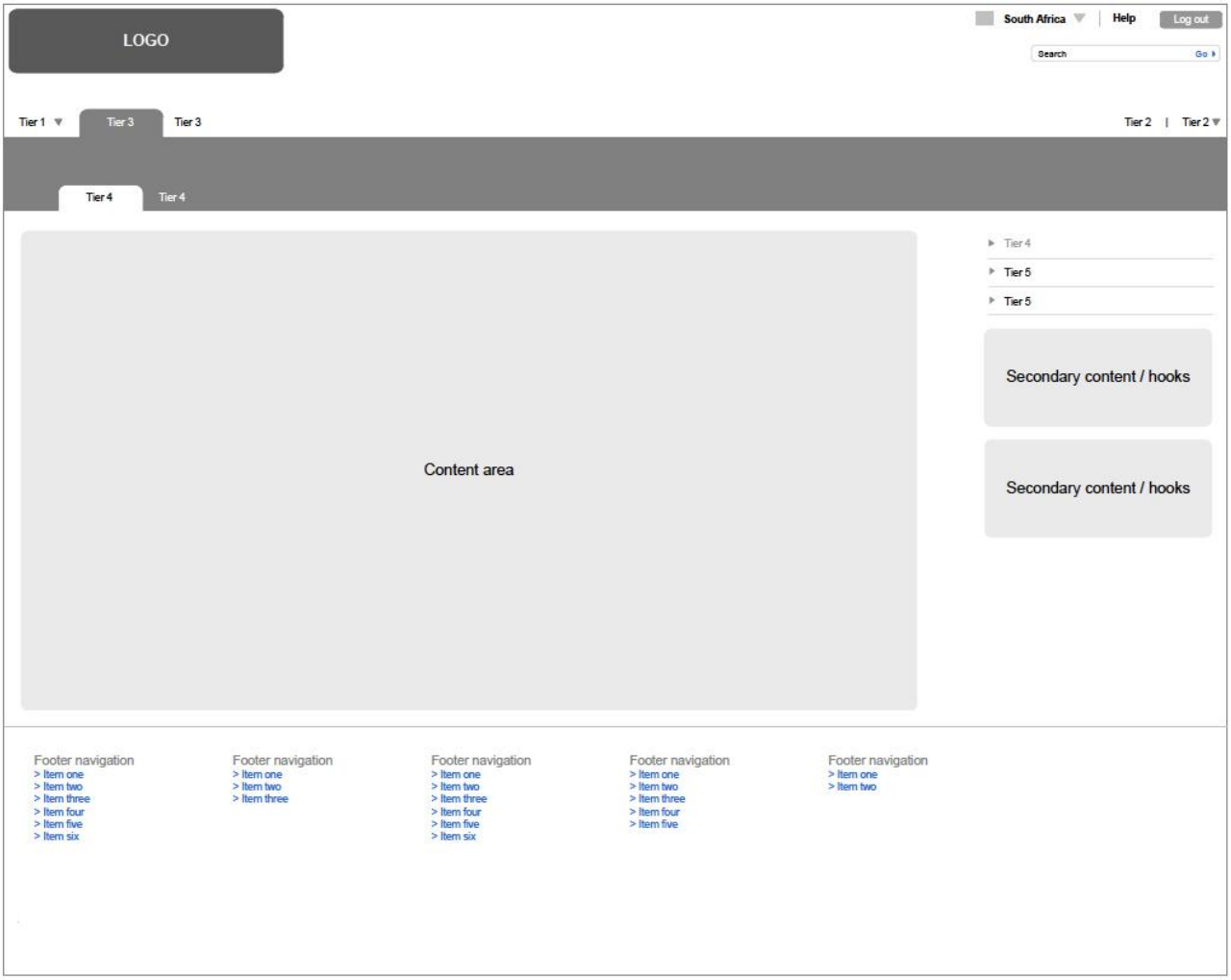


Figure 12: an example of a wireframe where the aforementioned tiers in the sitemap hierarchy are being demonstrated as areas of navigation.



Additionally, when creating the IA for a website the designer will be thinking about how the IA needs to effectively work within the constraints and opportunities provided by the media in which it will be experienced (a desktop browser, a mobile phone browser or a tablet browser for instance), however the IA remains one step removed from the end-product.

For example, the information architecture of a website is bounded to the media in as much as a key benefit may be facilitating the findability of various items of content and functionality in the website through designing carefully labeled categories or a search mechanism. However, the sematic, organisational and structural relationships between content and functionality are in no way necessarily bound to any media: it is

an illusion of a product-led approach to (information architecture) design that presents the media (or an outcomes based approach) as the driver behind the information architecture design; first and foremost, information architecture is interested in meaning as it exists in structure which thereafter is tailored for media (although it may not appear this way in practice).

All the above examples are drawn from bounded IA, however cross-channel IA has an easier job of describing the transdisciplinary nature of IA. In their book *Pervasive Information Architecture: Designing Cross-Channel User Experiences* (2011) Resmini and Rosati present five heuristics (place-making, consistency, resilience, reduction and correlation) that specifically argue the way in which pervasive logics for the formation of structures across media can form the basis of experiences that take their meaning, in part, through structures that in the first instance are unbounded.

For example, they describe Correlation as "...the capability of a pervasive information architecture model to suggest relevant connections among pieces of information, services, and goods to help users achieve explicit goals or stimulate latent needs" (Resmini & Rosati 2011: 168). Note that there is no mention of channel or media; rather, it is correlations between the 'pieces of information, services and goods', first and foremost, that ultimately are experienced across channels and media, or independent of any particular channel, that the IA seeks to design and define. Further they describe the way in which these heuristics operate in the context of one another: " …correlation strategies of course impact on other heuristics. Correlation helps reduce the paradox of choice (reduction […] especially when dealing with focus and magnification), supplies alternative and custom navigation paths (resilience), and ultimately facilitates a berry-picking approach (place-making, resilience)." (Resmini & Rosati, 2011: 183).

The argument for the transdisciplinary nature of IA is closely coupled with the need for a language of expressing solutions. From an educational perspective this is critical and information architecture provides a multitude of deliverables that can be applied directly or adapted for the purposes of developing in learners the ability to analyse, synthesise and express solutions in an un-bounded manner, where the solution can be presented, discussed and critiqued as separate to and without the need for it to be inferred through final designed artifacts and products. In this way we can explicitly develop the thinking skills implicit in information architecture design that will assist in solving indeterminate problems.

The transdisciplinary nature of IA is perhaps best argued through exploring the manner in which meaning is created in IA. Meaning making in information architecture is a very recent discourse among both practitioners and academics in the field and the importance of understanding it is overdue given how far we are into the informational age, where the proliferation of indeterminate problems (and their elusive solutions) are increasingly being defined by the large amounts of data that define them.

It is in the act of synthesis, restructuring and solutioning with the end of creating solution-ecosystems, that composition occurs and it is in this act of composition, that new meanings through new structural forms and arrangements of parts, is created. These activities, and the associated design, can be found in both bounded and cross-channel IA but are most clearly exhibited in poetic IA. In all instances however it is the distinction between design-solution and design-artifact that provides the opportunity for the application of IA to extend beyond the current view of its application in practice.

Conclusion

In reference to selection of contemporary and historic theoretical descriptions of design cognition this paper presented a series of arguments for the ways in which IA is suited to dealing with indeterminate problems including: techniques available from the field for discovering and understanding problem ecologies; tools and techniques for synthesis and reconfiguring problem / solution ecologies; the transdiciplinary nature of IA; and the manner in which meaning is constructed in the act of IA design.

It is thus our position that divorced from the bounded, product-led practice of information architecture design for digital environments that the thinking tools and techniques that characterise IA, could be

considered to be a critical tool for solving indeterminate design problems within any or across multiple environments, and it is this skill, which we hope to develop in our students.

The specific manner in which IA's analyse and discover, synthesise, and express their solutions provide:

A design method for discussing shifts in meaning (and what this may mean in terms of risk, impact, socialization, etc.) through the tools used and
A basis for students to directly engage with what structuring complex solutions involves because it is given form through deliverables that labour to express the underlying structure and meaning in solutions and not just the final artifactual evidence that resides at the product-level.

Ideally, the cognitive abilities and processes that facilitate structured thinking, as employed by information architecture designers, should be understood to form the basis for conceptualising, executing and measuring learning methods for design students. This will form the basis of future research in this topic by the authors where the 'thinking skills' of information architecture will be unpacked in psychological terms to inform teaching modules that will be tested and measured with students to determine their effectiveness as aids to developing leaners' ability to solve indeterminate problems.

References and Citations:

1. Brown, N. 2000. The Representation of Practice. Working Papers in Art and Design 1. [o]
2. Available at http://www.herts.ac.uk/artdes/research/papers/wpades/vol1/brown2full.html. Accessed May 14 2010.
3. Buchanan, R. 1992. Wicked Problems. Design Issues, Vol 8, No2, pp. 5-21
4. Cross, N. 2001. Designerly Ways of Knowing: Design Discipline versus Design Science. Design Issues, Vol. 17, No. 3, pp. 49-55, 2001
5. Cross, N. 2006. Designerly Ways of Knowing. London: Springer- Verlag
6. Johnson, N. 2007. Simply Complexity: a Clear Guide to Complexity Theory. Oxford: Oneworld Books. Pg 13- 15
7. Kazmierczak, E. 2003. Design as Meaning Making: From Making Things to the Design of Thinking. Design Issues. 19(2) 45-59
8. Kuniavsky, M. 2010. Smart Things: Ubiquitous Computing User Experience Design. Morgan Kaufmann: Burlington, MA
9. Norman, D. 1998. The Design of Everyday Things. MIT Press: London
10. Norman, D. 2011 . Living with Complexity. Cambridge (Mass) & London: MIT Press.
11. Resmini, A & Rosati, L. 2011. Pervasive Information Architecture. Morgan Kauffman: Burlington, MA
12. Rittel, H & Webber, M. 1973. Dilemmas in a General Theory of Planning. Policy Sciences. (4) 155-169
13. Rosenfeld, L & Morville, P. 2002. Information Architecture for the World Wide Web. O'Reilley Media: Sebastopol, CA
14. Shedroff, N in (ed) Jacobson, Robert E. 1999. Information Design. MIT Press: Cambridge, Mass
15. Van der Merwe, J. 2010. A Natural Death is Announced. Design Issues. 26(3) 6-17
16. Wickson *et al*. 2006. Transdisciplinary research: characteristics, quandaries and quality. *Futures.* 38 1046-1059.
17. Wurman, R. S. 1996. Information Architects. Graphis Press Corp: Zurich

Indigenous knowledge and design: humanising the story behind the aesthetic facade

Keneilwe Munyai
Faculty of Informatics and Design
Cape Peninsula University of Technology
80 Roeland Street
Cape Town, 8000
munyaik205@yahoo.com

Mugendi K. M'Rithaa
Faculty of Informatics and Design
Cape Peninsula University of Technology
80 Roeland Street
Cape Town, 8000
mugendim@cput.ac.za

Abstract

This paper interrogates the manner in which narratives of one's life journey (informed by embedded knowledge) can contribute to the discourse on sustainability in design. Storytelling and narratives have been part of humankind since the beginning of time and were used as an effective means of knowledge transmission. In this regard, narratives as elaborated within the framework of oral communication can be viewed as an essential component of indigenous modes of expression and cultural production on the African continent.

Design is a powerful tool for raising our collective consciousness to challenge the way we do things in order to effect meaningful change. Design is an agent of change – change through telling our own stories can make social innovation a reality. When elements of narratives are informed by an indigenous upbringing, they become more meaningful and humanised due to the potency they derive from lived experience. This paper highlights the importance of adding narrative to the repertoire of design within a South African context. Subsequently, narratives bring concepts to life and further redefine the human experience.

The account of the research paper is interwoven with references to the indigenous ways of doing, and how stories told through craft help preserve culture. The paper employs qualitative methodologies to demonstrate how aesthetics and reflective activities contribute to good design innovations. The narratives discussed herein embrace social, historical and contemporary contexts to gain a wider significance, from both an academic and personal perspective. This paper further argues that disjuncture between industry and local knowledge can be attributed to the fact that industry produces generic merchandise that fails to take cognisance of the socio-cultural dynamics in the context of sale (and use).

Keywords: Aesthetics, design for sustainability; design identity; human experience; indigenous knowledge; South Africa

Introduction

This paper contends that one's life journey (as informed by embedded knowledge) can contribute to the discourse of Design for Sustainability (DfS). Sustainability is a highly nuanced concept – the need to consider what we wish to sustain is central to this discourse. In the case of DfS in Africa,

designers need to focus on sustaining culture, industry, society, identity, resources, environment, and economic independence (Stelzer, 2006).

DfS by definition exists only in relation to people's lives, their past and present and future life stories or experiences (Brandt, 2009). Design is about telling stories – these stories ultimately create identity. Life-enhancing design has to address all senses and align our image of self with the experience of the world (Munyai, 2007). Design articulates the experience of being in the world and strengthens our sense of reality and self – each designer automatically tends to reflect on their personal relationship with their surroundings, sometimes this happens subconsciously. Constructivist theorists suggest that we construct new knowledge based on what is already known to us (Ausubel, 1968). Consequently, it is expected that designers bring aesthetic perceptions and experiences into their work. This act enables designers to more effectively utilise their technical ability, ultimately leading to superior design solutions. Since design is seen as a socially negotiated understanding of events and phenomena that comprises the experiences that designers have encountered in their lives, design can therefore be seen as the art of communication (Schön, 1987; Tippins & Toppin, 1993:4). It is therefore imperative that learning opportunities link design principles and concepts to their applications encountered in everyday experience. This will ultimately aid in achieving a lasting connection to local cultures and help promote design as an effective catalyst for social change.

Since DfS stipulates that we should limit the exploitation of natural resources for the manufacture of new product, but focus instead on innovative ways of thinking (Fry, 2003). It is therefore, essential that designers come up with solutions by linking their products to their socio-cultural contexts and by looking at traditional narratives to which local knowledge is linked and sustained (Knight, 2009). Beyond the sourcing of stimuli and borrowing of aesthetic codes from their immediate context, designers need to allow their tacit knowledge to help make sense of their current environment. Many authors link problem-solving prowess to the inherent narrative as being of greater importance than codified knowledge and analytical principles (Nonaka *et al.,* 2000; Tsoukas, 2001).

Narrative forms of communication are seen as a means of knowledge management and fulfil multiple functions of distributing tacit knowledge and providing problem-solving practice (Swap, *et.al*, 2001). Narratives help in sensemaking and present a holistic description of the practice and their context it also enables those involved to get a richer understanding of the situation (Bartel & Garud, 2009; Abolafia, 2010). The narrative descriptions usually evolve from experience that links them to the context of action.

Tacit narrative theory

Narrative is defined as a structure for conveying a series of related events, while design narratives describe history, evolution of design over time and how design came into being (Hoadley, 2002; Munyai, 2007). This paper focuses on using narratives as a means of promoting design for sustainability and design for social innovation through local knowledge systems to enhance the user experience in the products we design. In the African context narratives are used to transmit knowledge and to teach local cultures through craftwork, storytelling, rituals and ceremonies (Munyai, 2007). Traditional craftwork often signifies social, or marital status, portray significant events and identity wherein the narratives can be modified to meet modern needs. Craft and design objects can also be used to convey the history of a community (Risattin, 2007).

Design narrative theory provides a practical and dynamic system for acknowledging the importance of human meaning in design (Ganoe, 1999). While the epistemic force of a narrative can be used as

a means of organising experiences and sensemaking, knowledge is constructed by indexing narratives of self and other's experiences, through mapping them to structures already in memory. These are contextual issues that habitually begin with an elucidation that lays out the context (Bruner, 1991; Schank, 1995).

The inability to give words to the experience of making things in design is an indication of intelligence that is express via alternative means (Albers, 1944). This type of internal intelligence is described as awareness, intuition or tacit knowledge. Tacit knowledge is difficult to articulate but, can be demonstrated and judged (Igoe, 2010). According to Nonaka and Konno (1998:42), there are two dimensions of tacit knowledge the first dimension is technical which encompasses the know-how. The second is the cognitive dimension that consists of beliefs, ideas, and values. The word *taciturn* in design is used to describe the doer and maker who cannot adequately articulate their knowledge through words (Dormer, 1994:15). Design can therefore be used to infuse narratives with clearer meaning thus ensuring that the embedded knowledge is duly accessed.

Tacit knowledge in design has modes of behaviour associated with specific methodologies. Such tacit knowledge is critical for creating new knowledge, generating new products and improving current procedures that patently result in innovation. The designerly outcomes of the internal knowledge provide us with means of verifying tacit knowledge, thereby enabling an increased perception of ideas, stimulating creativity (Igoe, 2010). Nonaka and Takeuchi (1998) distinguish four modes of knowledge conversion: from tacit knowledge to tacit knowledge (*socialisation*); from tacit knowledge to explicit knowledge (*externalisation*); from explicit knowledge to explicit knowledge (*combination*); and from explicit knowledge to tacit knowledge (*internalisation*). Tacit knowledge is created through observation, imitation and practice, in those cases where an apprentice learns from a master. Tacit knowledge is converted to explicit knowledge when it is articulated and it takes the form of concepts, models, hypotheses, metaphors, and analogies. Explicit knowledge is converted into tacit knowledge when it is first verbalised and then absorbed, internalised by the individuals involved (Tsoukas, 2002). Tacit knowledge can therefore be viewed as part of the long-term learning process that is often the beginning of a systematic and scientific understanding of innovation (Senker, 1993). To increase the transfer of tacit knowledge, industrial collaboration between designer, companies and students in various parts of the world is encouraged.

Design as a narrative

Designed objects should tell stories that are sometimes deliberate, and at other times imbued with consciousness that permeates with narratives constituted in the field of ideological, theoretical psychological and formal discourses (Porter & Sotelo, 2004). Design narratives give definition to social narratives that influence behaviour associated with designing of spaces and objects. It is the role of design narratives to make explicit some implicit knowledge and to understand and implement benign interventions. Furthermore, narratives contribute to the design identity, cultural identity and design for social sustainability strategies (Munyai, 2007). Hence, references to the indigenous ways of doing and being help in understanding how stories told through craft have helped in preserving culture and local knowledge, design interventions become culturally embodied. Design is similar to personal narrative as it integrates a complex variety of human and environmental phenomena.

A design that is informed by an awareness of the various phenomena that may shape it allows the design to constitute a pre-existing reality. This is particularly true where designs intentionally seek to incorporate the essence of time and human finitude, spontaneity, possibility, grace of the earth, cantering and interconnectedness, mystery and disclosure – this aids in heightening awareness of universality by providing a guide for tapping into lived experiences (Tacit Knowledge) (Bruner, 1991; Ganoe, 1999).

Crafts and design is used to record experience (see Figures 1 and 2) in the stories that are mirrored in the objects, the objects are reflective and bear narratives created by someone who has a story to tell. Narratives are a primary and reflective mode of articulation of human life (Bell, 1989; Manyuchi, 2011). They are not an eruption of raw emotions but rather, a highly structured reflective process. When design is viewed as part of an inseparable but always changing story that consists of reconfiguring interaction between persons, place, event and purpose the normative aspect or central meaning cannot be culturally or historically fixed. The textile print tells the story of the city of Johannesburg's street scenes – where urban meets rural and formal meets informal and tradition meets modernity. The city is rendered in the faded French Toile du Jouy fabric, but instead of typical rural French scenes it tells the story of a cosmopolitan African city. The traditional Toile du Jouy is a type of decorating repeated pattern depicting a fairly complex scene with a single colour on a white background generally of pastoral themes.

Figure 1: Toile du Jozi print.
Source: www.fabricfabricnation.co.za (2012)

Designs are created by someone who has a story to tell. According to Wole Sonyika (1976), narratives are material evidence of integration, cohesiveness of a culture in position and used as celebration instruments of an integrative world. It is important for designers to consider the social sustainability and direct impact that the designs have on society. It is also imperative to focus design education on experience of personal life in order to come up with pertinent ideas and quick solutions which can be translated into communicative designs. This will also help to raise awareness of direct relationship between people and places we live in, this will not only help design education to shift away from thematic and trend based education approaches to more context and relevant design (Brandt, 2009).

Figure 2: Traditional Xhosa designs used on beadwork for various ceremonies.
Source: Google images (2012)

This requires a design education approach where each designer is allowed to bring in their lived experiences – these automatically tend to reflect their personal relationship with their surroundings and often happens subconsciously.

Figure 3: Contemporary knit wear that borrows from traditional patterns for symbolic meaning.
Source: www.africanknitwear.com (2012)

The designer Laduma Ngxokolo decided to weave in the traditional initiation school that he attended as part of his culture. Due to the initiation process the boys are required to give up all their boyhood clothing and take on a new dressing styles that reflect their social status of having graduated from boyhood to manhood (*amakrwala*).

There is no doubt that for the most part, Africa lives sustainably by default – the challenge is to maintain this by design (M'Rithaa, 2009). There are excellent examples of community-affirming modes of transmitting sustainable practices throughout the continent. Subsequently, local designers have a rich base of exemplars to help stem the unfortunate practice of perpetuating wasteful production and consumption patterns that are typical of industrially developed contexts (*ibid*). DfS in Africa offers designers an opportunity to tell authentic stories; to infuse their inspiration with their talent and create pieces that embody multi-dimensional perspectives and narratives. An increasing number of designers are using vintage locally available materials to preserve their history, or (even more proactively) to create new meaning that can be passed down generations. While some designers have started seeing design as a practical discipline that enables them to convert conceptual ideas into a docile state and help them realise the values and culture of a country (Buchanan, 2001).

Design is about the way things are used, and should be committed to the wellbeing of the world as design informs the means by which objects they are conceived, produced and consumed (Thackara, 2006). The goal of sustainable design is to effect methods of production that continue to evolve during the production lifecycle (McDonough, 2004). As design is about communications, it is therefore important that designers put emphasis on narrating stories of sustainability in order for the message to be spread. Though narratives offer fascinating ways of knowing and shaping landscapes, their true value is not typically acknowledged in conventional documentation, mapping, surveys, and even in formal concerns of design. Specific narratives which are related to local knowledge and practices can be applied across a range or design projects and help bridge the gap between theory and practice, and by tracing the narrative of specific cultural and environmental practices, as well as places that include personal experience.

Ndebele mural painting is one such example (see Figure 4). It started as a form of self-expression for women and evolved into a unique art form that gave the tribe its individuality and a collective sense of self-worth. The women borrowed elements from social and cultural repertoires to create an aesthetic grammar that allowed them to invent images reinterpreted from other cultures with their own symbolic meaning. These would include recording images that they might have seen during a trip.

Figure 4: Ndebele authentic colours.
Source: www.eartharchitecture.org (2009)

Currently, many people assume that earth is used to build houses for the poor in rural areas. However, there are examples of big structures and some of the oldest extant buildings on the planet are made of earth (see Figure 5). Earth is a low impact material, that is low on waste and offers superior re-use or recycle opportunities (Rael, 2009). These are materials that have been used for centuries – the said materials have ecologically sound material properties that make them ideally suited to their environments of use and are thus arguably more sustainable than most modern substitutes. Additionally, available local knowledge ensures adequate maintenance and repair of the said buildings.

Figure 5: Badawiya Hotel in Farafra, Egypt.
Source: Google images (2012)

Design activities impact upon the use of resources, modes of consumptions and lifecycles of products and services and ensure the stories they tell through the products they create focus on reducing the use of non-renewable resources and minimise environmental impact. This is often done either through finding narratives that are related to the context and environmental management initiatives that are currently applicable to the place (See figure 5). Through creating our own relevant narratives we can use design as a platform to expose existing habits, hidden norms as well as proposing alternative actions and views. Building using natural materials by contemporary architects and constructors will send a message to even those who follow trends to see using mud bricks and other natural materials as valuable and help resolve the drawbacks associated with criticism of earth construction which will result in improvement in design and technology (Zami & Lee, 2011).

Reflexivity in design focuses on the conditions and processes of design but move beyond describing and exposing them, to engage in complementing existing innovation and design-driven innovation. Design should be a system that places the user at the centre without necessarily negating the value of positive societal influences. It should act as a bridge between the (needs of the) user, the product development process and specific socio-cultural implications. Design is often characterised as a process of creating a product. However, design is also a social process which communication plays a critical role. Materials and informational artefacts collected and generated during the design process play a key role in mediating and catalysing communication. Socio-economic and environmental problems are linked to social practices and are governed by norms (Shove, 2003). DfS therefore should not only be concerned with problem solving, but should encompass reflexive enquiry wherein pertinent questions are generated along the way.

Conclusion

Technological tools for aiding in the ideation and design process presently allow design practitioners an array of near-limitless permutation of proffered solutions. A by-product of an over-reliance on these technological tools has resulted in near-identical artefacts that lack deeper meaning and relevance in the socio-cultural context of use. To ameliorate this concern, this paper encourages designers to re-interrogate cultural probes that could infuse freshness and authenticity in their efforts. The power of narratives in conveying resultant meaning cannot be over-emphasised.

Additionally, South Africa has a rich diversity of cultures each with a unique tradition of ‘meaning-making’ through their architectural, craft and design offerings that could potentially imbue products

with desirable content. Further, by interrogating pertinent principles of Design for Sustainability, new and suitable modes of production and consumption can be envisaged. Such practices inherently protect our ecological heritage whilst simultaneously ensuring sustainable livelihoods for those operating within the creative industries. As Cape Town (in particular, and South Africa in general) increasingly adopt strategies that embrace and celebrate design-thinking in the socio-cultural, geopolitical and economic domains, the challenge to humanise the story behind the aesthetic facade of artefacts emanating from its sphere of influence takes on an even more urgent tone.

References

1. Albers, A. 1944. Anni Albers: on designing. Connecticut: Wesleyan university press.

2. Abolafia, M.Y. 2010. ‘‘Narrative construction as sense making: how a central bank thinks’’, Organization Studies, Vol. 31 No. 3, pp. 349-67.

3. Ausubel D.P. 1968. *Educational Psychology: A Cognitive View*. New York: Holt, Rinehart and Winston.
4. Bartel, A.C., & Garud, R. 2009. The role of narratives in organisational innovation. Organisation science. 20(1):107-117
5. Barthes, R. 1974. An introduction into the structural analysis of narratives. Translated by Richard Miller.
6. Brandt, S. 2009. Narrative design: meaningful places for people a study on the relevance of narrative in spatial design education. 2009 International Association of Societies of Design Research conference: design/rigor and relevance. Seoul, South Korea. October 18-22. www.iasdr2009.org

7. Bruner, J. 1991. Narrative construction of reality. Critical enquiry. 18 (Autumn, 1991)
8. University of Chicago.

9. Buchanan, R. 2001. Design Research and the new learning. *Design Issues*, 17(4): 3-23.
10. Dormer, P. 1994. The Art of the makers: skills and its meaning in art, craft, and design. London: Thames and Hudson.

11. Fry, T. 2003. The voice of sustainment: the gap. Design Philosophy Papers, Vol. 1., n.p., http://www.desphilosophy.com/dpp/dpp_journal/feature/body.html
12. [Accessed 02 May 2012].

13. Ganoe, C.J. 1999. Design as a narrative: A theory of inhabiting interior space. Journal of interior design. 25(2): 1-15.

14. Hoadley, C.P. 2002. Creating context: Design-based research in creating and understanding CSCL. In Proceedings of Computer Support for Cooperative Learning (CSCL) 2002, Boulder, CO. (pp. 453- 462). Lawrence Erlbaum.

15. Igoe, E. 2010. The tacit-turn: textile design in design research. *Duck Journal for Research in Textiles and Design Research*, 1: pp1-11

16. Knight, A. 2009. Hidden histories the story of sustainable design. Proquest discovery guidelines. http://www.csa.com/discoveryguides/design/review.pdf [accessed 08 May 2012].

17. Manyuchi, I. 2011. Connecting craft techniques to produce contemporary space coverings. BTech dissertation, Cape Peninsula University of Technology. Cape Town.
18. McDonough, W. 2004. *Presentation to Engineers for a Sustainable World conference*
19. Mor, Y. 2011. Design narratives: an intuitive scientific form for capturing design knowledge in education. In: *Sixth Chais Conference on Instructional Technologies Research: Learning in the Technological Era*, 17 Feb 2011, Raanana, Israel.

20. M'Rithaa, M.K. 2009. Embracing sustainability: revisiting the authenticity of 'event' time... Proceedings of the *2nd International Symposium on Sustainable Design* (ISSD), 5-6 November 2009. Sao Paolo. www.portal.anhembi.br/sbds/anais/ISSD2009-P-32.pdf

21. Munyai, K. 2007. The story of nomadic upbringing: tracing the history of South African and African shoemaking through a range of handcrafted sandals and slippers. Unpublished BTech dissertation, Cape Peninsula University of Technology. Cape Town.
22. Nonaka, I. & Takeuchi, H. 1995. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York, NY: Oxford University Press.

23. Nonaka, I. & Konno, N. 1998. *"The Concept of 'Ba': Building a Foundation for Knowledge Creation*". *California Management Review*, 40(3):pp 116-132.

24. Porter, L & Sotelo, S. 2004. Design by narrative. July 12-17 2004. Congresco Internacional IERG conference proceedings. www.sfu.ca/conferences/ierg2004/.../Porter_Sotelo_IERG2004.pdf

25. Rael, R. (2009), 'Earth Architecture', New York, Princeton University Press

26. Risattin, H. 2007. A craft theory: function and aesthetic expression. USA: University of North Carolina press.

27. Schank, R. 1995. Tell me a story: Narrative and intelligence, rethinking theory. North Western University Press.

28. Schön D. 1987. Educating the Reflective Practitioner. San Francisco: Josey Bass.

29. Senker, J. 1993. The contribution of tacit knowledge to innonvation. In AI & society, 7, pp. 208-224.

30. Shove, E., 2003. *Comfort Cleanliness and Convenience: The Social Organization of*
31. *Normality*. Berg, Oxford.

32. Sonyika, W. 1976. In Rael, R. 2009. Earth Architecture. New York. Princeton university press. www.eartharhitecture.org

33. Stelzer, K. 2006. Sustainability = good design. *Cruem.*1 (2): pp. 27-40. Fall

34. Swap, W., Leonard, D., Shields, M. & Abrams, L. 2001. Using mentoring and storytelling to transfer knowledge in workplace. *Journal of Information Management Systems.*
35. Thackara, J. 2006. *In the bubble: designing in a complex world*. pbk ed. Cambridge, Massachusetts: MIT Press, pp.18-19.

36. Topin K. & Tippins, D. 1993. Constructivism as a referent for teaching and learning. In: KG Tobin (ed.). *The practice of constructivism in education*. Available at books.google.co.za/books. [Accessed 4 February 2008].
37. Tsoukas, H. 2002. Do we really understand tacit knowledge? Presented at the Knowledge economy and society seminar 14 June 2002, London School of Economics: Department of Information systems. http://mba.eci.ufmg.br/downloads/dowereally.pdf. [Date accessed 9 May 2012].
38. Zami, M.S., & Lee, A. 2011. Widespread adaptation of contemporary earth construction in Africa to address urban housing crisis. *The built human environment review.* 4(2): pp. 85-96

Information and communication technology and the turbulence of the ideation phase of graphic design

Edward Appiah
Faculty of Informatics and Design
Cape Peninsula University of Technology
Cape Town, South Africa
eddappiah@gmail.com

Abstract

The introduction of technology into graphic design education has resulted in some challenges within the pedagogy, as it requires relearning, training and upgrading. In ideation - the process of generating, developing, and testing ideas that lead to solutions - influences of technology are creating new possibilities for students to conceive ideas differently from the traditional methods of sketching. Using activity theory as a lens, the paper discusses the disturbances in the ideation process with and without ICT in a large class in a developing country. It concludes with a call for a review of pedagogical issues of ideation. Whatever our scepticism about how ICT, there are important aspects that can only be addressed if we adopt some of the new digital technologies, by modifying the current pedagogy.

Keywords: Ideation, pedagogy, ICT, graphic design education

Introduction

The introduction of technology into graphic design education has resulted in some challenges within the pedagogy, as it requires relearning, training and upgrading. One of the critical areas in design education that has attracted much attention as a result of ICT introduction is the issue of ideation (Jonson 2005; Stones & Cassidy, 2007; Stones & Cassidy 2010). According to Yeoh (2006), while teachers are caught in the conundrum of teaching a generation of technologically literate students, especially in the issue of ideation, 'they must also allow them the opportunities to explore their own strengths and weaknesses with a piece of so called anti-creativity equipment' (Yeoh, 2006). If such opportunities are going to be meaningful, it requires that educators also take another look at the pedagogy that informs ideation. This paper, which is part of on-going research into how ICT is impacting on the teaching and learning of ideation, is in line with how the ideation pedagogy should be a focus in design research. Studies into how students are using ICT in their ideation process will help educators re-look at the pedagogy and possibly, make some informed decisions as to current educational paradigms. Bender (2005:8) postulates that, as technology becomes more transparent in the learning process and offerings of online courses continue to rise, knowing how technology affects teaching and learning is imperative for educators. What this also means is that research into areas of educational use of ICT such as pedagogy, identity and electronic learning portfolios (e-portfolios) will have to be increased and, in this context, ICT and the ideation process. For this study, the focus was to explore the integration of ICT in the design process that includes the process of ideation, in the broader context of its "effective link between purpose, people, and pedagogy inside the institution" (Stensaker & Maassen, 2007:431).

Design education has undergone various changes 'mainly as a result of developments in information and communication technology (ICT), the commercialization and globalization of education, social changes and the pursuit of quality' (Brown, 2006: 109). The indispensability of information and communication technologies has led to graphic design educators supporting their teaching and learning with ICT, one way or the other. As a result of this, new ideas and possibilities in design education and its practices, such as online studio as a support for learning and teaching

(Kvan, 2001, Bennett, 2000) and blended learning, which involves both traditional face-to-face instruction and asynchronous and/or synchronous communication via the Internet (Bender & Vredevoogd 2006:114) have all come up as innovations in the design education. Moreover, new courses are also being designed in response to growing needs of ICT in design education (Bender 2005:4; Ranjan 2005:2). Educators need to find answers to the following questions: **How do educators regulate the issue of ideation in graphic design with ICT**? What are the perceptions of ICT by design students in the current graphic design pedagogy? What are the purposes of ICT in the modern studio, and how do they feature in the ideation process?

Literature Review

Ideation

Ideation is 'seen as a matter of generation, developing and communicating ideas, where 'idea' is understood as a basic element of thought that can be either visual, concrete or abstract' (Jonson 2005: p. 613); a sense-making activity that helps us to knock around our half-formed ideas in the search for greater sense that shapes our design solution (Kimbell, 2004:137) and 'the process of generating, developing, and testing ideas that may lead to solutions' (Brown, 2008: p 4). Ideation involves the mind acting in consonant with the environment or tools for which design sometimes involves sub-consciousness. Ideation can also be seen as an ability to conceive a plan for a particular purpose or effect (Yeoh, 2002: p. 71). Within the ideation process, therefore, one engages with the mind and tools in the process of brainstorming, organising, sketching and drawing, when thinking and imagining with the view of creating ideas for implementation (Kimbell, 2004). This process is best described metaphorically as a system of spaces rather than predefined series of orderly steps (Brown, 2008: p. 4). In his three-phase design-thinking model, Brown (2008) put ideation in between "inspiration" and "implementation" loops, and believes that the process will loop back more than once as ideas are refined and new directions are taken (p. 4), as is depicted in Figure 1.

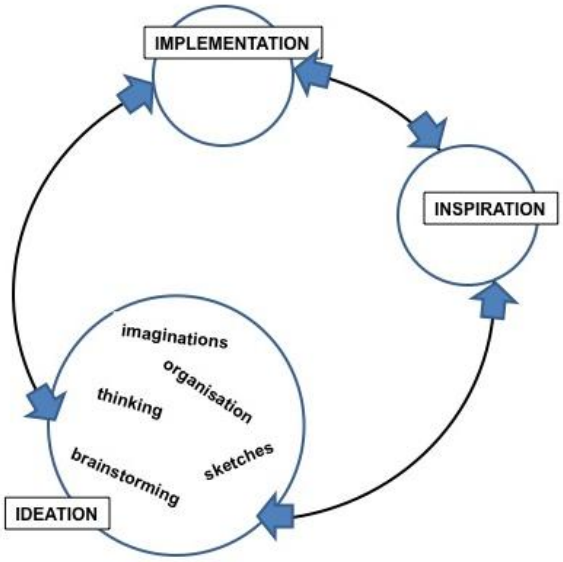


Fig. 1: A three-phase design-thinking model for design process (Brown, 2008)

Design processes adopted for creative work in design are derived from "Ideation" models (Dorst & Cross, 2001, Cross, 1997). More importantly, creative thinking tools such as brainstorming enable one to have many ideas to choose from (Dorst & Cross, 2001:426). Designers have to undergo these brainstorming sections to arrive at the creative work by doing thumbnail sketches and some preliminary drawings, also referred to as idea development. Schenk (1991) sees drawing as a vehicle for creative interchange in group sessions in which the designers share and stimulate ideas.

Many designers use drawing to develop their visual literacy and fund of 'stored analogy' to support creative behaviour (p. 181).

Traditionally, ideation is viewed as a paper-based activity and, as ICT enters the scene of teaching and learning in graphic design, there seem to be some ‘disturbances’ in the practices as students veer into the use of ICT in their ideation process. This is because the integration seems to paint a picture of distortion in the ideation steps as far as the pedagogy of idea development is concern. While the traditional principles of design call for identifying the processes of idea development on paper with its studio practices, students act in different ways especially by developing ideas with ICT, as interacting with technology has become natural to them. Anecdotal evidence indicates that educators see these tensions as disturbing issues and a deviation from the learning outcomes of the pedagogy of ideation in graphic design. Ideation in graphic design is geared towards finding a solution, not only to studio work, but also to real-life challenges as far as design is concerned. Indeed, it is an essential part of the design process, both in education and practice (Broadbent, in Jonson 2005: 613). The Bauhaus principles, which call for the learner to open up to issues solely from the master, might not be the most appropriate educational paradigm when it comes to ICT integration. Using activity theory as a lens, observation of activities and documentations clearly displays the fact that much needs to be done by educators to correct and regulate the disturbances and tensions that characterise the issue of ideation in graphic design with ICT integration by students.

Influences of technology are creating new possibilities for students to conceive ideas different from those generated by the traditional methods of drawing and sketching. Schenk (2007) admits that even though computer-technology can provide a viable substitute for many of the skill-based drawings, they do not support early ideation (Schenk, 2007:5). How then does current graphic design pedagogy, based on the principles of the Bauhaus concept, engaged with the current practices of ideation with ICT? What are the purposes of ICT in the modern studio and how do they feature in the ideation process? What are design students’ and educators’ perceptions of ICT in the current graphic design pedagogy? Understanding the phenomena that engage students and educators in the use of information and communication technology within the process of ideation in graphic design will help frame the right pedagogy for ideation with ICT.

Framework for graphic design

In his ‘study on the influences of computer usage on idea formation in graphic design students’; Yeoh (2002) discusses three relevant theoretical fields that framed his study. These are a market-driven framework, graphic design processes and theories, and models of creativity.

Within the graphic design process framework, Yeoh places great emphasis on visual exploration in ideation by designers since that is considered to be an essential part of the design process. He also sees sketching in ideation as “that which materializes the content of an image and is importantly linked to the formation of images” (Yeoh, 2002:69). Through sketching, ideation can be reinterpreted and this creates many opportunities for exploration and also an important tool for understanding and discovering design paradigms.

Design paradigms can act as powerful tools for creating new designs since they encourage interactivity, negotiation, and communication between art directors, other designers in a design studio as well as designers and their clients. By exploring new paradigms and applying learned paradigms, designers learn what works and what does not (Yeoh, 2002:69).

In theories and models of creativity, one describes how creativity is intertwined with the design process and it becomes important to describe the concepts, approaches, phases, and methods rather than creativity all by itself. The concentration should be on graphic design methods, technology

associated with the field, and design pedagogical perspectives more than anything. but all the perspectives add important dimensions to the concept. The three models described by Yeoh (2002) are lengthy partly due to the complexities of knowledge in graphic design. Tan and Melles (2010) believe that graphic design is made up of complexities and employ a range of symbolic and material resources from the conceptual phase, through to the commercial and professional practices(Tan & Melles 2010:462).

Framework for design-based education

Sagun et al.(2001) make a case for a framework for web-based education which is applicable to technology-based design studio, seeing that design education involves lecture and studio teaching to engage students with design knowledge, skills and practice (Sagun et al: 335). The framework considers pedagogical, ideological and epistemological levels relating to design education, which include studio approach, tools-mediated systems and outcome-based results.

The first step of the framework involves looking at the objectives (why): the methodology and management issues and the question of 'why' a technological-based system is preferred to traditional design system. The next step involves practical issues: can technological-based education be practiced in either as a support to the existing traditional teaching methods or a complete replacement of the existing method. It also looks at the major implications of the design and delivery of technology-based education and of the study requirements of the learner. Tools ranging from simple programmes to large expensive software packages can be used in a technological-based course.

In a pragmatist, but interpretive quadrant that seek to explore pedagogical issues, the aim is to inquire why ICT is being engaged in the ideation phase. Using activity theory as a lens, the study is engaged in looking at complexities that have evolved since the introduction of ICT into the teaching and learning of ideation in graphic design.

Activity theory as a framework for graphic design

As indicated previously, a framework of activity theory (AT) is being used as a theoretical lens to analyse ideation in graphic design. The theory explores, through observation and interviews, how students use of tools-mediated systems in their ideation process for an outcome. According to Tan and Melles (2010), using activity theory in such an exploratory study helps to understand the complex and intriguing aspect in the field of ideation (Tan & Melles, 2010:2). The aim is not to answer the question of why but how the introduction of ICT in graphic design education is affecting the teaching and learning process of ideation.

As a model for the analysis of tool-mediated professional and everyday practice, activity theory offers a potential framework for such an analysis (Tan & Melles 2010:3). Tan and Melles (2010) made a case for activity theory in graphic design research with the following statement:

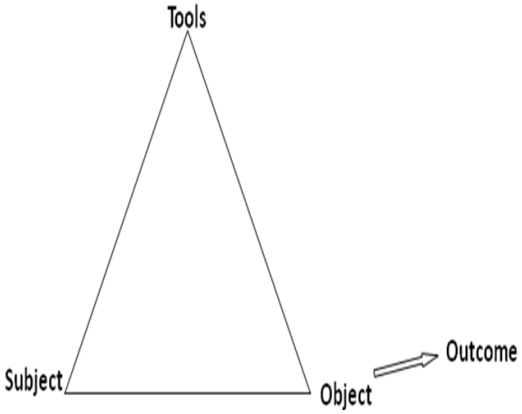
In comparison to other frameworks ..., activity theory appeared to have certain advantages for analysing situated graphic design practices. While protocol analysis and laboratory studies are commonly used for research into graphic design, activity theory as a framework provides a model that is appropriately oriented towards qualitatively focused studies of real-world practice, where the concern is to achieve depth of data rather than large sample sizes (Tan & Melles, 2010).

Philosophy of Activity Theory

People meet social needs by working and learning over time to achieve particular goals or to act on particular motives. To facilitate their activities, they also develop systems and use tools. These tools include not only things such as hammers or computers, but software and ideas. As people refine their tools and add new ones to solve problems more effectively, the activities they perform using

those tools can change—and vice versa: as their activities change, people use their tools differently and modify their tools to meet their changing needs. Activity theory, which has its roots in Russia in the early 20th century, was originally a psychological theory that sees all aspects of activity as shaped over time by people's social interactions with each other and the tools they use (Kain & Wardle n.d.:2).

Unpacking activity theory reveals a psychological meta-theory, paradigm, or theoretical framework, which seeks to understand human activities as complex, socially situated phenomena and also beyond paradigms of cognition, psychoanalysis and behaviourism. The philosophical roots of activity theory originated from Karl Marx's works, whose concept of labour and production of use value was the 'paradigmatic model of human object-oriented activity' for Leont'ev's concept of activity (Engeström et al. 1999: p.3). Before then, Vygotsky had introduced the unit of analysis of object-oriented action mediated by cultural tools and signs (Fig. 2) (Vygotsky, 1978, p. 40). Interestingly, the theory of mediation by other human beings and social relations had not come up in Vygotsky's triangle until Leont'ev introduced the concept of the division of labour; a resultant from a human object-oriented activity. Engestrom (1987) later modified his own version by introducing another dimension – a community - that brings into focus two new relationships: rules mediating between the subject and the community, and division of labour - mediating between the object and the community (Figure 3). Jonassen & Rohrer-Murphy (1999) believe that activity theory therefore can be used as 'a powerful socio-cultural and socio-historical lens through which we can analyse most forms of human activity' (Jonassen & Rohrer-murphy, 1999: p 62). It also focuses on the interaction of, and consciousness within its relevant environmental-context human activity.



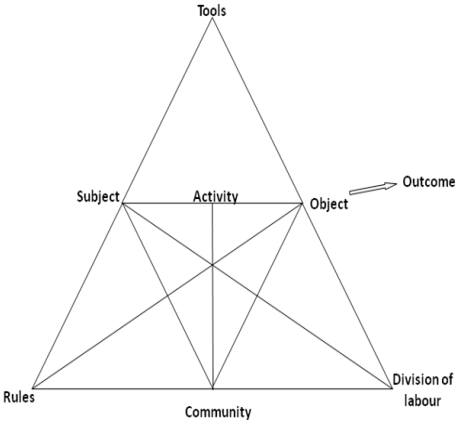


Fig. 2.: Diagram of Activity theory (Vygotsky, 1978) ***Fig. 3: Activity theory by Engestroom (1987)***

Justifying the use of activity theory in their research into graphic design, Tan and Melles (2010) also considered three areas that made explicit, the grounds for its applicability. These are;
its applicability to the complexities of the observed world;
its utility when considering ethnographic data collection methods; and
its avoidance of objectification in the analyst account (Tan & Melles, 2010: 463).

The complexities of graphic design education stem from the use of tools and strategies, no matter how 'unrefined' they may be, to reach a defined objective in the contemporary world of design. It involves a range of personal decision-making, design and creative activities, together with the use of preferred tools and strategies (Tan & Melles, 2010: p. 462).

Activity theory is being employed to explore the tensions and experiences created by everyday activities of the students and lecturers of graphic design as they interact with ICT in their ideation process. This is a complex situation since the teaching of the ideation process was conceived on a non-ICT platform, but is currently being grapple with using ICT. There is therefore the need to first establish whether ICT is creating such tensions and if then continue to look at the implications such tensions are informing current pedagogical imbalance.

Methods

The study presented was situated in a practical classroom setting in which students were given the task to design an advert for a 'dying' telecommunication network provider 'Expresso'. The primary author observed the processes in which students engaged in their lecture room/studio environments. The focus was not the entire duration of the completed project; the emphasis was on the processes of developing ideas, which dovetail to the final execution of the work. There was also the focus on the use of technological tools against the traditional graphic design practice that led to the final presentation of the design.

The participants were final year graphic design students, and the rationale for using them was that they had undergone the basic fundamentals of ideation and had also done, at least, six months' internship at professional design studios. They were also in transition to the professional world outside the university and therefore were neither novices nor fully professionals. Such a purposive sampling occurs when a researcher wants to identify particular types of cases for in-depth investigation. The purpose is less to generalise to a larger population than it is to gain a deeper understanding of various types of cases (Neuman, 2007).

Through note-taking and observation of the activities (both in the studio/lecture rooms), visual evidence of development (designs and thumbnail sketches), as well as conducting open-ended interviews with the participants, data were collected. These were done to enhance the rigour and analysis of the qualitative empirical data gathered and also as a verification method for data triangulation (Yin, 2011). This was also used as a frame of mind more than as a methodological technique— 'something that helps to keep your eyes and ears open for corroborating or conflicting ideas or data' (Yin 2011:153).

Discussions and Analysis

While the briefs were being discussed in the lecture rooms, students were seen scribbling thumbnail ideas in sketchbooks, while others were working on their laptops. Students who were in study groups met later to discuss their initial thumbnails with the view of choosing and refining them. Later interviews with students revealed that, conceptualization took place while the brief of the assignment were given. Conceptualisation leads to visualisation, brainstorming with thumbnails, and later a choice of one realistic idea for fine-tuning. Such steps are more of a professional approach than a student's approach (Resnick, 2003).

In the studio, after formal lectures, students discussed their thumbnail sketches with their lecturer and colleagues, as a way of fine-tuning. Significantly, less than half of the students in the class were able to discuss their thumbnails sketches during formal studio jury. This is because of the class being large, and time allocated for this course, albeit that the assignment is an independent study. These initial thumbnails were then scanned digitally and displayed via an LCD projector for the lecturer's comments during later studio discussions. These digital thumbnails began the digital process of ideation, where students tried out various layouts and different fonts and types on the computer to see how they work with the chosen concepts. From this point forward, the processes become exclusively computer-human interaction, with downloaded images - some taken from the

internet - alongside students' own photographs, taken at an attached photography studio with friends as models. It is important to note that these processes took between two to five days to arrive at the chosen solution to the problem.

The chosen ideas were then presented to the class as a final rough presentation of the concept for critique and jury in the studio. Students are required to make some presentations and explain their outcomes for final approval and feedback upon completion of the idea generation phase. Except for a few cases, almost all presentations were accepted. At this stage the critique involved discussions on colour choice, layout and images that had been captured according to the brief requirements.

Observation with activity theory

Activity theory provides a philosophical and cross-disciplinary framework for studying different types of human practices as development processes (Kuuti, 1996). Observing the thumbnails (both initial and digital), and how students went through their ideation process led to the realisation, that technology no doubt has caused changes in the pedagogy of graphic design. Ideation is 'the process of generating, developing, and testing ideas that may lead to solutions' (Brown, 2008: p 4). However, one engages with the mind and tools in the process of brainstorming, organising, sketching, thinking and imagining with the view of creating ideas for implementation. From observation, about 70% of technological tools were used to realise these objectives and outcomes during the ideation process by students.

Most students used their pencils and sketchbook for the initial capturing of briefs and conceptualisation. The only interaction with lecturers here were the time taken to discuss the briefs, which was done in the studio/lecture rooms. The pedagogy of design education calls for more interactions since the lecturer acts as the 'client' and 'master', according to the Bauhaus principle, which informs the basis of graphic design pedagogy has made us to believe.

i

Fig. 4: Sample of thumbnail sketches by students that were scanned digitally for fine-tuning

During studio interaction, especially juries and with students, no meaningful feedback was captured since the large class did not allow for proper interactions. Students whose works were displayed had one or two feedbacks from peers, since the majority of their peers were far from the displayed works and were therefore seen concentrating on their own work in their sketchbooks. As Graham (2003) emphasised, 'criticism is the main pedagogical method used in the design studio'. The studio revolves around teacher demonstrations, desk crits given to individual students by peer and teacher, and juries of final design solutions. 'Critiques in the studio also help students develop their own critical faculties by instilling the process of reflecting and reacting to design intentions, which lead to their design decisions, and then reacting to the consequences of each action' (Graham 2003:18).

In this reported study, there were not enough critiques and interactions that helped the individual students in their design decisions.

Looking at the sketches revealed some attempts by students to conceptualise the ideas, as being the reflection of the brief. These ideas were easily captured with the pencil on paper. However, the quantity of sketches did not reflect the pedagogy of design as indicated by Hodge, (2009). Moreover, the final design solutions also did not reflect in the less number of thumbnails seen from the sketches even though the designs indicated 'great' ideas from the brief. Later in an interview, one such student indicated that *'an idea can creep up at the final stage of all your thumbnails, and the more you come up with them the more new ideas you come up with'*. Such activity could create problems with pedagogy since ideation requires a follow through of sketches to arrive at the design solution. Traditionally, the designer's way of thought has to go through the design process to

communicate effectively.

Fig. 5: The 'traditional method' of the design process (Author, 2011)

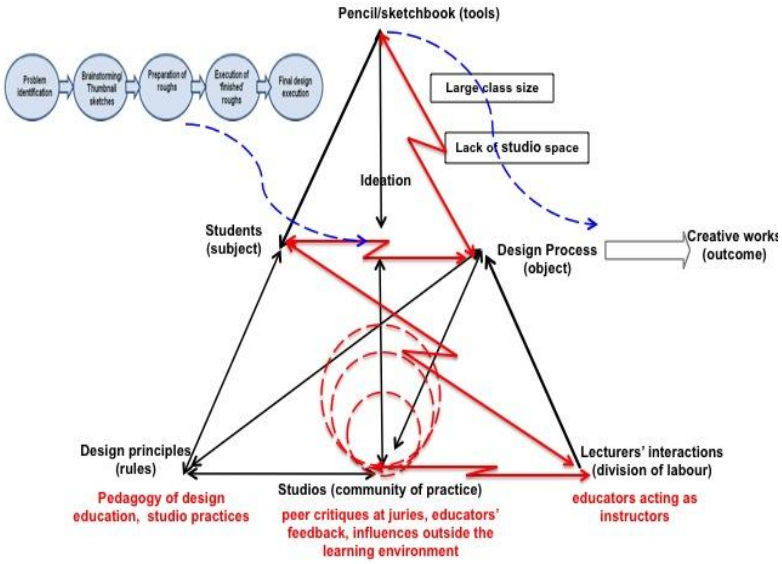


Fig. 6: The 'disturbances' of the ideation process as seen with the large class size without ICT integration

The design processes - problem identification, brainstorming/thumbnail sketches, roughs, finished rough/comprehensive, and the final design – will have to be followed through according to the adopted rules (Fig. 5), (Authors, 2011) Altering it could endanger the smooth process of idea development as seen in the current situation with large class numbers (Fig. 6): the students have problems meeting lecturers one-on-one to discuss the initial pencil sketches. However, they choose to communicate with one another at the studio critique and possibly with outside influences.

The emergence of digital studios has shifted the design process into the digital domain. Students now engage with the Internet and other software applications to move their concepts and ideas into

reality. One student, when questioned on the choice of image for his work, apparently because he used a white lady, remarked: "*after the composition, I had to go online and get images that suites the composition; sometimes it is difficult to come by a direct image like the one on a sofa; the type which can be understood on campus, not to talk of that environment, less time for submission… I normally use search engines like AOL and click on image; … instead of web, you type in all the words like, 'lying', 'relaxing', 'stretching'; … a word that has something to do with your composition*". In such instances, we graphically see ICT as a tool shaping our design process.

The introduction of technology also meant that, even though the class was large, students had the chance to obtain the needed feed back from peers and the teacher. In the studio, since everyone had the opportunity to view the sketches on display through the digital projections, others could make their contributions known, and feedback from other colleagues helped shape ideas.

However one of the most serious disturbances occurs within the process of ideation, which is due to the size of the class. This 'disturbance' is noticed when the process takes place without ICT. When students are being 'forced' to go the traditional way of developing ideas, there is a clear circumvention of the ideation process (Fig 6). Because student/lecturer interaction is absent, students seem to circumvent the ideation process and arrive at their final outcome. The ideation process, however, is evident when ICT is included in the equation (Fig 7). By trying out new types, layouts and manipulation of images on the computer, students go through vigorous ideation process based on iterative analysis - design, development, implementation and formative evaluation (ADDIE) - similar to the traditional method (Fig. 5). Such processes also promote 'sense-making activity' as an ideation process for problem-solving (Kimbell, 2004).

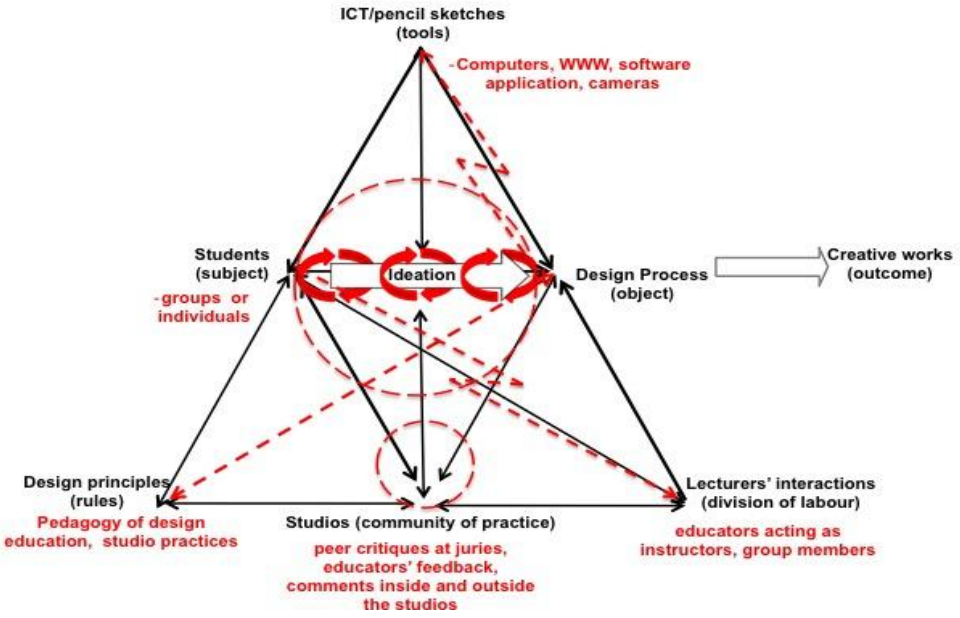


Fig. 7: The process of ideation captured with the large class size with ICT integration

Fig. 8: Sample of refined works with computer technology

Outside the studio, students engage with lecturers online in some discussions during which lecturers communicated on their designs via emails for feedbacks. Such a situation requires that both the student and lecturer have a clear understanding of the problems and sufficient specialised vocabulary with which to exchange ideas. It also transpired that, judging by the questions asked, lecturers seemed not to have trusted some students' capacity to execute their work, and the final designs showed some serious gaps in the flow of the thumbnail sketches. This apparently is because, when the final work was viewed against the approved thumbnails that were digitised for refining, dramatic changes had occurred (Fig. 6). Between the digitisation and the final stages of the ideation process, major changes with types/fonts, layouts and even with the choice of image and manipulations had occurred. These gave the impression of a vigorous iterative ideation process, but there was no way ideation process could be captured by the pedagogy. As one student remarked during a follow-up interview; "… *an idea could 'drop' at the final stages of all your thumbnails, especially when you start using the computer to refine your ideas; and the more you try refining them, the more new ideas you come up with…"* This might be the probable cause of the lecturer's lack of confidence in the students and the fact that there was no clear pedagogy that sought to interrogate and integrate ICT and ideation. It is in the light of such gaps that this author advocates an exploration into the study of ideation pedagogy as it relates to ICT.

Exploration of the pedagogy of ideation is particularly critical to educational research where the object of its inquiry is not simply knowledge of ICT, but how ICT knowledge could be used in the ideation process. Such knowledge will be responsive to the current or emerging needs of practitioners and ultimately to the solution of professional and educational problems (Richey, 1998, 7). Moreover, researches on the effects of ICT on learning are variable and inconclusive (Jonassen & Reeves, 1996; Ungerleider & Burns 2002). Perhaps educators and researchers need to focus on the issue that students need to be taught how to seek out new information for their designs, think critically and show initiative to with the challenges of the fast-changing world of ICT.

Moving Forward

Moving ahead, there seems to be a lack of detailed investigation into what actually takes place in the ICT learning environment, most especially within the context of graphic design. Design educators will need to understand that ICT does not exist in isolation; it is interwoven with the rest of the tools and participants in the learning environment. The purpose of ICT in the modern design studio, which now comprises technological innovations, will need to be clearly understood with regard to ideation process. Studies in research in ICT-supported design education needs to shift attention towards the whole configuration of events, activities, content, and interpersonal processes. This issue becomes important since ideation is a fundamental and critical issue in design education and should be the focus not only in the traditional model of design process.

Pedagogically, graphic design should not be an exception to design education especially when it comes to ideation process in design. As technological developments are also taking place in the developing countries, there is the need for educators to take a look at what is happening in the educational world of design in the developing economies. Educators are eager to equip the schools with technology as a way of moving with modern times. But, as Yeoh (2006) remarks; "state-of-the-art building, fancy equipment, and bungling bureaucracies aside, teaching is about inspiring curious minds, recognizing raw talents, and challenging students to think beyond their perceived capabilities especially in the field of graphic design where the methods and products are interactive and constantly changing' (Yeoh, 2006:174). Educators can only achieve this by developing a clearer pedagogy of ICT within ideation in the design process. This study is a contribution to the quest for a clearer pedagogy, especially with regard to the developing economies. Furthermore, this article encourages an on-going research into issues that will greatly help in answering the question: what methods of ICT are there for the teaching and learning processes of ideation in graphic design and how effective are they for the educator and the learner in the developing economy? This can be achieved within the right and appropriate framework for the research; an activity-oriented framework that relates to graphic design and that will show the tensions and imbalances in current pedagogy. It is hoped that these answers will eventually emerge as the study progresses.

References

1. Bender, D. M. (2005). Developing a Collaborative Multidisciplinary Online Design Course. *Journal of Educators Online*, *2*(2).
2. Bender, D. M., & Vredevoogd, J. D. (2006). Using Online Education Technologies to Support Studio Instruction. *Educational Technology & Society*, *9*(4), 114-122.
3. Bennett, R. (2000). Proposing a framework for creative online interaction. *The omnium project:Online*. Retrieved from
4. Brown, T. (2008). Design Thinking. *Harvard Business Review*, 1-10.
5. Brown, T. H. (2006). Beyond constructivism: navigationism in the knowledge era. *On the Horizon*, *14*(3), 108-120. doi:10.1108/10748120610690681
6. Cross, N. (1997). Creativity in design: analysing and modelling the creative leap. *LEONARDO*, *30*(4), 311 -317.
7. Dorst, K., & Cross, N. (2001). Creativity in the design process: co-evolution of problem–solution. *Design Studies*, *22*(5), 425 - 437. doi:10.1016/S0142-694X(01)00009-6
8. Graham, E. M. (2003). *Studio design critique: student and faculty expectations and reality. Criticism*. Louisiana State University.
9. Hodge, S. (2009). Drawing. Retrieved April 20, 2009, from http://psd.tutsplus.com
10. Jonson, B. (2005). Design ideation: the conceptual sketch in the digital age. *Design Studies*, *26*(6), 613-624. doi:10.1016/j.destud.2005.03.001
11. Kimbell, R. (2004). Ideas and Ideation. *Journal of Design and Technology Education*, *9*(3), 136-137.

12. Kvan, T. (2001). The pedagogy of virtual design studios. *Automation in Construction*, *10*, 345-353. Retrieved from www.elsevier.com/locate/autcon
13. Neuman, L. W. (2007). *Basics of Social Research: Qualitat ive and Quanftative Approaches* (Second., p. 365). New York: Pearson Educational, Inc.
14. Ranjan, M. P. (2005). *Creating the Unknowable : Designing the Future in Education Multi-disciplinary*. *Culture*. Ahmedabad.
15. Resnick, E. (2003). *Design of communicatin: conceptual graphic design basics*. New Jersey: John Wiley and Sons.
16. Sagun, A., Demirkan, H., & Goktepe, M. (2001). A Framework for the Design Studio in Web-Based Education. *JADE*, *20*(3), 332-342.
17. Schenk, P. (1991). The role of drawing in the graphic design process. *Design Studies*, *12*(3), 168-181.
18. Schenk, P. (2007). Developing a taxanomy on drawing for design. *Design* (pp. 1-15). Hong Kong.
19. Stones, C., & Cassidy, T. (2007). Comparing synthesis strategies of novice graphic designers using digital and traditional design tools. *Design Studies*, *28*, 59-72. doi:10.1016/j.destud.2006.09.001
20. Stones, C., & Cassidy, T. (2010). Seeing and discovering: how do student designers reinterpret sketches and digital marks during graphic design ideation? *Design Studies*, *31*(5), 439-460. Elsevier Ltd. doi:10.1016/j.destud.2010.05.003
21. Tan, S., & Melles, G. (2010). An activity theory focused case study of graphic designers' tool-mediated activities during the conceptual design phase. *Design Studies*, *31*(5), 461-478. Elsevier Ltd. doi:10.1016/j.destud.2010.05.002
22. Ungerleider, C. S., & Burns, T. C. (2002). *Information and Communication Technologies in Elementary and Secondary Education : A State of the Art Review*. Montreal.
23. Yeoh, K C. (2006). Recommendations for Design Educators and Students Who Embrace Computer Technology. *International Journal of the Arts in Society*, *1*, 167 - 182.
24. Yeoh, Kok Cheow. (2002). *A study on the influences of computer usage on idea formation in graphic design students*. Texas Tech University.
25. Yin, R. K. (2011). *Qualitatively Research from start to finish* (p. 369). New York: The Guilford Press.

Process modelling as an evolutionary systemisation for design in a demanding situation

Shohre Shahnoori and Andy (A. A. J. F.) van den Dobbeisteen
Technology University of Delft, Netherlands
S.Shahnoori@tudelft.nl

Abstract:

Designing for reconstruction after catastrophic earthquakes is a delicate task, especially when the re-occurring of the earthquake is probable. It becomes even trickier if it is subject to a sensitive context. Hence, although sustainability is being a common issue in the debates for about three decades, achieving sustainable solutions for some practical designs is a challenging responsibility. For example, Sustainable Reconstruction of Houses in a Seismic Desert city (SRH-SD) is an extremely complex and demanding design case. Besides, architectural design is a multi-disciplinary area, in which integrity of the design on various levels is crucial.

The current research is a part of a larger study on the SRH-SD that introduced systemisation in the previous research as one of the applicable solutions of the integrated design approach. For this, the design processes are modelled in a summery model as a larger system. Each phase of these processes has been assumed as a sub-system. A critical and the most crowded phase of these, which is called "exploration" phase has significant effects on the succession or failure of the design. Almost all the involved items in the complex design case of SRH-SD also play roles in this phase. Therefore, it has been sub-divided and sub-categorised in various ways and stages, and is being one step further integrated, organised, and modelled in this paper. As a result, in addition to the argumentations for these modelling(s), a model of this sub-system is of the main conclusions that will be presented at the end.

Keywords: Design systemisation, (sub)process modelling, SEP, context dependent, complex design, SRH-SD

1. Background, problem statement

Although many design related problems are being solved by modern methods and systems, human has to deal with some old problems yet. A demanding case of design is a Sustainable Reconstruction of Houses in a Seismic Desert, or SRH-SD, as a complex situation. This complexity is caused by two severe constraints of seismicity and conditions in a desert circumstance, which is the focus of the current research. Particular focus is on finding solutions in order to prevent the complex design from complication and chaos. Due to the involvement of a large range of varieties and because sustainability is the general aim of the research, the design becomes extremely complex, thus, it comprises a risky situation.

Figure 1. Examples of the scale of influences of earthquakes on buildings, structures, and materials from the earthquakes of Bam, 2003; Haiti, 2010; and Italy, 2012 (sources: BHAC, 2004; EARLB, 2010; FStv, 2012).

From one hand, in order to achieve a successful design the involved segments and aspects should be accurately incorporated. However, from the other hand the rise of numbers increases the design complexity. Hence in a SHR-SD a multiple of disciplines are involved (Shahnoori & Voorbij, 2008), which causes further complexity. This growth may turn the situation into complications, in which the design may fail to reach any appropriate conclusions. Therefore, solutions are required to let the entire segments, elements, and aspects to interplay in a manageable organised manner. A general solution was proposed in the previous research (Shahnoori & Dobbelsteen, 2010a) as systemisation of the design. The first scale of this solution is to model the design processes in a large flexible model. Because of a global knowledge and local applications, this backbone summery model was called the Glocal Process Model or the GPM.

Within the GPM processes the most crowded area and phase is its second phase, the exploration phase. In a sensitive design situation as a SRH-SD, this phase is significantly important (Shahnoori et al., 2011a). Exploration phase is the phase in which all the involved items, aspects, domains, and disciplines need to be carefully studied and known. The role of this phase on the success or failure of the design is crucial. Therefore, systemisations similar to that of the GPM, is being implemented for organising the huge populations inside the Subsystem of Exploration Phase, or SEP (Shahnoori et al., 2011b) as well.

Complexity and chaos

In a complex design situation, the probability of chaos increases with the increase in the number of involved items and their interactions (Bakker, 2007; Shahnoori et al, 2012). In order to avoid chaos in an architectural design, integration is a major concern (Shahnoori et al 2010a). Manipulated systems are normally set to avoid chaos or to control the chaos (Ott, et al., 1990), in the function or in the relationship, which again may end in functional disability (Grebogi et al., 1997). According to Bakker (2007), in order to control chaos, it is necessary to construct models that represent the complete behaviour of a system. Thus, using models for organising the design environment such as design processes is a good alternative. In a systematic approach to avoid chaos in a complex design situation, it is also helpful to arrange the subsystems inside the system of the process model (Kalay et al., 2003). However, as Lawson (2006) also states: 'Designing is far too complex a phenomenon to be describable by a simple diagram.' Nevertheless, the growing complexity in a SRH-SD may be more describable and controllable with these methods, of course, not by application of only one simple method or diagram.

In conventional architecture, designers often rely upon prototypical sets of objectives adapted from building codes, common practices, experience, and the ubiquitous 'average occupant' label (Carrara et al., 1991). From Gero's (2000) point of view, design is 'a goal-oriented, constrained, decision-making, exploration and learning activity, operating within a situation that depends on the

designer's perception of the situation, and results in the description of a future engineering system'. The greater the rational and scientific basis of this design process, the less will any wrong personal interpretations influence it. By systemisation this will also be achievable in easier ways.

(Sub) systemisation

To realise modern design, modern methods and systems should be invented (Lawson, 2006; Cross, 2008). Methods and systematic approaches in engineering design (e.g., system-engineering and computer science) are more specific than those in the architecture are. Besides, there are various interpretations of these systems and methods. For example, Freivalds et al. (2009) state that 'Methods-engineering include designing, creating, and selecting the best manufacturing methods, processes, tools, equipment and skills to manufacture a product.' This definition itself shows a systematic approach to engineering. Although it has been applied in engineering fields rather than in architecture, the application of modern materials and construction systems makes modern architecture even more eligible for new systemisations. An example is involving computers in the design. Digital design requires adjustation of the design to the computer's methods of understanding, recognition, and languages. Thus, the potentials for this adjustment have been tacitly experienced.

2.1. Systems and the SEP

System is derived from the Greek *σύστημα* (systēma) meaning an integrated group of interaction, interrelated, and interdependent entities (AHD, 2000). In the environment of a system elements have particular relationship with one another; they are distinguished from the surrounding by a boundary (the scheme in figure 2).

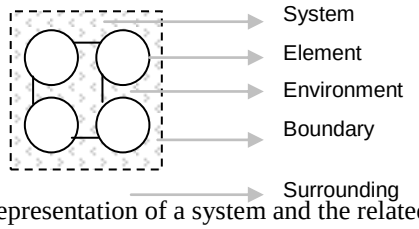
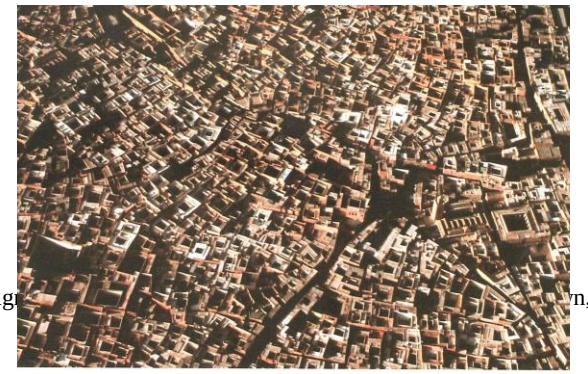


Figure 2. A schematic representation of a system and the related items

An element of a system is identifiable only inside that specific system (Roozenburg et al., 1991). This is because all the characteristics and roles of the element are meaningful as long as it belongs to the system. A set of element-attributes is termed a 'class' (Klassen 2003). For example, four-storey residential complexes can form a class. Within systems, various complex relations are possible. Hence, systems may become context-dependent, meaning that the arrangement inside a system may occur due to particular local conditions. Thus, a system that functions very well in a particular environment may not function in other surroundings at all. For example, a perfect heating and cooling system for houses in London may not be appropriate for a house in the desert city of Bam. The system of concentrated urban fabrics in Fez or Marrakech (fig. 3) does not apply to the urban tissues in some Mediterranean coastal regions that have to deal with the problem of sprawl (Antipolis, 2001) or even with the urban fabric in the warm region of Millbrae in Nevada (fig. 4).



.

Figure 3. A bird's-eye view of the urban fabric in Marrakech

Figure 4. Urban tissue of a part of Millbrae, Nevada, USA

However, according to the law of assimilation-contrast (Vroon, 1995; Krech and Crutchfield, 1961; Klassen, 2003) many designers, engineers, and technologists tend not to perceive either this context-dependent functioning or distinction between the system, its environment, and its internal coherent.

For organising the exploration phase of the design in a complex situation, we first assume the system of design process model, GPM, as a larger system or the environment for (the smaller system or) the SEP. Therefore, in a complex design as a SRH-SD, the SEP plays a specific role in GPM, and functions as an element of that system, while it includes its own particular internal arrangement, environment and elements (e.g. fig. 5). With these distinctions and according to the definitions, the system of SEP and its environment (the GPM), are similar and hierarchical.

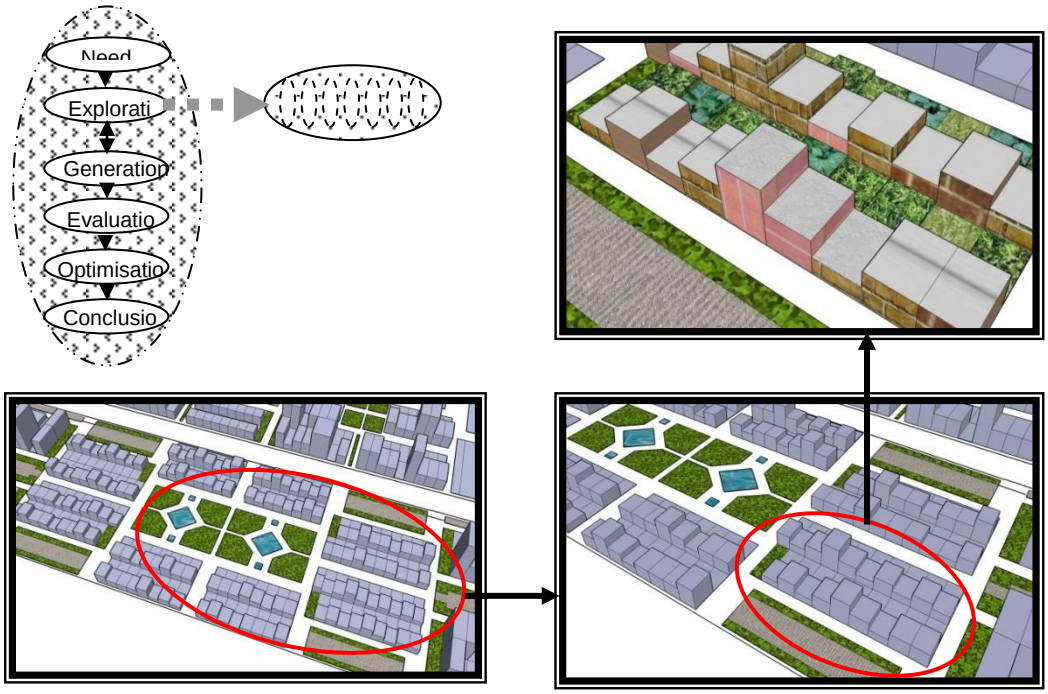


Figure 5. Schematic demonstration of the relationship between a larger system (environment for the subsystem) and the smaller system in the GPM (with the SEP), and similarly in the system of a city

However, this subsystem (SEP) also includes various types of items. Therefore, before arranging (sub)process model, which is neither fixed nor limited, a general classification of actions was presented in the previous research (Shahnoori et al., 2011a).

2.2. Classifying the actions in the Subsystem of Exploration Phase

The general classification of the type of details within the SEP includes first, data, investigation, information, and problem statement. The second type of actions involves analysing these, which is followed by prioritisation and partitioning, decision-making and synthesis as the third. These form the basis for the conceptual design (e.g. figure. 6.). The categorisation of the elements in SEP and their relationships and connections inside the GPM, are emphasised by iterative feedback loops (e.g. the scheme in fig 7).

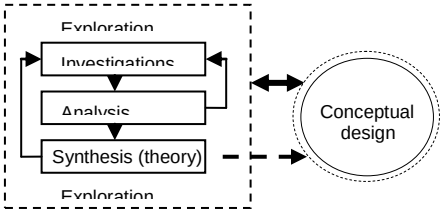


Figure 6. General classification of actions inside the exploration phase

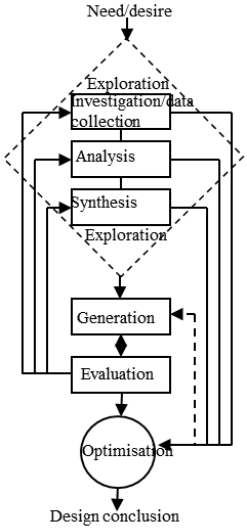


Figure 7. The GPM process model in a SRH-SD, including the three classes of actions inside the SEP

3. Towards modelling the processes inside the subsystem

Innovative solutions may also derive from an evolutionary background by a new kind of thinking. Einstein (1879-1955) states *'We cannot solve problems by using the same kind of thinking we used when we created them'* (Khan, 2007). For modelling the processes of the SEP, the new way of thinking includes also application and development of existing solutions from other fields, which is similar to the technology transfer. In the methodology for further organising the SEP, as the sub-process, Cross's model (2008) forms the basis. However, as was indicated, adjustment for an architectural design is necessary. The detailed processes proposed by Cross (2008) contains stages collected in Table 1.

Table 1. Details of processes for the design, introduced by Cross (2008)

Stage of the process	The relevant method, characteristics and the aim
Identifying opportunities	User scenarios Aim: to identify and define an opportunity for a new or improved product
Clarifying objectives	Objectives tree Aim: to clarify design objectives and sub-objectives, and the relationships between them
Establishing functions	Function analysis Aim: to establish the functions required and the system boundary, of a new design
Setting requirements	Performance specification Aim: to make an accurate specification of the performance required of a design solution
Determining characteristics	Quality function development to set target to be achieved for the engineering characteristics of a product such that they satisfy customer requirements
Generating	Morphological chart

alternatives	to generate the complete range of alternative solutions for a product, and to widen the search for potential new solutions
Evaluating alternatives	Weighed objectives to compare the utility values of alternative proposals on the basis of performance against differentially weight objectives
Improving details	Value engineering Aim: to increase or maintain the value of a product to its purchaser whilst reducing its costs to its producer.

A summary of stages in the Subsystem of Exploration Phase (in the SEP)

In an architectural design, a list of pre-defined objectives and information, including the site and location, is normally prepared by the client - i.e., person, developer, organisation, etc. (Simon, 1969; Schön, 1986; Cohn, 1992; Ferguson, 1993; Leupen et al., 1997) as the core of the design task. These initial objectives need to be clarified after receiving the first data. These can also be called 'initial goals', because they do not constitute the whole design aim, and they do not show the design outputs. Generally, in such a procedure, the outcome of the process cannot be deduced from its initial goal (Ferguson, 1993). Thus, in architectural design, the function is mostly pre-defined. This pre-defined function may require further investigation and elaborations during the processes after the designer is familiar with the context and the information.

Many cases of architectural design do not have individual clients, but organisational clients, developers, or even governments (see Cohn, 1999; Carmona et al., 2000; Lawson 2006…). In such cases, the client may ask for a comprehensive investigation about and estimation for the production, which satisfies the specified need. Otherwise, the developer, for example, may ask the architect or the group to perform the preparatory work. However, on the upper level of architectural design as urban and even in landscape design, the sub-functions may not be recognised by the user or by the client in advance, although the general function is known prior to the design. These are defined throughout investigation and analysis in the SEP.

After refining the function, identifying the boundaries and limitations is required. Now, recognition of the sources and opportunities are important to investigate and explore in the SEP. Here, Cross's (2008) detailed model is relevant. In fact, the design is directly influenced by these sources and opportunities, especially in the generation phase (Bonenberger, 2005). This step, in conjunction with the limitations and constraints, is critical (Kalay, 1991; Lawson, 2006; Cross, 2008) when the design is seriously complex.

Constraints, regarding the terminology of this study, may affect several elements of the design directly and others indirectly. For example, technical aspects may be directly influenced by the constraints (Bonenberger, 2005; Shahnoori 2008), which also indirectly influence the social aspects (Shahnoori et al. 2007d). Hence, a severe constraint plays a major role in decision-making and prioritisation (French, 1999). Therefore, in developing a process model for SRH-SD, the sources & opportunities, together with the limitations & constraints, require special considerations.

In a normal design process, not all the objectives are known in advance (Lawson, 2006). 'The designer first defines the boundaries of the system (often involving highly arbitrary judgments). Then the permissible inputs to the system and the permissible output from the system are carefully determined. Nothing may cross the boundaries unobserved. Analysing the gathered information and completing the site observation and other complementary activities will be prior to synthesising and proposing ideas as the basis for conceptualisation in the next phase, which is the generation' phase.

3.2. Procedural steps; developing the processes model for the SEP in a SRH-SD

In an architectural design, based on the given initial programme and the location, a general investigation is needed for becoming familiar with all the aspects, criteria, domains, and disciplines. On-site observations or *in situ* investigations are followed by the identification of resources and limitations, and refinement of the functions. Further objectives can be identified at the stage in which information and documents for the design are more or less collected and prepared. In the philosophy of science, new process and research may start up whenever available knowledge is insufficient (Bunge, 1967). Thus, first the available knowledge will back up the beginning of the research. Similarly, but in a 'Designerly approach' (Cross, 2003), when existing solutions do not fulfil the needs of a design a new design process will be initiated. In science, the relevant data and information are essential elements of the scientific approach. However, extraordinary knowledge is required to analyse this collected information (Bunge, 1967). Analysis is necessary to come up with a hypothesis in which synthesising is the best rational approach (Ritchey, 1997). In a design process, only visionaries are capable of comprehensiveness (Shahnoori, 2008). Visionaries have a panoramic overview and can envisage the result (Mintzberg et al., 2006). They can analyse the available information in the light of existing knowledge and come up with suitable solutions in an appropriate way (Porter, 1998). With regard to this last factor, an appropriate supervision of the entire stages and the steps in the exploration phase should be also established.

This classification enables the designer to reduce the risk of chaos in a complex design situation, and facilitates further ramification in the design processes in a systemised way. In this classification and ramification, which is analogous to science (see French, 1988; Roozenburg, 1988; March and Smith, 1988; Ferguson, 1993; Archer, 1999), the exploration phase of the process forms a strong foundation for the design. Accordingly, almost everything is known at the end of the investigation. At that point, the investigation can be finalised and moved on into the analytical phase. The result of this finalisation and analysis is 'set of the requirements' for the design, as specified in Cross (2008) as well. After this, the characteristics can be determined.

The design environment at this stage has been recognised, the fundamentals are solidly grounded, and the pre-design/conceptualisation documentation can be provided. In fact, the analytical step consists of identifying the degree to which the specifications need to be satisfied as precisely and desirably as possible (French, 1999). This step includes all the involved aspects along with the relevant criteria. Based on the output of the analytical step, the exploration phase can end with the theoretical outcomes (French, 1999) or synthesis.

4. Summary and conclusions

Although the step-by-step structure and organising is helpful, it does not guarantee a successful solution, but it does reduce the risk of failure. Some information on design problems may never be available. Besides, the relevant activities to the SEP are not terminated in this phase, because these activities may be iterative and need to be completed in various ways and phases. For organising the steps of the sub-system of exploration phase for a SRH-SD, models should be developed/ adjusted to the architectural design.

In such arrangements, the sub-process inside the SEP for a complex situation as a SRH-SD is classified in more detailed (table 2.)

Table 2. The stages of the processes in the SEP for a SRH-SD within the frame of the GPM

Subsystem of Exploration phase (SEP) in a SRH-SD	
Investigation/ data	Initial objectives
	Sources and opportunities
	Limitations and constraints
Analysis	Functions refinement
	Clarifying objectives
	Setting requirements

Synthesis (on theoretical level)	Determining characteristics
	Establishing strategies & final decisions

Finally, a model of these steps is presented in this paper (e.g. the diagram in fig 8).

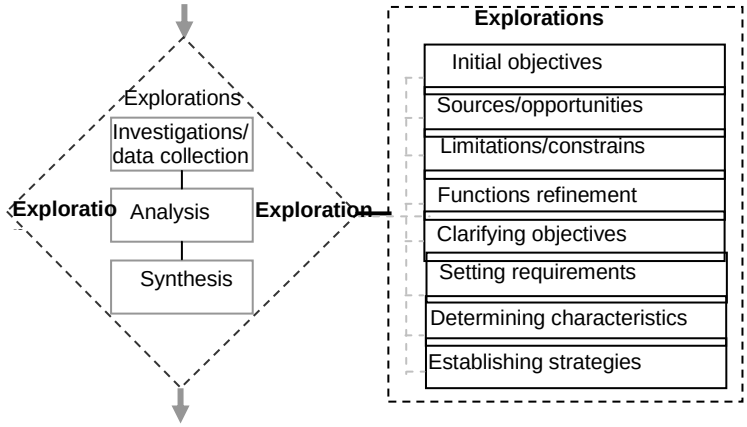


Figure 8. A model of the detailed stages of the exploration phase of the GPM

References

1. *AHD, 2000. American Heritage Dictionary, Houghton Mafflin Hardcourt; Thumb Indexed edition, ISBN: 0395825172*
2. *Alexander, C. 1964. Notes on the Synthesis of Form, Cambridge, MA: Harvard University Press*
3. *Antipolis, S. 2001. URBAN SPRAWL IN THE MEDITERRANEAN REGION, Blue Plan, Regional Activity Centre, UNHP, 03-04-2001*
4. *Archer, 1999. Design in general education. Royal College of Art, London*
5. *Bakker, 2007. Learning to simulate and predict chaotic dynamical systems, Delft, S. L. S. n., ISBN: 978-90- 8891-011-1*
6. *Bonenberger, P. R. 2005. The first Snap-fit handbook, Munich, Hanser, 2005, ISBN: 3-446-22753-9.*
7. Bunge, M., 1967. Scientific research I; the search for system, Studies in foundation Methodology and Philosophy of science' Berlin, Springer 1967.
8. *Carmona et al., 2000 Carmona, M. (2001). Strategic planning and urban projects: responses to globalisation from 15 cities. Delft: DUP Science, ISBN: 90-407-2272-2.*
9. *Carrara G.; Kalay, Y., 1994. Knowledge-based computer-aided architectural design, Amsterdam: Elsevier, ISBN: 0-444-81759-x*
10. *Chen, Y. J. and Corter, J. E., 2006. When mixed options are preferred in multiple-trail decision. Journal of Behavioural Decision Making, 19(1) pp17-42.*
11. *Cohn, J. L. 1992. Towards an Architecture, Translation of the 1928 printin of Le Corbusier, Vers Une Architecture (Paris G. Cress, 1924).*
12. *Cross, N. (2008). Engineering Design methods. Chichester, Wiley, ISBN: 9780470519264.*
13. *Eckert, C; and Stacy, M, 2000. Sources of inspiration: A language of design. Design Studies 21(5), 523-538.*
14. EARLB, 2010. Haiti earthquake, ' Stats of Destruction in Haiti, by EARLB march2.2010 in IMAGE PHOTO.ESSAY
15. *Ferguson, E. S., 1993. Engineering and the Mind's Eye, Cambridge, Mass, MIT Press, ISBN: 0262061473*
16. *Freivalds at al., 2003. Freivalds, A. and Nibers, W. B. 'Nibel's Methods, Standards, and Work design' (twelfth edition) New York, McGrow-Hill, ISBN: 978-0-07-337631-8*

17. *French, 1999. Conceptual design for engineering, 3rd ed. London; Springer ISBN: 1852330279*
18. FStv, 2012. ITALY QUAKE KILLS AT LEAST FIVE, at FStv, A network powered by the people, 20.05.2012.
19. *Gero, 2000 Artificial Intelligence in design. 00. Kluwer Academic Publications, Dordrecht, 719pp. ISBN: 1-4020-0716-7.*
20. *Grebogi, C. and Lai, Y. C. (1997). Controlling chaos in high dimensions, "IEEE Trans. Circ. Syst. – I: Fund. Th. Appl. 44(10), 971-975*
21. *Jones, J. C., 2002. Design methods (architecture). John Wiley & sons, ISBN: 0471284963*
22. *Kalay et al., 2003 Evaluating and predicting design performance, Chichester; Wiley, ISBN: 0-471-85385-2*
23. *Khan, S. 2007. Einstein His life and Universe, Book Review on Amazon.com, 14, April, 2007.*
24. *Klassen I. T. 2003. Knowledge-based design: developing urban & regional design into a science. Dissertation, Delft University of Technology, Print: DocVision (Delft).*
25. *Krech D. and Crutchfield, R. S. 1961. Elements of Psychology. Alfred A. Knopf publisher, ASIN: B001IMODA2*
26. *Lawson, B. (2004). What designers know? Oxford: Architectural Press, ISBN: 0-7506-6448-7.*
27. *Lawson, B., 2005. Oracles, draughtsmen, and agents; The nature of knowledge and creativity in design and the role of it. Automation in Construction 14(3), 383-391.*
28. *Lawson, B. (2006). How designers think, demystifying the design process, Oxford, Architectural Press, ISBN: 0-7506-6077-5.*
29. *Leupen, B. (1997). Design and analysis, Rotterdam, 010 Publishers, ISBN: 90-6450-259-5*
30. *O'Reilly, C. A., (2000). Hidden Value: How Great Companies Achieve Extraordinary with Ordinary People. Harvard Business School Press; 1edition, ISBN: 0875848982*
31. *(Ott, et al., 1990),*
32. *March and Smith, 1995 Design and Natural- science research on information Technology, Decision Support, vol. 15, no. 4, pp. 251-266.*
33. *Mintzberg et al., 2005 Mintzberg, H., Ahlstrand, B., Lample, J., Strategy bits back: it is a lot more, and less, than you ever imagined, ISBN: 0-273-693-468*
34. *Oxman, R., and R., 1993. Precedents: Memory structure in design case libraries. IN Fleming, U. and Wyk, S. V. (Eds) Proceedings of the Fifth Int. Conf. on Computer-Aided architectural Design Futures. Pittsburgh, Pennsylvania, US, north-Holland Publishing Co., Amsterdam, the Netherlands.*
35. *Porter, 1998 Michael e. porter, competitive strategy: techniques for analysing industries and competitors, free press, New York, June 1998, ISBN: 0684841487*
36. *Pugh, S., 1991. Total design: Integrated methods for successful product engineering, Wokingham, Addison-wesly Publisher inc. ISBN: 0201416395.*
37. *Ritchey, T., 1996. "Analysis and Synthesis On Scientific Method- Based on a Study by Bernhard Riemann." System Research 8(4): 21.*
38. *Roozenburg, N. F. M. and Eekels, J., 1995. Product design; fundamentals, Chichester, Wiley, ISBN: 0-471-94351-7*
39. *Schön, D. A., 1983. The reflective practitioner, Temple-Smith, London, 1983*
40. *Schön, D. A., 1985; The Design Studio; An Exploration of its Traditions and Potentials, RIBA publications Frank Peters Ltd. Kendal, ISBN: 0947877452*
41. *Shahnoori, S. and Voorbij, A. I. M., 2007. Glocal Structural System in a seismic desert city, in the Proceedings Of the International Conference of Sustainable Building construction and Materials SB07 Lisbon, Portugal, 2007.*

42. *Shahnoori, 2008, Strategy establishment, scientific report for the PhD Peer review and the Scientific committee, Department of Building Technology, Delft University of Technology, November 2008, Delft The Netherlands*
43. *Shahnoori, S. and Van Den Dobbelsteen, A. A. J. F., 2010a. Design Systemisation, Supporting architectural design in a demanding situation, Adjusting and developing a process model for a complex architectural design, in the proc. Int. conf. Design Research, by Achten, H. H.; de Vries, B.; and Stappers, P. J., May 2010, Eindhoven, the Netherlands, Eindhoven University of Technology, ISBN: 978-90-6814-630-1.*
44. *Shahnoori, S. and van den Dobbelsteen, A. A. J. F., 2010b. The first stage of an architectural design in a complex situation, a critical task; seismic prone desert environments and designing houses. Journal Of Art & Science, ISSN: 1944-6934.*
45. *Shahnoori. S, and van den Dobbelsteen, A. A. J. F., 2011. Modelling and Leading the design in a complex situation; strategy establishment, submitted to The International Journal Of Design Research, Sweden.*
46. *Simon, H., 1977. The new science of management decision, Englewood Cliffs, Prentice-Hall, ISBN: 0136161367*
47. *Simon, 1969. The Sciences of artificial, MIT press, Cambridge, Massachusetts first edition*
48. *van loon, E. 1998. The new science of management decision, Englewood Cliffs, Prentice-Hall, ISBN: 0136161367*
49. *Vroon, P. 1995. Tranen van de Krokodil Baarn, the Netherlands, Ambo.*

Acknowledgment

The writers' express deepest gratitude to Prof. Klaas van Breugel, Dr. Liek Voorbij, and Dr. Lara Schrijver for their valuable comments.

Design through storytelling

R. Moalosi
Industrial Design & Technology Department,
University of Botswana, Botswana.
Moalosi@mopipi.ub.bw

M. M'Rithaa,
Department of Industrial Design,
Cape Peninsula University of Technology, South Africa.
MugendiM@cput.ac.za

B. Morekoo
Mmanaana Junior Secondary School, Botswana,
mstarboikanyo@yahoo.com

Abstract

Plagiarism is one of the major challenges in undergraduate students' written assignments. Against a background of general under preparedness of students entering higher education, poor academic literacy levels, limited knowledge about plagiarism and an increasing affinity among students towards visual learning resources, this paper reports on a research study that investigated the potential of digital storytelling as an alternative assessment method in a first year Industrial Design course, at a University of Technology, South Africa. In this course,

Technology 1, digital storytelling was used for student assessment instead of a paper-based essay. Digital stories are usually short movie clips, created with off-the-shelf equipment and techniques, combining text, images, videos, music and narration. Drawing from the principles of authentic learning, the researchers investigated benefits and challenges of using digital stories as alternative assessment method. Qualitative methods of collecting data were used, which included focus group interviews with the students and in-depth interviews with lecturers. Findings of the study showed that digital storytelling promoted authentic learning, which led to high levels of student engagement with their studies and hence meaningful understanding of the subject matter. However, findings also revealed the importance of providing support to students in developing a high quality, polished end product. More research is needed to explore the potential of transferring this highly independent, student-led project into other disciplines.

Keywords: digital storytelling, authentic learning, assessment methods, student engagement, industrial design

Introduction

Plagiarism is one of the major challenges in undergraduate students' written assignments. Furthermore there is an increasing critique that students are not ready for industry as a result of the fact that Higher Education (HE) is teaching theory and not linking theory to practice (Bennett, Harper, & Hedberg, 2001; Herrington & Herrington, 2006). Against this background and the increasing affinity among students towards visual learning resources (Hull, 2003), this paper reports on a research study that investigated the potential of digital storytelling as an alternative assessment method in a first year Industrial Design course, at a University of Technology, in Cape Town, South Africa.

This study adopted a theoretical and analytical framework of authentic learning, which places a particular emphasis on learning happening in a real world context. This study adopts a qualitative research approach, analyzing staff and students' self-reported perspectives through an authentic learning lens. Although originating from digitally saturated contexts, the increasing access to mobile technologies has made digital storytelling viable in less resource rich environments. However, limited research evidence exists to support the above claim (Lundby, 2008). This project will aim to contribute to this small but growing field of knowledge of the use of digital storytelling for authentic learning in resource poor environments. The conclusions drawn from this study and recommendations for future digital storytelling projects, as well as areas for further research, will conclude this paper.

Background of the study

The subject Technology 1 is an introductory course, within the Industrial Design programme at a South African University of Technology. The average class size is fifty students, which becomes substantial when dealing with one-on-one tuition and feedback on practical assignments (Tucker & Reynolds, 2006: 40). Over the preceding years, the subject lecturers had noticed a significant change in the level of preparedness of students, especially evident in their lack of academic writing skills. This resulted in a substantial number of students fully or partly plagiarising their written assignments, or using incomplete or incorrect referencing techniques. Apart from adding to an already heavy burden on the lecturers assessing the work, it led to general frustration among students and lecturers alike. The combination of these factors necessitated a change of teaching and learning approach.

The digital storytelling project was an experimental project, devised by the lecturers as an alternative form of assessment, replacing an essay-style assessment. The intention was to ensure that the students engaged with the material, learnt from their peers, showed an understanding of referencing techniques, and that the time needed to assess the work was reduced. If the results of the digital storytelling project were reasonable, these stories would also form the start of a more updated library of Technology resources.

Literature review

Increasingly, Higher Education classrooms in South Africa have become more diverse. While in the past the student body was considerably smaller and could be expected to be of greater homogeneity in terms of level of preparedness and student demographics, today's student body is not only larger, but comes into Higher Education with diverse levels of preparedness and diverse demographic backgrounds, such as gender and age (Duggan, 2004: 5; Scott et al., 2007). In order to meet the needs of this diverse student body, a variety of teaching and learning activities have to be introduced, as well as different and varied assessment methods. Furthermore, due to the general drive to open access to South Africa's Higher Education and changes in the school curriculum, learners who are unfamiliar with academic writing and referencing need to be accommodated (Scott et al., 2007; Teferra & Altbach, 2004).

Industrial Design studio-based education, with its pedagogical approach firmly rooted in the cognitive apprenticeship model (Duggan, 2004; Tucker & Reynolds, 2006), subscribes to a teaching and learning approach that is highly interactive, project based and with a strong link to real-world problems (Docherty, Sutton, Brereton, & Kaplan, 2001: 235).

However, assessment methods often follow the traditional academic patterns, such as essays and other written work and are thus less authentic. Authors such as Allen (2009) and McLaren (2007) argue that traditional approaches to assessment such as essays, tests, student-centred discussions and presentations will begin to appear inauthentic if they do not, to some extent at least, recognize and embrace multi-modal, internet-enabled knowledge networking.

Increasingly lecturers are introducing digital storytelling as an alternative means of appropriating knowledge or content in and outside the classroom, based on the belief that knowledge is context-dependent and should therefore be acquired in realistic contexts (Duffy and Cunningham cited in Bennett 2001). Digital stories are usually short movie clips, created with off-the-shelf equipment and techniques, combining text, images, videos, music and narration (Lundby, 2008).

Digital storytelling foregrounds the importance of not only textual literacy and reasoning that predominate schools and universities, but facilitates the development of a full range of digital literacies, necessary for 21st century graduates (Hull, 2003). These literacies require students to know how and when to use tools and technologies. By allowing students to tap into existing visual and technological literacies, they can at the same time develop their academic literacies (Kajder, 2004).

Theoretical and analytical framework: authentic learning principles

This study adopted an authentic learning framework as a theoretical and analytical framework. Guided by a socio-constructivist philosophy and drawing from cognitive apprenticeship theory and situated learning (Dennen & Burner, 2008), authentic learning is defined as learning where students are situated in authentic learning contexts and where they are exposed to learning activities that are as close as possible to problems they will encounter in their real world professional context (J. Herrington, Mantei, Herrington, Olney, & Ferry, 2008). This can thus bridge the boundaries of

formal education and the professional workplace and between theory and practice (J. Herrington & Reeves, 2003).

Herrington and Herrington (2006) identified nine characteristics of authentic learning:

1. **Authentic contexts**, that reflect the way the knowledge will be used in real-life and can serve as an authentic rationale for the study of a complex problem, guided by genuine practices of professionals (p.4).
2. **Authentic activities**, that are complex and comprise ill-defined problems and investigations, which have real-world relevance (p.5).
3. Access to **expert performances** enabling modeling of processes, which allows students to observe how relevant tasks are performed in the real world (p.5).
4. **Multiple roles and perspectives** providing alternative solution pathways, which allow students to examine problems from a variety of stakeholders' perspectives to conduct a sustained and deep exploration of a problem (p. 6).
5. **Collaboration** allowing for the social construction of knowledge, mirroring the often collaborative problem-solving encountered in real-life work experiences (p. 6).
6. Opportunities for **reflection,** a social process, whereby through collaboration a reflective process can become apparent (p. 7).
7. Opportunities for **articulation** to enable tacit knowledge to be made explicit, and whereby students through presentations have to defend their arguments publicly (p. 7).
8. **Coaching** and scaffolding by the teacher - and other students - at critical times. Complex problems of this kind would be extremely difficult without the guidance and support of the teacher and by other students within collaborative groups (Reeves, Herrington, & Oliver, 2002).
9. **Authentic assessment** that reflects the way knowledge is assessed in real life and is seamlessly integrated with the activity, often leading to polished products (Herrington & Herrington, 2006: 8-9).

However, one dimension that is implied in Herrington's above-mentioned characteristics of authentic learning, but that is not explicitly mentioned, is student engagement. Learning needs to be significant, meaningful, and seen to involve the interests of students. A strong link to intrinsic motivation developed through the challenge, relevance, interest and involvement in the contexts they study (Riggs & Gholar, 2009). Similarly Herrington et al (2003) found that students involved in authentic learning are motivated to persevere despite initial disorientation or frustration, as long as the exercise simulates what really counts—the social structure and culture that gives the discipline its meaning and relevance (Lombardi & Oblinger, 2007).

The use of emerging technologies can promote a number of the characteristics of authentic learning, such as collaboration across distance, sharing of results and communicating with experts (Lombardi & Oblinger 2007). One example of a mobile technology that can support authentic learning, is digital storytelling (Olney, Herrington, & Verenikina, 2009). Olney, Herrington and Verenikina's study (2009) in which early childhood educators developed an authentic digital story book, shows that, in general, the response of the students to learning new and potentially complex technologies and software was made much more focused and achievable through the use of an authentic task.

Methodology

In this study, a qualitative approach was employed with an aim of understanding lecturers' and students' perceptions on whether digital storytelling as an assessment activity in a first year Industrial Design course, at a South African University of Technology, promoted authentic learning. This approach was suitable for the study because of its strength in investigating experiences as they are ' lived' or 'felt' or 'undergone' by the participants (Sherman & Webb, 1988).

The study was conducted in 2011, and the population of the study was 49 first year Industrial Design students. Informed consent was sought from students and the lecturer of the course. Confidentiality was ensured by allocating alphabetical numbers to study participants in order to ensure anonymity in transcription and analysis. Two focus group interviews were conducted; each comprising 10 students (thus a total of 20 students participated in the study), and two in-depth interviews were carried out with the lecturer teaching this course.

The coding system used in this study was informed by the nine elements of authentic learning (Herrington and Herrington, 2006). Data was analyzed through constant comparison in order to establish whether the production of digital stories as an assessment activity promoted authentic learning (Morgan, 1993).

Members of the research team discussed the research process, the congruency of the emerging findings with the raw data, and tentative interpretations, which promoted validity. Audit trails (detailed accounts of the methods, procedure and decision points in carrying out this study) were recorded. Ethical clearance was obtained from Research Ethics Committee of the institution.

The researchers in this study acknowledge that findings can offer valuable insights into the use of digital storytelling for authentic assessment purpose could draw from, but are limited by the scope of the study.

Results

In this part of the paper we will report the findings from student focus group discussions and the lecturer's interview along the nine dimensions of authentic learning as identified by Herrington and Herrington (2006).

Dimension 1: Authentic context

The real-world context of an Industrial Designer includes teamwork, division of tasks based on individual strengths and skills, sourcing of information and materials from various sources and working to a brief by a client, under time and resource constraints.

Students worked in and out of the studio, some filming on the authentic location. As one of the main advantages of this project, the lecturer mentioned that this project allowed students to acquire content in a more visceral way than by doing an online search:

> Lecturer: "The best thing a film where two students had gone to Newlands Forest: they literally walked until they found the burr[13] to film. Previously you would get a diagram and later you could show students a burr and ask them what that is and they wouldn't know…because the disconnect between the diagram and the actual thing was huge..., but for

[13] A burr is a visible defect in timber.

this project they actually went out into a forest and found one on a tree ... they will never forget what that is."

In terms of authentic contexts and resource-restrained environments, one of the students argued that responding to unforeseen challenges and developments helped them to be creative in their problem solving:

> Student D: "The day that we were supposed to shoot …we had a campus riot […] strikes and what ended up - that really interrupted our shooting schedule because we had specific locations, specific ideas and we couldn't get access to those areas …Because we had the information ready and so we used the strikes as a backdrop and used it to our advantage…"

Dimension 2: Authentic task

An authentic task in an Industrial Design real world scenario, would involve a brief by a client defining the requirements of the task, specifying materials and target group and limitations in terms of time and financial resources. In this course the project brief was set up along specific requirements in terms of content and deliverables (e.g. topic of movie, length of movie), but was broad in terms of processes, allowing for students' freedom and creativity. The lecturers deliberately did not show any model stories, in order not to limit students' imagination.

Students appreciated the freedom and creativity this project offered them:

> Student A: "I found it interesting how everyone had a different style for their movie so it like really got the creative juices flowing and different ways as well it wasn't like a set. With each brief there's like a very set skill that we have to learn, so everyone's designs are reasonably similar but this was so vast we could do whatever we wanted. It was nice."

Dimension 3: Expert performances

Because of the openness of the brief and the diverse skill set involved in developing a digital story, which group members might not have possessed, students approached the wider community of friends and families to support them in carrying out the task, such as asking a brother to act in a movie, sourcing necessary equipment or asking friends to help with editing. They also interviewed experts on the content, such as visiting a lumber mill. This helped them in establishing networks of experts, an important skill in their future career.

> Student E:" … from a shooting perspective I've never shot a film so I actually got a friend in to like explain how you need to shoot a film if you're going to edit it where you like have a two second pause at the beginning and at the end so that if you mixing things together..."

Dimension 4: Multiple roles and perspectives

As mentioned before, students relied on a variety of resources to develop their movie, such as the Internet, but also field trips, expert interviews, their own experience and support from the wider community of family and friends.

Student C: “I just think it’s wonderful to try new things all the time and to push yourself to look at things from a different point of view.”

Dimension 5: Collaboration

In this project students were grouped randomly, to prepare students for what they would encounter in a real world, where students have to work and collaborate with a diverse group of colleagues. In students’ responses one can see varied levels of collaboration.

Student B: “I found it was quite nice to write the script with all three of us because we kind of like, I don’t know it becomes fun and you start feeding – as I said you start feeding off each other’s – so like someone will come up with a basic outline of the story and then like you start putting in little details, which was quite cool.”

However, most groups applied a more strategic approach, dividing tasks according to skills and interest of students and also gaining knowledge about group dynamics and how to achieve best results in a collaborative project.

Student F: “I for instance did some, most of the scripting, the other guy did the editing and one guy did most of the recording and we also did and took turns with the recording because we needed more people in the shot but … a natural division of labour happened. People migrate towards what they kind of feel comfortable with.”

Student B: “I think also different people have better skills at certain things. So if you can find what you’re good at and you find what they’re good at then it’s better in the end.”

The lecturer referred to the importance of students’ learning to divide tasks based on their skills:

Lecturer: “That was something the students commented on, to work towards peoples' strengths...they may not have previously known what that person's strengths were...because they were in a situation where they had to divide task, they had to be realistic about what they could do...”

While the collaboration increased motivation among some of the groups, the most challenges that students mentioned in the project were also based around the collaborative aspects of the project, especially around planning the project and communicating among geographically dispersed group members.

Student F: “When working with the group you will kind of feel obliged to actually work as hard as you can because if you’re not you’re letting down the group so it’s basically everyone just putting in, ja the motivation because you don’t want to let down another group basically…”

Student B: “I think there are different pros and cons for each. Like if you’re working in a group it’s nice to bounce ideas between each other and like improve on someone else’s idea. But then you also have your time management problems and like your leadership problems ….“

Dimension 6: Reflection

Because of the experimental and self-directed approach this project took on, students experienced, albeit not formally structured, reflection in and on action (Schoen, 1987).

> Student B: "…but we had a lot of trial and error because we'd end up shooting about like two or three different movies. Because the first one we sort of got the group members to act in it and that was quite funny really it just, so then what we sort of did was actually split the movie into not just the movie itself because we needed referencing on all the notes so then one person did that and then the other guy basically just introduced the movie but he did it really well."

Their participation in the focus groups at the end of the project could also be seen as part of their reflective process.

Dimension 7: Articulation

At the end of the project, on due date, a public screening was arranged for the digital movies to be shown. This screening took the form of an Oscar ceremony, awarding prizes for different categories. Team members introduced their movie and their groups, but did not have to defend their movie (e.g. answer questions on content of the movie). The idea of showing the stories to an authentic audience, i.e. their peers played a big role in their motivation to submit a high quality end product, as the following quotes show.

> Student B: "I just wanted to say is something that I think you have the audience in mind throughout the production which made it a little bit different than your essay..."

Students appreciated sharing their stories and listening to and learning from each others' movies, not just about the content of the movie, but also the creative process that groups went through.

> Student A: I think where the movie is very successful because doing a movie a presentations got to fit standard to it … by doing a movie you entitled to do just about anything just as long as you get your point across. So because it's so diverse and interesting you watching other peoples' movies you're much more engaged because you can relate to it because you did the same thing and then you learn a whole lot more.

Dimension 8: Coaching and scaffolding

This project was designed in a way that put a high level of responsibility onto the student groups. Lecturers issued a brief and suggested intermediate deadlines to help students plan their work. Students perceived lecturers as "clients" or "the audience", but also see the importance of learning on their own for their future careers as industrial designers.

> Interviewer: "What was the role of your lecturers in this process?"
> Student: "Just to review the outcome really so very little input in actually how we were able to or going to approach our subject matter."

> Student A: "But it's also - its tertiary education. You are here to learn for yourself you're alone you're not going to be held you know your hand's not going to be held the whole way

through each thing but you we will be going out into the working world and people are going to be setting parameters on everything that we design."

Dimension 9: Assessment

The assessment of the digital films was carefully planned, in order for the project to be marked on the day of the presentation. Using a rubric enabled the lecturers to evaluate the presentation in categories such as the introduction of the film, logic and sequencing, the visual impact of the film and content. Marks were given for the group as a whole, but students were also asked to rate their group members' contribution, which could potentially influence the individual student's final mark.

The public screening of the movie led to immense pride among group members in their movie. The awarding of Oscars introduced a competitive element that also increased students' sense of ownership and achievement during this project.

> Lecturer: "…they were terribly impressed with their own achievement...there is (pride), we handed out some Oscars at the day they viewed their films, for best film and best actor and best editing, most creative presentation..we had 5 categories and they smiled very broadly when you gave them an Oscar..."

> Lecturer: "Competitive element? I did not expect it, but there was a terribly competitive element…they couldn't care less what lecturers thought of their movie, they were much more concerned what their colleagues thought...."

The time constraints and lack of ability for time management among students, resulted in some of the movies not to be of the quality level students would have liked to achieve, which again is an important lesson for them to learn for their future work:

> Interviewer: "would you submit something to a client that's not perfect?"
> Lecturer: "You would, because there is a time constraint and that's the point of ending...and you could continue and never see a client your whole life. At a certain time you have to choose, this is the best I can do with this time frame…"

Students' comments on the peer marking system revealed students' discomfort with assessing each other's work:

> Interviewer: "So does it mean that the guy who didn't do anything you gave him like zero marks?"
> Student B: "I think we felt a bit bad and we weren't completely. So we didn't completely cut him out but we did ja mark him down. I think we should have been more harsh actually to be honest. Ja we were a probably bit nice in a way."

Discussion

It should be emphasized that this study was an *investigation of the potential* of digital storytelling as an alternative assessment method for Industrial Design students (in the subject Technology). While this investigation sought to address the issue of plagiarism – by offering an alternative assessment method to more traditional tasks, such as essay-writing – it by can, by no means claim to solve the

issue of underprepared students. The digital storytelling project was designed to reduce the amount of written research handed in, while at the same time creating a space for students' meaningful learning, as fore grounded by the proponents of authentic learning. The means of assessing the success of the project was, therefore, to examine students and the lecturer's perception of this project's potential to facilitate such an authentic learning environment.

In this project Industrial Design student groups developed digital stories. While the context in which they developed this task can be classified as authentic, reflecting the practices of their profession, such as collaborative work, based on a client's brief under resource constraints, the task of developing a digital story might not be considered authentic for a future Industrial Designer. However, authenticity is subjective and "many authentic environments are the creation of the teachers', authors' and instructional designers' imaginations, and are thus inevitably someone's view of what is authentic" (Herrington and Reeves 2003). Jonassen and Rohrer-Murphy (1999) suggest that an authentic activity may simply be one that is personally meaningful to the learner - that is engaging and relevant in a way that assists them in their own meaning-making. These students' responses show a high sense of ownership and pride in their final product and a sense that what they are doing is relevant to their own lives as individuals, as students and future professionals, all elements of authentic pedagogy (Snape & Fox-Turnbull, 2011).

Developing digital stories requires a diverse skill set that is essential for 21st century graduates. Students acquired digital literacies, such as scripting, storyboarding, shooting and editing a movie, but also crucial intra and interpersonal skills such as negotiation, leadership, collaboration, time and resource management (Hull, 2003; Kajder, 2004). Skills were acquired as the need arose and to achieve a real purpose, in what can be defined as an authentic way (Olney et al., 2009).

The design of the project helped students explore these skills and strategically decide which skills to self-develop and which to outsource and thus to grow expert networks, another skill that is essential for their future careers. In this process they not only got to know each other's strengths and weaknesses, but also started to develop their own sense of personal and professional identity. The importance of collaboration was emphasized in this project and students learnt to engage across their own social boundaries with peers, exploring opportunities and challenges of collaboration. Although cooperation would not be defined as authentic by Herrington and Herrington (2006), we argue that the strategic decision to either collaborate or cooperate in a project (Johnson, Johnson, & Smith, 1998) would be a necessary skill for a future Industrial Designer.

Confirming findings of other studies (Olney et al., 2009), students had the opportunity, through the group process and the final screening of the movies, to articulate their growing understanding of the tools and technologies they were engaged with, both through in and on-action reflection (Schoen, 1987), while making decisions on how to proceed in their process of developing digital stories. Peer critique and peer marking are other important elements of the reflective process and important skills for students to acquire to be able to give and receive critique in the workplace. However, students need to be supported to provide, accept and respond to constructive feedback appropriately (Walker & Barwell, 2009).

This particular initiative proved that by trusting students' collective resourcefulness, they could be empowered to own their learning process. This project showed that a strong link to intrinsic motivation developed through the challenge, relevance, interest and involvement in the digital stories project (Riggs & Gholar, 2009). Scaffolding processes should focus on establishing safe environments, providing the external parameters for students to explore their own individual and collective growth. In a project where such weight lies on the final polished outcome, greater support should be provided with the final editing of the movies, since it is this final product that is going to

be screened, seen and marked by lecturers and students alike. More emphasis on the quality of the final product would also increase its potential to be part of a student-generated updated library of Technology resources for the department.

Conclusion

This project set out to investigate the potential of digital storytelling as an authentic learning intervention to address the issues of plagiarism in under-prepared first year Industrial Design students. Both from the perspective of the lecturer and the students this project proved that when trusting students' collective abilities, complex projects can succeed with minimal support from lecturers, relying on students' own resourcefulness. This project created an authentic learning environment for students on many levels and improved their skills as future industrial designers in a way that traditional essays could not have done.

This project also showed that a strong link to students' intrinsic motivation developed through the challenge, relevance, interest and involvement in the digital stories project. However, although this project set out to explore an alternative assessment method for under-prepared students, these students broadly represent a more privileged group of students and one that is focused on visual and digital literacies because of their academic field, compared to the rest of the institution's student body. More research is needed to establish whether this approach - promoting students' independence and self-directed learning, which is highly conducive to authentic learning - would be as successful in other contexts and disciplines.

References

1. Allen, M. 2009. Authentic Assessment and the Internet: Contributions within Knowledge Networks. In T. Bastiaens (Ed.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2009* (pp. 1505-1510). Chesapeake, VA: AACE.

2. Bennett, S., Harper, B., & Hedberg, J. 2001. Designing real life cases to support authentic design activities. In G. Kennedy, M. Keppell, C. McNaught, & T. Petrovic (Eds.), *Meeting at the Crossroads. Proceedings of the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 73-82). Melbourne: Biomedical Multimedia Unit, University of Melbourne. Available: http://www.ascilite.org.au/conferences/melbourne01/pdf/papers/bennetts.pdf

3. Dennen, V. P., & Burner, K. 2008. Cognitive apprenticeship in educational practice: research on scaffolding, modeling, mentoring and coaching as instructional strategies. In J. Spector, M. Merrill, J. Merrienboe, & M. Driscoll (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 425–440). New York: Lawrence Erlbaum.

4. Docherty, M., Sutton, P., Brereton, M., & Kaplan, S. 2001. An Innovative Design and Studio-based CS Degree. *Proceedings of the thirty-second SIGCSE technical symposium on Computer Science Education* (pp. 233 – 237). Available: http://delivery.acm.org/10.1145/370000/364591/p233docherty.pdf?ip=155.238.4.86&acc=ACTIVESERVICE&CFID=112074168&CFOKEN=62779657&__acm__=1339752696_0ad33a393cce77ead9421744bc40a7b5

5. Duggan, F. 2004. The changing nature of the studio as an educational setting. CEBE Transactions. 1 (2): 70-77. Available: http://www.heacademy.ac.uk/assets/documents /subjects/cebe/Transaction/FionaDuggan.pdf (accessed 18 June 2012)
6. Herrington, J., Mantei, J., Herrington, A., Olney, I., & Ferry, B. 2008. New technologies , new pedagogies : Mobile technologies and new ways of teaching and learning. *Ascilite2008 Melbourne* (pp. 419-427).

7. Herrington, J., & Reeves, T. C. 2003. Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology*, *19*(1), 59-71. Available: http://www.ascilite.org.au/ajet/ajet19/herrington.html

8. Herrington, T., & Herrington, J. 2006. *Authentic learning environments in Higher Education*. Hershey PA: Information Science Publishing.

9. Hull, G. A. 2003. At Last: Youth Culture and Digital Media: New Literacies for New Times. *Research in the Teaching of English*, *38*(2), 229-233. Available: http://www.jstor.org/stable/pdfplus/40171638.pdf?acceptTC=true

10. Johnson, D. W., Johnson, R. T., & Smith, K. A. 1998. Cooperative Learning Returns To College: What Evidence Is There That It Works? *Change*, 27-35.

11. Jonassen, D. H., & Rohrer-Murphy, L. 1999. Activity Theory as a Framework for Designing Constructivist Learning Environments. *ETR&D*, *47*(1), 61-79.

12. Kajder, S. B. 2004. Enter Here: Personal Narrative and Digital Storytelling. *The English Journal*, *93*(3), 64-68. Available: http://www.jstor.org/stable/pdfplus/4128811.pdf?acceptTC=true

13. Lombardi, M. M., & Oblinger, D. G. 2007. *Authentic Learning for the 21st Century : An Overview*. *EducauseLearningInitiative*.

14. Lundby, K. 2008. *Digital storytelling, mediatized stories: Self-representations in new media* (p. 326). New York: P. Lang. Available: http://www.seminar.net/index.php/reviews-hovedmeny-110/72-reviews/157-digital-storytelling-mediatized-stories-self-representations-in-new-media

15. McLaren, S. V. 2007. An International Overview of Assessment Issues in Technology Education: Disentangling the influences, confusion and complexities. *Design and Technology Education: An International Journal*, *12*(2), 10 – 24. Available: http://ojs.lboro.ac.uk/ojs/index.php/DATE/article/view/Journal_12.2_0707_RES1

16. Morgan, D. 1993. Qualitative content analysis: a guide to paths not taken. *Qualitative Health Research*, *3*(1), 112-121.

17. Olney, I., Herrington, J., & Verenikina, I. 2009. Digital story telling using iPods. *New technologies, new pedagogies: Mobile learning in higher education* (pp. 36-44). University of Wollogong. Available: ro.uow.edu.au/newtech

18. Reeves, T. C., Herrington, J., & Oliver, R. 2002. Authentic learning and online learning. *HERDSA* (pp. 562-567).

19. Riggs, E. G., & Gholar, C. R. 2009. *Strategies that promote student engagement*. California: Corwin Press.

20. Schoen, D. 1987. *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass.

21. Scott, I., Yeld, N., & Hendry, J. 2007. *Higher Education Monitor A case for Improving Teaching and Learning in South African Higher Education*. *Higher Education*. Available: http://www.che.ac.za/documents/d000155/HE_Monitor_6_ITLS_Oct2007.pdf

22. Sherman, R., & Webb, R. 1988. *Qualitative research in education: Forms and methods*. Lewes, UK: Falmer.

23. Snape, P., & Fox-Turnbull, W. 2011. Perspectives of authenticity: implementation in technology education. *International Journal of Technology and Design Education*. doi:10.1007/s10798-011-9168-2

24. Teferra, D., & Altbach, P. D. 2004. African higher education: Challenges for the 21st century. *Higher Education*, *47*, 21–50. Available: http://www.springerlink.com/content/x0u36w41016m805q/full

25. Tucker, R., & Reynolds, C. 2006. The Impact of Teaching Models, Group Structures and Assessment Modes on Cooperative Learning in the Student Design Studio. *Journal for Education in the Built Environment*, *1*(2). Available: http://dro.deakin.edu.au/eserv/DU:30003698/tucker-impactofteaching-2006.pdf

26. Walker, R., & Barwell, G. 2009. Click or clique? Using educational technology to address students' anxieties about peer evaluation. *International Journal for the Scholarship of Teaching and Learning*, *3*(1). Available: http://www.georgiasouthern.edu/ijsotl

Considered spontaneity: the new role of the product designer

S. Gungaya
Faculty of Informatics and Design
Cape Peninsula University of Technology, Cape Town, South Africa
<gungaya@gmail.com>

M.K. M'Rithaa
Faculty of Informatics and Design
Cape Peninsula University of Technology, Cape Town, South Africa
<MugendiM@cput.ac.za>

Abstract

This paper employs qualitative research methods to explore trends in consumerism, and in particular their potential implications for an industrially developing context such as South Africa. Additionally, the paper interrogates a number of pertinent cases ranging from household goods, packaging, and fast food chains from an industrial design perspective. In the conventional design model (where consumer products are made for one specific use, or set of uses), the designer plays the role of organic interface between producer, product, and user. The 'designed' product is perceived as being acceptable due to the fact that it has been designed by a professional with specialist knowledge. The user in this context plays the role of passive consumer, making no input into product function beyond that intended by the designer. In emerging design models, such as the Ecodesign strategy of product reuse, the user is required to play an active role in either choosing an established use or creating a new use for the product, once it's first usage cycle has ended. These new models require the user to apply traditional or empirical design knowledge, in realising subsequent methods of reuse. However, negative perception of empirical design by the consumer makes reused products less desirable than virgin products created by designers. The designer therefore has the opportunity of procuring a new role for this emerging context: that of making the product acceptable to the user. The designer's specialist knowledge, coupled to the users specialist knowledge, result in a new design approach: considered spontaneity.

Keywords: *artefacts; Ecodesign; consumer behaviour; design models; industrial design; product lifecycle; repurposing; socially responsible design; sustainable lifestyles.*

From Industry to Revolution

A *Google image search* for the word *industry* produces an array of pictures of electricity pylons, mechanisms, conduits, factories belching smoke, and other objects relating to what the average person regards as *industry* (Google, 2012). It is therefore somewhat odd that the original meaning of *industry* was simply, 'hard work' – a definition derived from the French *industrie* and the Latin *industria* meaning *diligence* (Oxford University Press, 2011). It is evident from this etymological basis that mass production was not necessarily originally associated with industry. Subsequently, in the context of production, the 'true' industrial era essentially began when human beings started working hard. Today however (as demonstrated by the Google search), the word *industry* is synonymous with the Industrial Revolution and mass production, which is what has perhaps led to the current primary definition of: "economic activity concerned with the processing of raw materials and manufacture of goods in factories" (Oxford University Press, 2011). The significance of this observation is that the profession of the Industrial Designer does not necessarily have to adhere to *industry*'s principal definition. However, in order to understand this profession, it is necessary to interrogate its origins and development further.

How Industry was Revolutionised

The pivotal event that sparked the Industrial Revolution is often claimed to be James Watt's design of an efficient steam engine (MacKay, 2010). This event accelerated the spread of the Industrial Revolution throughout Europe and North America (Bürdek, 2005, p. 73). The Revolution resulted in several social and economic benefits, including the creation of wealth, and poverty alleviation (University of Cambridge, 2011). The fact that people had more disposable income meant that they could spend it on the new products that were being mass-produced during this period (Ward, 1990). The Industrial Revolution thus created the consumer.

The Birth of the Industrial Designer

The first consumer products containing mechanical parts were difficult for people to accept and to use as engineers were responsible for their design. The resultant 'industrial aesthetic' was alien to ordinary people – its functionality was understandable only to those with specialist knowledge of these particular machines (Brummet, 1999, p. 30). Producers therefore sought the assistance of experts who could inject familiarity and desire into their products, whilst simultaneously adding elements to help users understand how they were meant to operate these particular products. Today, these experts are referred to as 'Industrial Designers'. Thus, in addition to manifesting the consumer, the Industrial Revolution also resulted in the birth of Industrial Design as a profession. From this background, the function of the Industrial Designer can be represented in Figure 1.

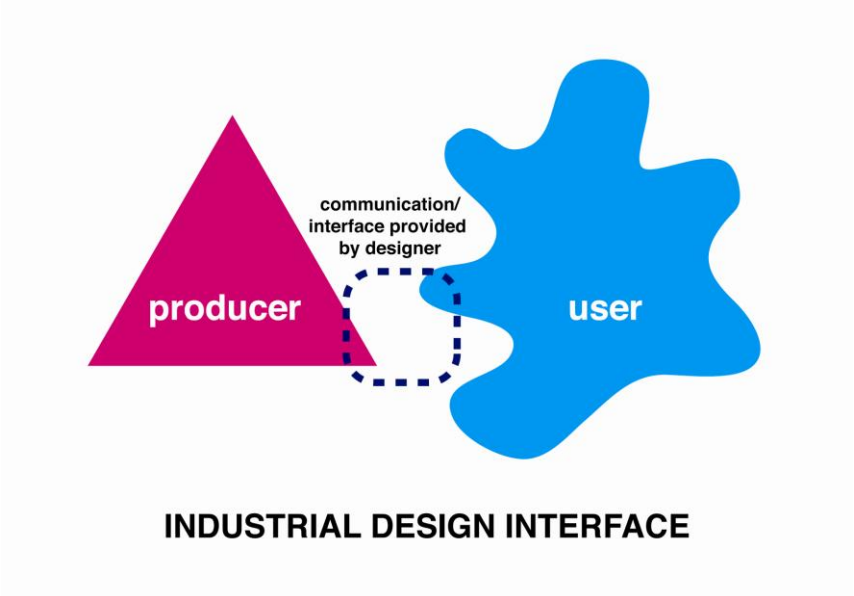


Figure 1: Industrial Design Interface
(Authors' construct)

In the above model, the Industrial Designer in effect acts as an interface between the producer and the user (or consumer). This model still exists to the present day, though it can be reconceptualised for contemporary relevance (as will be discussed later on in this paper).

The Dark Side of the Revolution

Despite several desirable outcomes, the Industrial Revolution also produced some undesirable or negative consequences. The most significant of these with respect to this discourse, has been the plundering of the earth's natural resources and the generation of large-scale pollution and waste (McDonough & Braungart, 1998). The industrial designer must consequently hold some of the blame for these results, and should also endure sustained criticism for the negative connotations

associated with the Industrial Revolution. By focusing on the need for ever-increasing profits, the resultant damage on social and ecological concerns is significant (Vezzoli & Manzini, 2008).

The Frivolous Fifties

After World War II, several companies that had formed during the war, needed to keep their existing customers or procure new ones in order to maintain a source of income. Out of this need, was born Marketing Propaganda through which psychology was increasingly used to encourage people to buy products that they did not necessarily require (BBC4, 2002). One of the ways in which products were made more desirable, was through styling (Bürdek, 2005, p. 15). Designers were thus no longer designing products only to provide the required functions. They were sometimes employed to simply create desire for a product based purely on its aesthetics (Doblin, 1987, p. 11). Thus, not only was part of the designer-client interface somewhat eroded by the introduction of an additional profession – that of the Marketer – but the designer's role was also somewhat diminished to that of artist or aesthetician.

Poison and Power

Among the significant events that brought the negative effects caused by the rapid industrialisation (naturally sparked by the Industrial Revolution) to general public attention, was the publication in 1962, of Rachel Carson's book 'Silent Spring' which described how industrial chemicals such as DDT were poisoning the habitat of Homo sapiens (Walsh, 2011). Another event that demonstrated that human beings were consuming natural resources at too high a rate and too lavishly, was a 'manufactured' oil crisis in the 1970s (Fuad-Luke, 2009, p. 44). Perhaps influenced partly by these factors, a 'Green Design' awakening began. The precariousness of the existence of modern industrialised man, and the possible harmful effects that he could cause to planetary ecosystems, the lives of people living in developing countries/majority world contexts, as well as to his own future descendants (BBC, 2012), caused designers, academics, and laymen interested in design, to speculate about the negative environmental consequences of certain product design decisions. Product design guidelines were thus drawn up to ensure that the manufacture, use, and disposal of products could have the smallest possible detrimental effect on the environment.

Products Have Lives Too

In order to determine appropriate guidelines for the environmentally conscious design of products, product lifecycles were analysed to find ways of minimising waste and maximising use of energy resources (Our Thinking - Lifecycle Thinking, 1999-2010). Additionally, materials recycling was consciously incorporated to the repertoire of desired interventions as a means of maximising use of resources. The product lifecycle in discussion is represented in Figure 2.

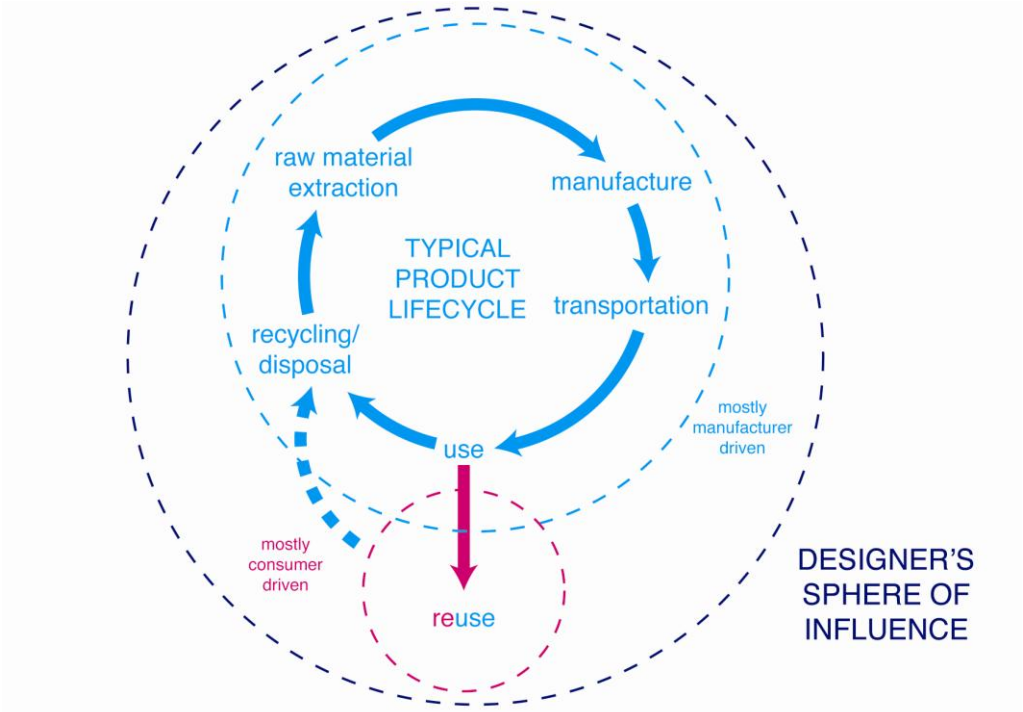


Figure 2: Typical Product Lifecycle
(Adapted from University of Cambridge Estate Management)

Using Reuse

Contemplation of Figure 2 presents a concept which is of particular interest to this paper: that of *reuse*. Apart from being a potential stage incorporated into the Product Lifecycle Model, product reuse is also considered to be an ecodesign approach, grouped together with recycling, as an 'end of life' strategy (Rose & Ishii, 1999, pp. 42-43). Unlike other stages of the product lifecycle that merely require 'theoretical' specifications from the designer, reuse is a 'physical' strategy that requires a reasonable degree of design creativity. This physical aspect demands creative input by both the designer and the user, and ultimately provides the benefit of elongating the temporal length of the designed product lifecycle (Minnesota Office of Environmental Assistance, n.d.). It is not unreasonable to assume that reuse strategies (when practised at an 'empirical' level) are likely to remain in the domain of naturally creative people. Perhaps in part due to the lack of 'designer' integrity, and also due to the psychological resistance to 'old' products created by the widespread practise of built-in-obsolescence (The Economist Newspaper Limited, 2009), one could anticipate that reused product designs would be less likely to be embraced as reasonable alternatives to brand new products.

The following examples of vases made of recycled bottles demonstrate the difference between 'designer' reuse and 'common' reuse (see Figure 3).

Figure 3: User-Designed Vase
(Creative Jewish Mom, 2011)

Figure 3 shows a design that has a child's craft aesthetic. The maker has painted used wine bottles and applied tissue paper as a decorative element, using the 'decoupage' technique (Creative Jewish Mom, 2011). Clearly, issues such as future recycling (which would probably have been considered by a professional designer) have not been taken into account.

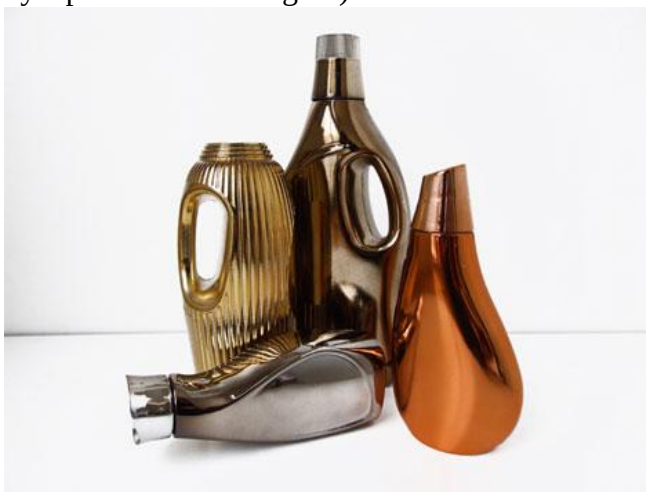


Figure 4: 'Second Life' Vases by studiosdgn
(studiosdgn, design & architecture, 2011)

The design in Figure 4 has an elegant and sophisticated aesthetic. Although the reuse aspect of the design appears simple, there are significant considerations made by the designers that allow the product to function optimally, and to ensure that the product can be recycled after its ultimate life: the addition of eco-friendly resin to adds weight to the base of the vase, thus preventing it from toppling over and the use of an eco-friendly coating allows for recyclability (studiosdgn, design & architecture, 2011). Although the user-produced vase may have value as a means of creative expression, it lacks the design integrity of the designer piece.

Figure 5: The range of Nutella jars (the 'drinking glass' jar is on the far left)
(Wake up to Nutella, 2009)

The Nutella drinking glass jar (shown in Figure 5) is an example of 'designed' reuse integrated into a product. A physical inspection of this jar reveals several characteristics that facilitate product reuse. Although the label gives no indication of the intended second use, the shape, size and the lack of a screw thread at the mouth of the jar (and, as a consequence, a snap fit lid instead of a threaded one) immediately indicates the intended second use to the consumer. The label is also easier to remove than a conventional jar label. As it is immediately evident that this product has a second use, there is no negative connotation of reuse. While it is clear that the jar is intended to be used as a drinking glass once its initial use has been exhausted, there is nothing preventing more creative consumers from using this jar in other, unconventional ways.

Global Shift Towards Sustainable Production and Consumption

The level of user involvement that reuse offers is useful at a global level to encourage consumer awareness of ecologically conscious designing. Although use of energy and materials can be made to be as efficient as possible and materials recycling can be maximised, if consumption continues at its present level, then it is reasonable to believe that an increasing global population will cancel out any benefits of efficient resource usage. The key, therefore, is to encourage sustainable lifestyles. The UNEP Sustainable Production and Consumption programme recognises the value of this observation (United Nations Environment Programme, n.d.). Obviously, in attempting to create or maintain sustainable lifestyles, the ultimate aim is to decrease levels of production and consumption. However, there has to be some kind of 'direction' or guide towards this goal. Reuse design can form the bridge between the present state of general consumer ignorance and unbridled consumption, and the desired level of consumer awareness that has to exist in order for lifestyles to be sustainable. This is done through encouraging user participation and creativity.

Reuse Opportunities for Designers and a Lesson from McDonalds

It is evident that primary product function is the 'use' that producers sell to consumers. Extra benefits to the consumer, which could possibly add to production costs are therefore likely to be undesirable to the producer from the perspective of 'immediate' use. However, if extra benefits could encourage brand loyalty, there would be both short- and long-term benefits for the consumer, as well as demonstrable long-term benefits for the producer. An example of a producer investing in user benefits in order to procure new, and keep existing customers, is McDonalds' in the manner in which they use 'Happy Meal' toys – these are given away 'for free' with children's meals (Smith, 2012, p. 330). Although it is logical to assume that the cost of these toys ultimately decreases profits in the short-term, in the long-term they actually encourage customer loyalty. Reuse design could be seen in this way, as an extra benefit encouraging brand loyalty (from a producer's perspective) and simply as an extra benefit, from the consumer's perspective. The designer's challenge therefore is to: encourage producers to adopt the reuse design strategy; make reuse design

quick and easy enough for consumers to understand how to 'use' the second product function; design second functions that will be of use to a large number of consumers; allow for the second product to be easily recyclable; make second life products desirable to both consumers and users. This scenario is one in which the consumer needs to be encouraged to creatively use a product in order to obtain its second use. Some users however, are creative and capable enough to attempt more adventurous reuses, which are also more challenging to create.

Instructables and Openness of Design

For these interested, creative people, Janet Shipton and Tom Fisher recommend creative web communities such as the website instructables.com where users upload instructions for creative projects, including a large number that feature reuse (Fisher & Shipton, 2010, p. 143). As these communities already exist and use ordinary products that have not been designed with reuse in mind, they can be taken as a present or interim solution. Shipton and Fisher also advocate 'openness of design' where a product's reuse is left as open as possible. In other words, the designer does not prescribe what form the subsequent use should take. He merely provides a canvas that is blank enough to encourage creative use (Fisher & Shipton, 2010, p. 135).

Despite the producer's apparent greater degree of 'control' in the producer-consumer relationship, consumers are afforded a certain measure of 'empowerment'. An example of this is branding, which is used by producers as a way of encouraging frequent purchases and ensuring consumer loyalty (Thompson, 2012). Although this is not an act of altruism on the part of the producer, but rather, a means of warding off rivals, it is of benefit to the consumer who is able to use it as a means of making certain that purchased products are reliable and of the required quality. Other devices working in the interest of the consumer include consumer policies that seek to protect consumers against misuse and offer them enhanced protection from questionable producers (OECD, n.d.).

Of particular interest to markets in which there is little (or little noticeable) differentiation between products, are consumer review mechanisms such as Which? Magazine, in which products are tested and evaluated, in order to ensure that consumers make informed choices (Which?, 2012). In some instances, the discovery of a producer's unsavoury practises may encourage consumers to protest against those practises. For example, Morgan Spurlock's public criticism of McDonalds' unhealthy food, together with his demonstration of its degree of unhealthiness, lead to a public outcry which forced McDonalds to make an attempt to add healthier items to its menus. Other campaigners, with a lesser degree of fame than Morgan Spurlock, were also able to oblige McDonalds to act ethically. An example is the protest against the use of polystyrene packaging at McDonalds, where consumers were concerned about the potential of this packaging to cause harm to the environment (Botterill & Kline, 2007).

Memes

The term 'meme' was coined by Richard Dawkins (2006, p. 192) to describe the phenomenon through which units of cultural information replicate and disperse themselves. The word is smartly derived from the Greek word 'mimema', meaning 'that which is imitated' (Oxford University Press, 2012) but condensed to mimic the word 'gene' which is its biological counterpart (Dawkins, 2006, p. 192). The importance of memes in the context of design and consumption lies both in the claim made by Mihaly Csikzentmihayli, that memes are the agents through which materialism was created, and is sustained (Csikszentmihayli, 1994, p. 139) and in the reasonable assumption that, through their definition as replicating cultural units, they can be used to disseminate ideas and guidelines related to sustainable living.

Social Media

The term 'social media' refers to the digital means through which people 'socialise' (using usually computers/cellphones/other mobile devices connected to the internet). Ideas (or memes) can be spread rapidly, amongst large numbers of people, and through geographic boundaries, by means of social media (Kaplan & Haenlein, 2010, p. 61). Proof of this claim can be found in the 'Arab Spring' protests that took place in North Africa, and the 'Occupy' protests that took place throughout the capitalist world. These protests were facilitated by social media websites such as *Facebook* and *Twitter* (Greenhouse, 2011) (Vargas, 2012). Although thus far, social media have been used in 'reactive' instances, it is possible that they could be used as 'initiators' of ideas: in this case, ideas related to sustainable living.

The Technical Herbalist

The authors were introduced to the term 'Technical Herbalist' by Giacomo Cadoni. This term was used by Cadoni to describe a graduate of the course 'Scienze e Tecnologie dei Prodotti Erboristici' which is offered at certain Italian universities and deals with the use of plant derivatives for the alleviation or cure of physical ailments. While at first glance this course may seem like a simple study of herbs and the ailments that they may (or may not) be able to treat, an examination of the course structure (Università degli Studi di Roma La Sapienza, 2010) reveals that it is a little more involved than that. The course seems to fit neatly between two seemingly polar opposites. On the one hand, its relationship to plants and the natural world, and their ability to heal physical complaints, places it squarely in the realm of 'traditional medicine' that often carries negative connotations due to its empirical nature and lack of scientific evidence of its ability to bring about relief from ailments. On the other hand, through its scientific study of the chemical properties of (plant) substances, coupled with the knowledge of how to use these properties to treat ailments, it resembles conventional pharmacy (which is trusted and respected due to the scientific evidence of its ability to provide relief). When it is understood that ordinary pharmaceutical products are often derived from plant sources, although they might be chemically synthesised later on, it becomes apparent that there is not such a huge distinction between traditional herbal medicine and conventional pharmacy (Discovery Communications, 2011). The main benefit of traditional herbal medicine, is its use of natural products whilst that of conventional pharmacy, is the scientific knowledge of the chemical properties of medicines. The technical herbalist, having knowledge of both empirical and conventional medicines, therefore bridges the gap between these two professions.

Considered Spontaneity

Parallels can be drawn between the Technical Herbalist and the role of the designer in the reuse design process. Reuse design, like traditional remedies, is often empirical in nature. For example, bottles are probably often turned into vases because of the similarities in shape between bottles and vases that are manufactured especially for the purpose, but also because many people recycle bottles into vases – this practise is in the public realm. In order to encourage more users to participate in reuse, however, the designer needs to make it simpler for conversion from original to second use to take place. This type of design, whilst encouraging user spontaneity, must also be well considered. Hence, considered spontaneity.

Producer-Designer-User Model

The designer provides an interface between producer and user. More often than not, the producer is a rigid, sharp, solid entity whereas the user is a soft, amorphous collection of varying characteristics (as shown in Figure 6). Most commonly, the interface between producer and user is that in which exchange of money and goods takes place. The capitalist (or 'bad') designer merely allows for profit-based interaction between producer and user. The holistic (or 'good') designer encourages

more meaningful interaction between producer and user. Whereas the capitalist designer is ignorant of conflicts that appear in the producer-user relationship, the holistic designer tries to guide the two entities towards a harmonious relationship, where points of each are made to more closely resemble the other. In other words, the sharp, rigid points of the producer are softened, so that they more closely resemble the user, and the soft, vulnerable areas of the user are toughened so that they more closely resemble the producer. This can ultimately lead towards a relationship wherein the producer and user are so closely aligned to each other, that the user completely 'consumes' the producer.

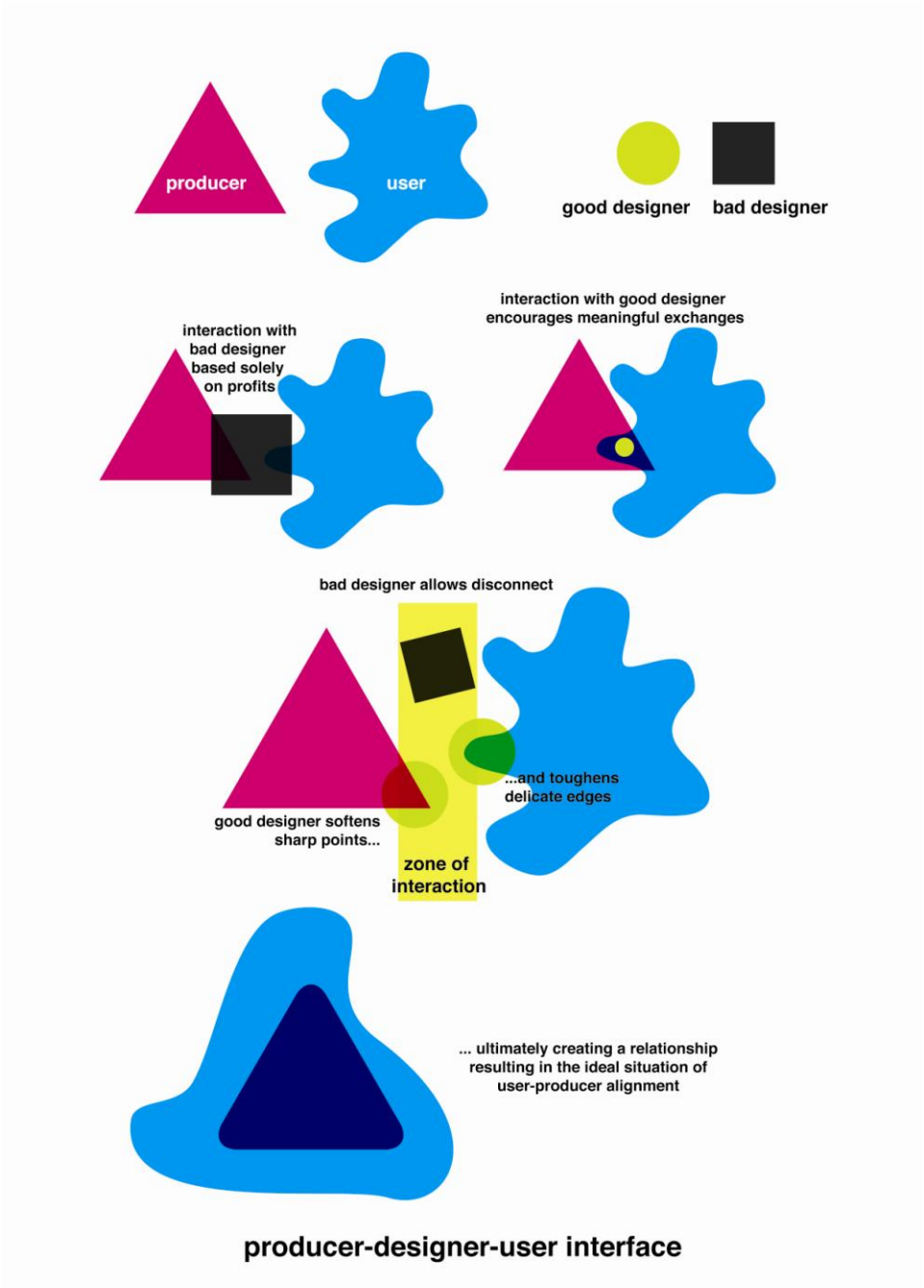


Figure 6: Producer-Designer-User Interface
(Authors' construct)

The Challenge for the South African Context

There is a dearth of literature that is specifically relevant to the local context – this has necessitated engaging with pertinent research on the subject from further afield. Notwithstanding this challenge,

this study identifies South African industrial design praxis as currently following the traditional rigid model wherein designers provide the specifications based on a brief from the client – the producer often stipulates specific criteria for implementation. In such a model, the user's requirements are considered from the perspective in which providing these requirements encourage product purchase. Although globally, new industrial design models have been developed in order to encourage sustainability, they are not in general use in South Africa at present. Examples of non-producer-centric design models – those that actively involve the consumer or user – include participatory design and co-design (Futerman & M'Rithaa, 2007). Such an approach is in alignment with a socially conscious and responsible design ethos that intrinsically is life affirming, as well as enhancing ecological and economic sustainability.

As argued in this paper, the conventional design model fails to elicit desirable consumer behaviour as the traditional design process relies heavily on the arguably designer's ability to infuse qualities of reuse in their products. The challenge in the South African context is to promote a more enlightened understanding (and practice of industrial design – one that patently enhances product usefulness by tapping into the consumer's natural propensity towards treasuring objects of beauty and functionality. This has implications on the training of current and future design professionals – such training will need to have a strong and deliberate ecodesign agenda. In so doing, dedicated efforts to mainstream the requisite skills that are indispensible to the creative exploration of the benefits of considered spontaneity should be a matter of great import. The said strategies would effectively contribute towards more sustainable production and consumption practises within our sphere of influence.

References

1. BBC4 (Director). (2002). *The century of the Self - Happiness Machines* [Motion Picture]. United Kingdom: BBC.
2. Botterill, J., & Kline, S. (2007, June). *Re-branding: the McDonald's strategy*. (E. G. Limited, Producer) Retrieved May 3, 2012, from Emerald Management First: http://first.emeraldinsight.com/samples/mcdonalds2.pdf
3. Burdek, B. E. (2005). *Design: History, Theory and Practice of Product Design.* Basel: Publishers for Architecture.
4. Csikszentmihayli, M. (1994). *The Evolving Self: A Psychology for the Third Millennium.* New York: HarperPerennial.
5. Dawkins, R. (2006). *The Selfish Gene* (3rd ed.). Oxford: Oxford University Press.
6. Doblin, J. (1987). A Short, Grandiose Theory of Design. *STA Journal* .
7. Estate Management, University of Cambridge. (2011). *Green Procurement Guide: Guidance on Environmental Aspects of Purchasing* . Retrieved June 3, 2012, from Estate Management, University of Cambridge: http://www.admin.cam.ac.uk/offices/em/sustainability/environment/guidance/purchase.html
8. Fisher, T., & Shipton, J. (2010). *Designing for Re-use: The Life of Consumer Packaging.* London: Earthscan.
9. Fuad-Luke, A. (2009). *Design Activism: Beautiful Strangeness for a Sustainable World* . Routeledge.
10. Futerman, R. G., & M'Rithaa, M. K. (2007). Engaging with the Elderly: a participatory approach to compatibility. Proceedings of the *10th Ergonomics Society of South Africa (ESSA) Conference on Applied Ergonomics*, International Convention Centre, 21-25 June 2007. Durban, South Africa.
11. Goldstone, J. A. (2002). Efflorescences and Economic Growth in World History: Rethinking the "Rise of the West" and the Industrial Revolution. *Journal of World History, 13*, 323-389.

12. Google. (2012, June 3). *Industry - Google Search*. Retrieved June 3, 2012, from Google: https://www.google.co.za/search?hl=en&q=industry&bav=on.2,or.r_gc.r_pw.r_qf.,cf.osb&biw=792&bih=425&wrapid=tlif134027487463110&um=1&ie=UTF-8&tbm=isch&source=og&sa=N&tab=wi&ei=-fjiT-b1OIiYhQfx4LS7Aw
13. Greenhouse, S. (2011, November 8). *Occupy Movement Inspires Unions to Embrace Bold Tactics*. Retrieved June 3, 2012, from The New York Times Company: http://www.nytimes.com/2011/11/09/business/occupy-movement-inspires-unions-to-embrace-bold-tactics.html?_r=1&pagewanted=all
14. Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons , 53* (1), 59-68.
15. MacKay, D. J. (2010, January 24). *Sustainable Energy - Without the Hot Air*. Retrieved June 3, 2012, from The Inference Group: http://www.inference.phy.cam.ac.uk/withouthotair/c1/page_6.shtml
16. McDonough, W., & Braungart, M. (1998). *The NEXT Industrial Revolution*. Retrieved May 3, 2012, from http://ratical.com/co-globalize/nextIndusRev.pdf
17. Minnesota Office of Environmental Assistance. (n.d.). *Design for the Environment Guide Extending Product Life*. Retrieved June 3, 2012, from Minnesota Pollution Control Agency: http://www.pca.state.mn.us/index.php/view-document.html?gid=4678
18. OECD. (n.d.). *Consumer Policy About*. Retrieved from OECD Better Policies for Better Lives: http://www.oecd.org/about/0,3347,en_2649_34267_1_1_1_1_1,00.html
19. *Our Thinking - Lifecycle Thinking*. (1999-2010). Retrieved June 3, 2012, from European Commission Joint Research Centre: http://lct.jrc.ec.europa.eu/
20. Oxford University Press. (2011). *Definition for Industry - Oxford Dictionaries Online (World English)*. Retrieved June 3, 2012, from Oxford Dictionaries: http://oxforddictionaries.com/definition/industry?q=industry
21. Rose, C. M., & Ishii, K. (1999). Product End-of-Life Strategy Categorization Design Tool. *Journal of Electronics Manufacturing* , 41-51.
22. Smith, A. F. (2012). *Fast Food and Junk Food: An Encyclopedia of What We Love to Eat.* Santa Barbara: ABC-CLIO, LLC.
23. studiosdgn, design & architecture. (2011). *Vasi Second Life*. Retrieved April 15, 2012, from studiosdgn, design & architecture: http://www.studiodsgn.com/progetti/prodottoprodotto/
24. The Economist Newspaper Limited. (2009, March 23). *Idea Planned Obsolescence*. Retrieved June 3, 2012, from The Economist : http://www.economist.com/node/13354332.?story_id=13354332.
25. Thompson, T. L. (2012, February 13). *Customer Loyalty: Give This Brand A Valentine!* Retrieved June 2012, 3, from Forbes.com: http://www.forbes.com/sites/teriluciethompson/2012/02/13/customer-loyalty-give-this-brand-a-valentine/
26. Università degli Studi di Roma La Sapienza. (2010). *Campusnet Brochure dei Corsi*. Retrieved May 3, 2012, from http://erboristeria.frm.uniroma1.it/corsi/corsi.pdf
27. University of Cambridge. (2011). *Reassessing the Industrial Revolution*. Retrieved June 3, 2012, from University of Cambridge Research news: http://www.cam.ac.uk/research/news/reassessing-the-industrial-revolution/
28. Vargas, J. A. (2012, February 17). *Spring AwakeningHow an Egyptian Revolution Began on Facebook*. Retrieved June 3, 2012, from The New York Times Company: http://www.nytimes.com/2012/02/19/books/review/how-an-egyptian-revolution-began-on-facebook.html?pagewanted=all
29. Vezzoli, C., & Manzini, E. (2008). *Design for Environmental Sustainability.* London: Springer-Verlag.
30. Wake up to Nutella. (2009). *FAQ*. Retrieved September 14, 2009, from Wake up to Nutella: http://www.wakeuptonutella.com/faq.html

31. Walsh, B. (2011, August 30). *Silent Spring - ALL TIME 100 Nonfiction Books*. Retrieved 3 June, 2012, from Time.com: http://entertainment.time.com/2011/08/30/all-time-100-best-nonfiction-books/slide/silent-spring-by-rachel-carson/#silent-spring-by-rachel-carson
32. Ward, J. P. (1990). Reinterpreting the Consumer Revolution. *Journal of British Studies* , 408-414.
33. Which? (2012). *Key Facts Press About Which?* Retrieved June 2012, 3, from Which?: http://www.which.co.uk/about-which/press/facts-figures-and-faces/key-facts/

Is ICT eating up our design pedagogy?

E. Appiah
Faculty of Informatics and Design
Cape Peninsula University of Technology,
Cape Town, South Africa
<eddappiah@gmail.com>

J. Cronjé
Faculty of Informatics and Design
Cape Peninsula University of Technology,
Cape Town, South Africa
<cronjej@cput.ac.za>

Abstract:

Having realised the influence and the indispensability of information and communication technologies, graphic design educators are supporting teaching and learning with ICT, one way or the other. The introduction of ICT into graphic design has also brought in some challenges as far as the pedagogy is concerned, as it requires relearning, training and upgrading. Ironically, the pedagogy of graphic design education, which is an adaptation of the Bauhaus theory, is in variance with current practices in both the profession and in its education. This article discusses the literature of current graphic design practices as a contribution to the adaptation of Innovation Education (IE) as way of looking at the paradigm shift due to the introduction of ICT. It discusses educational theories in the context of ICT and graphic design education and agrees that current ICT practices calls for a review of pedagogy that allows students to develop ideas digitally. It concludes by calling for an exploration of current ICT practices in graphic design education, especially in issues of ideation and pedagogy.

Keywords:

Introduction

Learning has undergone tremendous shift in paradigm since the beginning of the 20th century. Various theories have been formulated in support of teaching and learning in education, especially as educational practices have continually and will continue to be subjected to changes and renewals. These changes are 'mainly as a result of developments in information and communication technology (ICT), the commercialization and globalization of education, social changes and the pursuit of quality' (Brown, 2006: 109). Having realised the influence and the indispensability of information and communication technologies, graphic design educators are supporting the teaching and learning with ICT - one way or the other. This has resulted in new ideas and possibilities in the design education and its practices Available literature shows that the online studio was advocated a decade ago in developed countries, as support for learning and teaching (Kvan, 2001, Bennett, 2000). Blended learning which involves both traditional face-to-face instruction and asynchronous and/or synchronous communication via the Internet is being introduced (Bender & Vredevoogd 2006:114). New courses are being designed in response to growing needs of ICT in design education (Bender 2005:4; Ranjan 2005:2) while collaborations in design projects are springing up due to the establishment of *virtual design studios* (VDS) especially in the developed economies.

Little attention is paid to graphic design pedagogy as it relates to ICT and ideation especially in the developing economies. Ideation, which is the process of brainstorming with images, letters, figures and sketches, plays a critical role in coming out with a design concept. Traditionally, ideation is

viewed as paper-based activity and as ICT wages into the teaching and learning of graphic design, there seems to be disturbances in the practices as students veered into the use of ICT in their ideation process. While graphic design educators still hold on to the Bauhaus principles of design, which calls for indentifying the processes of idea development in ideation on paper with its studio practices, students in their development seem to gain ideas on the use of ICT as they interact with technology. Anecdotal evidence indicates that educators see these tensions as disturbing issues and a deviation of the learning outcomes of the pedagogy. The creative process and problem-solving strategies based on technological education are important because they enhance quality of solutions based on real-life problems. Ideation in graphic design is geared towards finding a solution, not only to studio works, but also to real-life challenges as far as design is concerned. Indeed, it is an essential part of the design process, both in education and practice (Broadbent, in Jonson 2005: 613). The Bauhaus principles which call for the learner opening up to issues solely from the master might not be the most appropriate educational paradigm when it comes to ICT integration. Such a paradigm might be that of behaviourism and constructivism.

Behaviourism versus Constructivism

In educational settings, behaviourism implies the dominance of the teacher, as in behaviour modification programmes. It can, however, be applied to an understanding of unintended learning. Perhaps because behaviourists describe experiments in which they structure learning for their subjects, attention tends to fall on ideas such as behaviour modification and the technology of behaviourism.

Behaviourism itself is more about a description of how learning occurs in the mind, as it were, than about how to make it happen, and it is when it is approached from this perspective that it gets most interesting (Atherton, 2011). What this means is that, in the learning process of behaviourism, the mind is excluded from the learning processes. The behavioural laws, according to Jonassen (1991), was a primary theoretical cause of the paradigm shift in learning psychology (Jonassen, 1991: p. 6). In his discussion on instructional system technology in the field of learning psychology, Jonassen debunked this assertion and explained the role of the mind as 'a material entity that controls the actions of the knower' (p. 7).

Jonassen (1991) went further to attack the theory of objective reality by posing that, 'if our learning theory assumes that we construct meaning for objects and events by interpreting our perceptions of them in terms of our past experiences, beliefs, and biases, then each of us mentally represents our own personal reality'. Such idea inference means, there will always be differences in the way we give meaning to a situation. In ideation in graphic design, it can be accepted as the basis for which educators cannot prescribe a lay-down approach for learners to gain ideas to achieve their design outcomes. This is because in graphic design, every design problem may have a different approach to its solution.

Jonassen (1991) advocates the need for objectivism and constructivism as the new philosophical paradigm for learning and education. He justifies the role of objectivism – that there is an objective reality – as what learners assimilate. And since the role of design educators is to help students learn about the real world, it is the role of the teacher or the instructor to interpret events for them (p. 10). Juxtaposing this to constructivism, he conceded that perhaps 'what is transferred to the student is learned by the student without interpretation or reconstruction'. 'Rather than attempting to map the structure of an external reality onto learners, constructivists recommend that we help them to construct their own meaningful and conceptually functional representations of the external world'. This he supported and quotes 'objectivism and constructivism represent alternative conceptions of learning and thinking, much like the artist-scientist, two-world dialectic (Snow, 1960 in Jonassen

1991: p. 12). Constructivist pedagogy holds the promise of transforming the relationship between teachers and students in the direction of empowering learners to be much more active and interactive in the classroom (Means & Olson, 1997 in Wang 2009:208)

Wang (2009) thinks constructivism is not new. Quoting von Glasersfeld (1989) and Hawkins (1994), he justifies this existence;

> *"The fact is that this epistemological and educational paradigm resides at the heart of Western civilization in the teaching method of Socrates who elicited knowledge from students by asking them carefully- chosen questions. Human reason, leading to the discovery of eternal ideas beyond individual experience, after the manner of the ancient Greek philosophers Plato and Aristotle, was glorified during the European Renaissance, culminating in the philosophical writings of Descartes and the founding of modern science by Newton. Nevertheless, beginning in the seventeenth century European philosophers started to question what humans can actually know through the senses and rationality. Locke, Hume, and later Kant all argued that objective reality, independent of the person experiencing it, is unknowable. Once this sceptical attitude became fairly well established among intellectuals, the development of constructivism as an epistemological and educational theory was inevitable (Wang 2009:206).*

According to Wang (2009), the strongest progenitor of constructivism should be the early twentieth century American philosopher John Dewey whose teachings, he believes is pragmatism. Wang (2009) refer to Dewey's philosophy as pragmatism because of its intellectual inquiry which is not to understand reality apart from experience, but to learn how to function in the best possible way within any given situation. This, according to Wang, Dewey called 'a theory of epistemology instrumentalism, a term that has virtually the same meaning as constructivism' (Field, 2007 in Wang 2009). Such teachings undoubtedly are known as pragmatism.

ICT and Constructivism

The introduction of ICT in design – its interactive and explorative nature – typifies the epistemology of constructivism in the educational theory. Wang (2009) in his discussions on the transformational promise of ICT for professional educators in architectural education comes out with the idea that ICTs have the potential for radically transforming educational practice. He also agrees that ICTs promote the constructivist paradigm of epistemology (p.206). 'If constructivism had not already existed, it seems likely that ICTs would have invented it to explain how they operate' (Wang, 2009). Quoting Murphy, he emphasised technology as being touted as an optimal medium for the application of constructivist principles of learning (Murphy, 1999 in Wang 2009).

Significantly, educators are rooting for learner-centred theory of learning which allows the student to gain knowledge in his discovery process, often quoted as "students should construct their own knowledge". In graphic design, students need to make informed decisions as to the visuals and ideas that will communicate well with their thoughts. Using ICT allows students to search and apply their own creative thoughts, together with principles acquired in earlier projects. This help in transforming them from being passive and uncritical receptacles of past knowledge into being active and creative learners (Wang 2009:208). Such is Wang support for ICT in design education as being emphasised in this statement.

Wang (2009) bemoans the issue of pedagogy when it comes to ICT in design and questions why educators struggle to embrace technology while the necessary groundwork is not done in terms of getting enough pedagogical preparation to work with it. Accordingly,

> *"certain questions about implementing ICT for pedagogical purposes will not go away. Why is there such a gap between promise and practice? Who is to blame for the gap? Is ICT being forced upon the education system by enthusiasts and policy makers eager to be up to date and to compete in the global marketplace? Is constructivism, the educational paradigm that is always associated with ICT, appropriate for any level lower than postgraduate studies?"(p. 210)*

He therefore advocates the need for scholars to continue examining these issues carefully together with other issues like the cultural context of ICT. Wang conclude his submissions with the statement that the "principal problems associated with using ICT for educational purposes appear to be a persistent failure to find a link between theory and practice and the difficulty of training teachers to use ICT creatively"(p. 211).

In her contribution to Foucault's 'Limit-experience', Thompson (2010) advocates a strong connection of learning to the concept of transformation. *'In learning, the learner gains a new perspective on the world as well as on herself. Learning means change and transformation.... Learning brings the individual in contact with a different view of the world, and it is impossible for the learner to the viewpoint as it was maintained before (Thompson 2010).*

At any point in time, one must see a change in the learning process. And this is even more significant with the introduction and use of information and communication technologies. What used to be working yesterday, might lead to a new knowledge today, which can also change the mode of learning and teaching tomorrow. With such knowledge, learners are able to construct new ideas and meanings in their studies. And such change might cause a paradigm shift in the pedagogy. According to Wang (2009), "the benefit of ICT for students – at least according to the enthusiasts – is that it will help transform them from being passive and uncritical receptacles of past knowledge into being active and creative learners, ready to take responsibility for the future" (Wang 2009:208).

Discussing the use, updating and integration of ICT in higher education, Stensaker et al. (2007) assert that 'current teaching and learning schemes have, so far, not been adjusted to the technological development' as far as ICT in design education is concern (Stensaker et al. 2007:427). The pedagogy of most of the design courses are still rooted in the Bauhaus principles of the 19th century, even though design educators are struggling to embrace today's technology of ICT. In the studio method of graphic design education, students practice hands-on skills with the instructor observing and critiquing their work as they progress (Ellmers 2006). Wang (2009) believes that this 'hands-on, exploratory, interactive nature of ICTs, particularly the Internet, causes them (students) to gravitate toward the postmodern epistemology and educational theory of constructivism. In fact, if constructivism had not already existed, it seems likely that ICTs would have invented it to explain how they operate'(Wang, 2009).

One of the arguments against the use of ICT in the ideation process of graphic design is that it eliminates the learner/educator studio interactions. Technology affords the same academic interaction, however the introduction of ICT requires 'a different approach for social interaction such as online chats, virtual office hours, group projects and interactive software with live video and audio' (Dale 2006:4). If ICT can make any meaningful impact in the teaching and learning of graphic design, then the pedagogy should be re-defined. Quoting Bates (2000), Stensaker et al. (2007) argue that 'the main intension behind the use and integration of ICT in teaching and learning is often to change how teaching and learning are conducted in the sense of putting more emphasis on interaction, flexibility and innovation' (Bates 2000 in Stensaker et al. 2007:431). They are therefore convince that if such intentions are to be realised, it should 'be in the link between purpose, people and pedagogy that much can be gained' (p. 431).

Making a case for a carefully consideration of Information and Communication Technologies (ICTs) implementation in university programmes for the education of design professionals, Wang (2011) argues for constructivism; traditional instructivist models emphasise learning as assimilating, while constructivist models regard learning as a combination of diverging, converging and accommodating. All things considered, constructivism, with its emphasis on student-centred, collaborative problem solving and its vision of the teacher/professor as a coach or a facilitator, instead of a disseminator of knowledge, seems to be very well suited to the education of professionals.

ICT and Experiential Learning

Linked to constructivism is the experiential learning theory, which draws on the work of prominent 20th century scholars like John Dewey, Kurt Lewis, Jean Piget and others. One of the pillars of the experiential learning theory (ELT), according to Kolb and Kolb is that ELT proposes constructivist learning (Kolb & Kolb 2005), where knowledge is created and recreated in the personal knowledge of the learner. Kolb and Kolb (2005) define ELT as a situation 'whereby knowledge is created through the transformation of experience and ... results from the combination of grasping and transforming the experience. 'Not only does ELT combine cognitive and behavioural learning theories, but it also allows for affective changes to be recognised as learning' (Wang, 2011:191). Through experience learners also create their own knowledge of ideas, which hitherto had not been conceived either by neither the learner nor the teacher.

ICT is allowing design students gain more knowledge in their ideation process than before and thus their 'traditional idea capturing' seems to be discarded. Not only are they seeking for better ways to capture their ideas, but also the fastest way to make them real. Conceptualization from the digital point of view also means focusing on the entire spectrum of design challenges. If learning is an active process of constructing rather than acquiring knowledge, and instruction is a process of supporting that construction rather than communicating knowledge (Duffy & Cunningham, 1996), then ICT is helping students to create knowledge when they engaged with the various ICT tools in the ideation process. What seem not to be clear are what, how and where the instruction should be aligned, with the introduction of ICT. Maybe it is about time design educators and researchers look at emerging theory of 'navigationism'.

Navigationism in the era of ICT

Brown (2006) in discussing the paradigm shift in education finds it difficult to accept that teachers and educationists still continuing to work within our "content-driven" paradigms of constructivism. In his article 'Beyond constructivism: navigationism in the knowledge era", he discusses how ICT is impacting on education and the shifts in the educational system for the past decade. Quoting Restak (2003, p. 57) he indicated that, "within the modern age, we must be able to rapidly process information, function amidst chaotic surroundings, always remain prepared to shift rapidly from one activity to another and redirect attention between competing tasks without losing time" (Brown, 2006:p 109). Accordingly, "providing our learners with preselected and carefully designed and developed content" in the current situation of changes in educational environment, especially with ICT means "we are heading for a disaster, if we are not willing to take the leap out of this fatal paradigm"(p. 116).

Brown therefore strongly argued for 'navigationism' as "the new learning paradigm that lies beyond constructivism". He define navigationism as a learning paradigm where "learners should be able to find, identify, manipulate and evaluate information and knowledge, to integrate this knowledge in their world of work and life, to solve problems and to communicate this knowledge to

others"(Brown, 2006: p 116). ICT is allowing graphic design students to locate the appropriate ideas within the virtual environment and studios, manipulate them for the development and execution of their desired objective as far as the design process of ideation is concern. They might have gone through the stages in ideation using the traditional pedagogy but working within the virtual environment will make it difficult for them to trace and document these stages as required by the traditional methods of ideation.

Brown concludes in his work by exhorting design educators to "focus on coaching learners to find, identify, manipulate and evaluate information and knowledge, to integrate this knowledge in their world of work and life, to solve problems and to communicate this knowledge to others" (p. 116). "Teachers and educators should become the source of HOW to navigate in the ocean of available information and knowledge. We should become coaches and mentors within the knowledge era". (p.116)

What is needed and which will be much appreciated is 'a paradigm that is underpinned by different principles, 'based not on the acquisition of isolated facts and knowledge, but on the development of multidisciplinary connections with global networks and participation in communities of practice, together with reformed teacher roles, and greater autonomy and agency for students'. Educators should therefore adopt 'pedagogies that move beyond instruction to creativity, innovation and generative thinking'(Mcloughlin & Lee, 2008:647).

New media and social software

Mcloughlin & Lee (2008) also takes the argument beyond constructivism. They propose a paradigm that blends social software, constructivism, connectivism and navigationism. In an increasingly digital world, where ubiquitous computing and demand-driven learning are the trends, there is a need to expand our vision of pedagogy so that learners become active participants and co-producers rather than passive consumers of content and learning processes are participatory and social, supportive of personal life goals and needs.

The concept of studio activity is to allow for interactive participation of students and their peers to discuss and critiquing their works. In other words, studio teaching is seen as a "model of interaction" and for "assimilation of real-life situations". Mcloughlin & Lee envision that; the affordances of these technologies, coupled with a paradigm of learning focused on knowledge creation and networking, offer the potential for transformational shifts in teaching and learning practices, whereby learners can access peers, experts, the wider community and digital media in ways that enable reflective, self-directed learning (Mcloughlin & Lee, 2008:649).

Implications for graphic design pedagogy

There seems to be pedagogical disturbances calling for a shift in paradigms informed by the introduction of ICT as far as ideation and ICT in graphic design education is concern. The review painted current topology of graphic design; both in the profession and in education, ICT and the pedagogy of graphic design leading to current educational paradigms that informs ICT in ideation.

The field of graphic design is much broader now than in the past and now includes disciplines such as motion graphics, environmental commodities, and new media. It has evolved from the pre-historic abstract geometric shapes to include a spectrum of ideas for film and TV and all manner of visual communication and design. It also involves understanding human engagement in an effort to useful and pleasing artefacts.

Technology has permeated every facet of graphic design – as in its teaching and learning as well as the profession. It is now almost impossible to talk about graphic design without the use of technological resources from idea development to final execution of the design solution. Computer technology has become one of the tools of ideation, in other words, a 'thinking tool'. It is a fact that professional designers and student designers will rely very heavily upon tools and techniques to make sense of their ideation within their respective design tasks.

It can be seen that with the introduction of ICT, there seems to be tensions and pedagogical disturbances and imbalances when it comes to ideation. The graphic design profession somehow influences the pedagogy of graphic design education. Current educational pedagogy cannot fully rely on the Bauhaus principles that defined the process of design as an object-centred process, which has to produce an artefact or environment that solves a problem. Moreover, the pedagogy that includes the issue of ideation - fundamental to the design process - but still viewed in the traditional model of professional graphic design does not accommodate ICT. We need an educational paradigm that encourages cognitive learning that comes with ICT and therefore encourages the issue of pedagogy that use technology to facilitate such learning paradigms. This article encourages a paradigm that is underpinned by different principles, based not on the acquisition of isolated facts and knowledge, but on the development of multidisciplinary connections with global networks and participation in communities of practice, together with reformed teacher roles, and greater autonomy and agency for students. When it comes to ICT in ideation in graphic design, educators are encourage to adopt pedagogies that move beyond instruction but that which encourage creativity, innovation and generative thinking (Mcloughlin & Lee, 2008:647). Contemporary goals in education, particularly graphic design education will mean giving students required tools to stimulate the search for creative solutions to problems, as well as a solid scientific basis for decision-making processes, especially in ideation.

Page et al (2009) advocate that 'individual must be able to adapt to novelty through Innovation Education (IE) environment which is increasingly relevant for ideation and collaboration, based on the notion that 'everyone has creative ability that can develop further some degree through educational stimuli and self-developmental activities' (Page et al. 2009:11). This article supports Page et al's (2009) IE for the reasons that It see possibilities in using new knowledge to produce new products and it stimulate and develop the creative abilities of students. IE also encourages the teaching, studying and learning in certain problem and innovation-based learning process; from identifying a context, where students develop their own and realization with apropriate models. Finally, it encourages and develops the students' initiative and strengthens their self-belief.

ICT is encouraging graphic design students to be more innovative in their approach to design development. The argument of ICT as a tool or subject in graphic design will be settled when educators adopt the IE approach in design education. According to Page *et al* (2009), creativity and problem solving are not only intrinsic to design education but also to technology education.

Pedagogically, graphic design should not be an exception especially when it comes to ideation process in design. Technological developments are also taking place in the developing countries and there is the need to also look at what is happening in the educational world of the developing economies. This study seems to be a forerunner in the quest for looking at ICT in ideation especially at what is happening in the developing economies. Going further, this article encourages an ongoing research of exploring issues that will greatly help in answering the question: **what methods of ICT are there for the teaching and learning processes of ideation in graphic design and how effective are they for the educator and the learner in the developing economy**. This can only be achieved within the right and appropriate framework for the research; an activity-

oriented framework that relates to graphic design that will show the tensions and imbalances in current pedagogy.

References

1. Atherton, J.S., 2011. Learning and Teaching; Behaviourism. *On-line: UK*. Available at: Http://www.learningandteaching.info/learning/behaviour.htm [Accessed August 21, 2011].
2. Bender, D.M., 2005. Developing a Collaborative Multidisciplinary Online Design Course. *Journal of Educators Online*, 2(2).
3. Bender, D.M. & Vredevoogd, J.D., 2006. Using Online Education Technologies to Support Studio Instruction. *Educational Technology & Society*, 9(4), pp.114-122.
4. Bennett, R., 2000. PROPOSING A FRAMEWORK FOR CREATIVE ONLINE INTERACTION. *The omnium project:Online*.
5. Brown, T.H., 2006. Beyond constructivism: navigationism in the knowledge era. *On the Horizon*, 14(3), pp.108-120. Available at: http://www.emeraldinsight.com/10.1108/10748120610690681.
6. Dale, J.S., 2006. A Technology-Based Online Design Curriculum. In *TCC*. pp. 2-11.
7. Duffy, T.M. & Cunningham, D.J., 1984. Constructivism: Implications for the design and delivery of instructions. *Context*, pp.1-31.
8. Ellmers, G., 2006. Reflection and Graphic Design Pedagogy: Developing a Reflective Framework to Enhance Learning in a Graphic Design Tertiary Environment Reflection and Graphic Design Pedagogy : In *Australian Council of University Art and Design Schools Conference*. Melbourne: ACUADS, pp. 1-10.
9. Jonassen, D.H., 1985. Objectivism versus Constructivism: Do We Need a New Philosophical Paradigm ? , 39, pp.5-14.
10. Jonson, B., 2005. Design ideation: the conceptual sketch in the digital age. *Design Studies*, 26(6), pp.613-624. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0142694X05000189 [Accessed August 1, 2011].
11. Kolb, A.Y. & Kolb, D.A., 2005. Learning styles and learning spaces: enhancing experiential learning in the higher education. *Academy of Management Learning & Education*, 4(2), pp.193 - 212.
12. Kvan, T., 2001. The pedagogy of virtual design studios. *Automation in Construction*, 10, pp.345-353. Available at: www.elsevier.com/locate/autcon.
13. Mcloughlin, C. & Lee, M.J.W., 2008. Mapping the digital terrain: New media and social software as catalysts for pedagogical change. In *Ascilite*. pp. 641-652. Available at: http://www.ascilite.org.au/conferences/melbourne08/proc/mcloughlin.html.
14. Page, T. et al., 2009. A virtual learning environment in support of blended learning and distance learning in technology and design education. *University of Wollongong*, pp.129-138. Available at: http://ir.nul.nagoya-u.ac.jp/jspai/handle/2237/12015 [Accessed August 21, 2011].
15. Ranjan, M.P., 2005. *Creating the Unknowable: Designing the Future in Education Multi-disciplinary*, Ahmedabad.
16. Stensaker, B. et al., 2007. Use , updating and integration of ICT in higher education: Linking purpose , people and pedagogy. *Higher Education*, 54, pp.417-433.
17. Thompson, C., 2010. Education and/or displacement? A pedagogical inquiry into Foucault's "limit-experience." *Educational Philosophy and Theory*, 42(3), pp.361-377.
18. Wang, Tsungjunag, 2009. The Transformational Promise of Information and Communications Technologies (ICTs) for the Professional Education of Architects. *Educational Technology & Society*, 12(3), pp.206-213.
19. Wang, Tsungjuang, 2011. Designing for Designing: Information and Communication Technologies (ICTs) and Professional Education. *International Journal of Art & Design*

Education, 30(2), pp.188-199. Available at: http://doi.wiley.com/10.1111/j.1476-8070.2011.01675.x.

The Role of Creative Problem Solving Skills among the Youth as a vehicle for Industrial Transformation in Kenya

Rose Oduho and Raphael Ogutu
Cape Peninsula University of Technology
Cape Town, South Africa
rodu7@yahoo.com

Abstract

The majority of youth in Kenya are educated and therefore are the key drivers of our economy now and in the future. It is so because of the energy and talents they posses. Kenyan youth are talented in many areas; this can be seen in socio-cultural, economic, information technology and scientific innovations witnessed in the recent times. Creativity is one of the driving forces in industrialization, but does the Kenyan youth have the creative-problem solving skills? Of late, Design skills have not been effectively inculcated in our youth, because the 8-4-4 education syllabus in Kenya does not put emphasis on art and design. Branding of small and medium enterprises for example, is a creative way of adding value to established businesses. The youth should be encouraged to start small and then grow big in their businesses through branding. The place of design is to help the youth focus on creative problem solving skills in different areas of specialization, for example, design process can be used to solve pragmatic problems in many areas of specialization and vocational training. Creative-problem solving skills will help the youth realize Kenya's vision 2030 and the millennium development goals as they become more innovative and creative thinkers. With more than 60 per cent of the population comprising of the youth, the Kenya Government and Donors have come up with youth empowering programmes such as Kenya Youth Empowerment and Employment Initiative (KYEEI). The main focus is on training to empower the youth through funding, seminars and workshops. This study relied on review of literature and focused on comparative case studies from developed countries. These findings will be used to implement design strategies for the industrialization process in Kenya.

INTRODUCTION

1.1 Background

A little girl was drawing a figure when the teacher asked "What are you drawing?". "God" she said. "But no one knows what God looks like" said the teacher. "They will in a minute!!" said the little girl. (Sir Ken Robinson tells the story)

Most children are born with an innate creative spirit of experimentation, playfulness and a disregard for social convention. This natural creative spirit is often systematically rendered mute by the imposition of structured formal education and societal pressure. It was done for most of us and is still being done for millions of others. Our task as educators and mentors is therefore to restore that sense of inquisitiveness, curiosity, playfulness and creative invention. In this fast-paced world of unrelenting change, it should be important that we develop a case for the incorporation of creative problem solving skill within the core of every training program not only in design; but within each subject or as a compulsory program of study.

With the industry's persistent expectation for excellent teamwork, clearly communicated concepts, innovative thinking, lifelong learning and reflective practice, creative problem solving is an essential skill for today's professional practitioner. Creativity is at the core of our personal and

collective evolution, whether as individuals or as teams. Yet creative behavior is poorly understood and commonly misinterpreted. It's frequently seen as something difficult to define, a mysterious phenomenon and an ability that some people have and others do not. The facts are different. Everyone is capable of creative effort given well-designed training, experiential exercises and reflective practice[14].

Design entails creatively using acquired skills to solve a problem. Acquisition and application of these creative skills all over the world are the important keys in any national development. Countries that have developed skills in their youth have a bright future, because everything created wears out with time and eventually will need a replacement. The majority of Kenyan youth are unemployed. This is the main cause of drug addictions, prostitution, drug abuse among many other social evil. The youth need jobs and businesses that will engage their time, energy and provide a source of livelihood. Developed countries put more emphasis in the acquisition and application of these creative problem solving skills through their education system. For instance, the 'Asian Tigers' have a different approach in the way they have advanced their technology, innovation and design of systems. They have succeeded through research, educating their youth on hands on technology or experience and industrial innovations. The creative problem solving skills are strategically developed in their youth as from a tender age; they grow up having acquired these skills gradually with the vision to use them for the country's future industrial development. When we examine the Asian Tigers and their industrial growth compared to Kenya, one cannot help but ask; where then did we go wrong as a country in that up to now our industrial development is still low when compared to theirs? What can we then do, to regain our speed and make remarkable steps on the countries industrialization process? The answer majorly lies on imparting the youth with or developing their creative problem solving skills. The creative problem solving skills can be successfully acquired and developed through research, teaching and learning of subjects such as Art and Design, engineering and other vocational subject.

The Youth population represent the reservoir of potential labour force of a nation's present and future industrialization. Any country that does not invest in its youth risks a future extinction in terms of social, economic, political and cultural development. According to a UNESCO a 'Youth' is defined as*: persons between the ages of 15 and 24. UNESCO understands that young people are a heterogeneous group in constant evolution and that the experience of 'being young' varies enormously across regions and within countries.*[15]

Kenya has a different youth description from the UNESCO's. According to the Ministry of Home Affairs, Heritage and Sports (2006), in the National youth policy of 2006, the youth is defined as: *persons resident in Kenya in the age bracket 15 to 30 years. This takes into account the physical, psychological, cultural, social, biological and political definitions of the term.*[16]
Global organizations and international bodies are focusing on the youth all over the World to equip them and prepare them for leadership and development of social, cultural, political and economic platforms, as illustrated by UNESCO. UNESCO's objective is to help empower young people, reaching out to them, responding to their expectations and ideas, fostering useful and long-lasting skills. There are Non-governmental bodies that are ready to cooperate with the government to aid

[14] http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value Friday, October 22, 2010 at 5:09 pm

[15] http://www.unesco.org/new/en/social-and-human-sciences/themes/social-transformations/youth/about-youth/ 4 April 2011

[16] http://www.g-youth.org/main/images/youth.pdf retrieved on May 16, 2011

in acquisition of the required creative problem solving skills. For instance UNESCO has for a while been encouraging**:**

Partnerships *between UNESCO and young people's networks and organizations, to solicit and integrate their views and priorities and collaborate with them in setting up projects and programmes in the areas of the Organization's competence.*

The ***integration*** *of youth concerns and issues into the policy agendas of Member States in education, the sciences, culture and communication, in order to create spaces and opportunities for empowering young people and giving recognition, visibility and credibility to their contributions.*[17]

This clearly shows that the stage is actually set for equipping youth with creative skills be it agreeable by the stake holders that this is what the youth lack in order for Kenyans to move quickly in the industrialization process. According to the Centre for Youth Development and Policy Research in the United States established in 1990 in response to growing concern about youth, defines youth as:

A process that all young people go through on the way to adulthood…it is a process or journey that automatically involves all of the people around a youth—family and community. A young person will not be able to build essential skills and competencies and be able to feel safe; cared for, valued, useful, and spiritually grounded unless their family and community provide them with the supports and opportunities they need along the way. Thus, youth development is also a process in which family and community must actively participate.[18]

The description above acknowledges an important aspect of youth that includes participation from the family and community. The stakeholders in the community includes the government, educationists, industrialists and all the people concerned with helping the upcoming labour reserve in achieving Kenya's industrialization vision. This sentiment from the United States is not unique as it stresses that the youth need family support, mentors and essential skills in order to be competent. They also need to acquire godly character, and be actively involved in community development programmes, and only then will they be able to meaningfully contribute at national level as required. Youth development is a process that will involve all stakeholders beginning with their families, educational institutions and nation/s participation at a larger scope. Youth development therefore requires a holistic approach in development. According to a World Bank description, Industrialization is:

The phase of a country's economic development in which industry grows faster than agriculture and gradually comes to play the leading role in the economy.[19]

Industrialization according to this definition is therefore a process that entails a country's economic development. Industrial sector grows faster than agriculture. In Kenya agricultural sector has always been described as the back-bone of the nation's development. Tourism has also played a key role in this country's economic development; however it is a very sensitive sector. For Kenya to be competitive, she needs a paradigm shift which will transform the country from dependency on agriculture to industrial exports.

The phrase Creative problem solving is a term that is widely used in other fields of study. Different definition have been given on this phrase, some of the definitions include:

---

[17] http://www.unesco.org/new/en/social-and-human-sciences/themes/social-transformations/youth/about-youth/ 4 April 2011

[18] http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value4 April 2011

[19] www.worldbank.org/depweb/english/beyond/global/glossary.ht… May 21, 2011

Creative Problem Solving is a proven method for approaching a problem or a challenge in an imaginative and innovative way. It's a tool that helps people re-define the problems they face, come up with breakthrough ideas and then take action on these new ideas.[20]

Creative problem solving skills have countless uses. Often people associate creative problem solving with dealing with crises or difficulties, or think of it as something that's used for games and puzzles or special kinds of jobs. However, creative problem solving skills are required for achieving exceptional performance in most jobs (and all the good jobs). The term "problem" simply refers to any discrepancy between the current situation and a desired future situation. So, finding a way to exploit an opportunity is a form of problem solving just as coping with a crisis is. Moreover, any opportunity to improve work processes or products fits that definition of a problem. Creative thinking is not just for certain jobs, like writing advertising copy or designing entertaining training programs. Creativity can help one to progress from our current situation to a desired future situation, whether our jobs are normally thought of as involving "creative work" or not. The creative problem solving process differs from routine problem solving in that with routine problem solving a pre-established method for solving the problem is used; with creative problems solving, any pre-established method for solving the problem is either unknown or not used. Creative problem solving involves a hunt for new solutions, while routine problem solving uses old solutions.[21]

[20] http://www.creativeeducationfoundation.org/our-process/what-is-cps

[21] http://www.wright.edu/~scott.williams/LeaderLetter/cps.htm May 23, 2011

1.2 Problem Statement

Humans create mostly whenever they are confronted with a problem. Creativity is one of the driving forces in design all over the world, but does the Kenyan youth have sufficient creative-problem solving skills? Developed countries like the United States of America have programmes that train youth on creative problem solving skills, from childhood to tertiary levels. But unlike the developed countries, art and design skills are minimally inculcated in our youth, because the 8-4-4 education syllabus in Kenya put little emphasis on art and design subjects in our schools. Art and design units are optional in most of the public high schools in Kenya, and compulsory in the majority of high cost schools.

Unemployment and poverty level is rising in Kenya, these can be successfully tackled through acquisition of creative problem solving skills. These skills in turn will be used in creation of job opportunities which will result in alleviating poverty as population masses become economically stable. It is important to note that at one point in time economies and industrialization levels of countries like Singapore, Malaysia, and Korea were at the same level of as that of Kenya during the 1960's. After some decades there was a noticeable difference between the mentioned economies and industrialization level with that of Kenya.[22] Where did the problem occur such that there was this disparity that brought about Kenya's lagging behind in industrialization? Some suggestions have been made to improve its economic power using:

- *Empower competent technocratic policymakers to manage macroeconomic and development policies with strong political support.*
- *Create a climate in which all ethnic groups, especially entrepreneurially talented minorities, can participate in development with low risk.*
- *Design strategies that build on existing comparative advantage in agriculture and labour intensive industry while investing in education that will create a more skilled workforce for a gradual transition to new industrial and service exports.*
- *Adhere strictly to sound macroeconomic policies including a realistic and flexible exchange rate, small budget deficits or preferably small surpluses and appropriately tight monetary policies; currency convertibility is a credible guarantor of these policies.*
- *Keep labor markets flexible, so that market forces determine wages and employers are free to hire and dismiss with a minimum of government regulation.*
- *Reform financial markets, permitting market forces to determine credit allocations and interest rates and, along with currency convertibility, creating a welcoming climate for foreign investors.*
- *Undertake trade reforms that will open economies increasingly to world markets; while the vestiges of protection remain in place, create mechanisms by which export producers can obtain inputs at world prices, free of duties and free from import controls.*[23]

One of the reasons for Kenya's lagging behind could be due to our education/training choices or priorities from childhood to youthful ages. In developed countries major focus of their education systems is on impartation of practical skills. These skills include creative problem solving skills while in developing and under developed countries main focus is on theoretical knowledge acquisition. When compared less of the practical aspect of skill application or acquisition during learning is stressed.

1.3 Scope of Study

[22] **Could Asian Policies Propel African Growth?**
Michael Roemer, July 1996 Harvard Institute for International Development

[23] **Could Asian Policies Propel African Growth?**
Michael Roemer, July 1996 Harvard Institute for International Development pg 16

Invention, innovation, creation, originality, technology are some of the terms related to creative problem solving skills. Designers and artists are creators in their own different areas of specialization such as web design, Graphic design, painting, sculpture, Product design, fashion and textiles, interior design and so on. Graphic designers for example create using specialized graphic software in computer to create billboards, posters among many other objects of design. Branding small and medium enterprises for example, is a creative way of adding value to established businesses. The scope of this study is limited to Kenya but comparative studies are done to draw lessons from the developed countries.

1.4 Objectives of the study

To investigate the role of creative problem solving skills in industrialization process

To investigate the role of art and design subject in aiding the youth in acquisition of creative problem solving skills, so as to realize Kenya's vision on industrialization as per 2030 vision.

To find out which concepts of creative problem solving skills would be essential to include in the education system towards preparing the youth.

To find out the state of Government's goodwill on the inclusion of necessary subjects for acquisition of these skills in the 8-4-4 syllabus.

2.0 METHODOLOGY

Research done is through compilation and analysis of existing information and field researches on this particular and related topic has been done to support various ideologies. It is purely desk research that has been used to come up with this body of information. Qualitative analysis of different author's findings has been done to come up with various opinions and conclusions recorded in the paper.

3.0 ANALYSIS AND RESULTS

Problem solving skills are a lifelong learning skill that enables the learner to be creative in many areas of their life. The youth in Kenya lack some of these skills as they grow up because very few schools instill these skills in their students. One of practical observation in this study is made from Odyssey of the Mind which illustrates the following concepts:

It teaches students to learn creative problem-solving methods while having fun in the process. For more than twenty five years, this unique program has helped teachers generate excitement in their students. By tapping into creativity, and through encouraging imaginative paths to problem-solving, students learn skills that will provide them with the ability to solve problems -- great and small -- for a lifetime. It also informs students on how to think divergently by providing open-ended problems that appeal to a wide range of interests. Students learn how to identify challenges and to think creatively to solve those problems. They are free to express their ideas and suggestions without fear of criticism. The creative problem-solving process rewards thinking "outside of the box." While conventional thinking has an important place in a well-rounded education, students need to learn how to think creatively and productively.[24]

The extract from Odyssey clearly illustrates that students are able to solve many problems easily and at the same time finding it fun. It is also important to notice that developing these skills is a process which takes time.

[24] http://www.odysseyofthemind.com/learn_more.php 4 April 2011

3.1 What is creative problem solving skill?

It is intentionally developing ones mental process with the aim of acquiring skill in creating a unique solution to a problem. It is a special form of problem solving in which the solution is independently created rather than learned with assistance. To qualify as creative problem solving the solution must either have value, clearly solve the stated problem, or be appreciated by someone for whom the situation improves.[25] Creativity is characterized by ideas or concepts that show originality and have value. These concepts could be relevant to an individual, a situation or a cultural context. When the products of creative thinking are completely original, they are characterized by distinguishing or emergent features that are clearly identifiable as breaking entirely new ground. This is therefore a good ground for industrialization to develop since solutions that fully satisfy a problem it what the world needs at the moment.

Creative problem solving demands two sets of complementary skills – convergent thinking and divergent thinking. The former is necessary for analyzing problems and situations as well as selecting, evaluating and implementing ideas. Divergent thinking is necessary for exploring, investigating and generating new concepts by finding ways to associate ideas that are generally not connected. [26] If the public education system in Kenya is encouraged to inculcate both divergent and convergent methods of thinking when solving problems in any subject, we would have had our level of industrialization escalate to new heights. The reason why Kenya is still where it is because this is not encouraged, if there is an already established way of doing things or a formula used that is what the education system stresses on. The instructors are afraid of encouraging exploration and curiosity which on most cases has given birth to inventions and innovations.

So the question remains, how do we guide Kenyan youth to develop creative problem solving skills and how do we integrate this into the curriculum and training? It's a major challenge and central to the impending transformation from the Information to the Conceptual Age. However, some of the core ideas applied to the process of integrating creative problem solving in the present 8-4-4 curriculum would include:

Providing more of hands on experience exercises and does not over emphasis theoretical instruction. Since Creative behavior is best acquired through experience and practice.

Instructors and mentors to ensure that learners are provided with a safe and non-judgmental psychological environment. This will encourage exploration, creativity etc which is the spring board for industrialization.

Learning exercises must be designed to demonstrate core principles and to challenge the mind but be within achievable goals.

Different programs at elementary up to tertiary levels should be structured in a way so as to include analytical, critical thinking as well as development of creative ideas.

Conceptual diversity must be encouraged if possible even demanded from the learners.

Mentors and instructors will be required lead by demonstration and example. This will act a source of inspiration and models that the learners who will spearhead industrialization can ape.[27]

Creativity is also thought to be about breaking boundaries and making connections between things that are not normally associated together. It may mean encouraging the Kenyan youth to find new ways of seeing and solving problems. Fortunately in Kenya there is incredible access to the widest variety of information and resources with which the youth can work and create through the Internet connections to diversify perspectives and opinions. For instance the first part of a youth course

---

[25] http://en.wikipedia.org/wiki/Creative_problem_solving 23 March 2011

[26] http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value Friday, October 22, 2010 at 5:09 pm

[27] . http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value Friday, October 22, 2010 at 5:09 pm

could use visual problem solving and design to identify, analyze and communicate concepts and ideas. This would involve an introductory exercise in the use of mind maps and concept maps to organize and document information in a primarily visual form. This usually serves to strengthen youth's analytical and convergent thinking patterns and reinforce the importance of building connections interconnected ideas. The result of this would be that the youth acquiring a range of visual design skills, individual expression and development of personal perspectives about the perception of the world around them. It also reinforces the importance of drawing and systematic design. All this would contribute systematically to the kind of skills that speed industrialization process.

The second part of the proposed creative problem solving skill course would be devoted to idea generation techniques for both individual and group applications. This course would emphasize methods by which learners would force connections among typically unrelated ideas. The exercises would be designed to be both pragmatic and playful; this is so as to encourage the students to experiment with wild ideas and unusual solutions. It would involve combining of visual and verbal brainstorming techniques of teaching creative problem solving skills that support teamwork in time-sensitive tasks and problem-solving activities. If this is practiced overtime Kenya's education system, we shall have a labour force equipped with skills essential for industrialization.

3.2 Techniques and tools

Many of the techniques and tools for creating an effective solution to a problem are described in creativity techniques and problem solving.

Creative-problem-solving techniques can be categorized as follows:

Creativity techniques designed to shift a person's mental state into one that fosters creativity. These techniques are described in ***creativity techniques.*** *One such popular technique is to take a break and relax or sleep after intensively trying to think of a solution.*

Creativity techniques designed to reframe the problem. For example, reconsidering one's goals by asking "What am I really trying to accomplish?" can lead to useful insights.

Creativity techniques designed to increase the quantity of fresh ideas. This approach is based on the belief that a larger number of ideas increase the chances that one of them has value. Some of these techniques involve randomly selecting an idea (such as choosing a word from a list), thinking about similarities with the undesired situation, and hopefully inspiring a related idea that leads to a solution. Such techniques are described in creativity techniques.

Creative-problem-solving techniques designed to efficiently lead to a fresh perspective that causes a solution to become obvious. This category is useful for solving especially challenging problems. Some of these techniques involve identifying independent dimensions that differentiate (or separate) closely associated concepts. Such techniques can overcome the mind's instinctive tendency to use "oversimplified associative thinking" in which two related concepts are so closely associated that their differences, and independence from one another, are overlooked.[28]

Listed below are some of the commonly used creative and creative problems solving techniques that are used in many parts of the World:

TRIZ, *which is also known as Theory of Inventive Problem Solving (TIPS), was developed by* ***Genrich Altshuller*** *and his colleagues based on examining more than 200,000 patents. This method is designed to foster the creation and development of patentable inventions, but is also useful for creating non-product solutions.*

Mind mapping *is a creativity technique that both reframes the situation and fosters creativity.*

---

[28] http://en.wikipedia.org/wiki/Creativity_techniques 4 April 2011 Richard Fobes, *The Creative Problem Solver's Toolbox: A Complete Course in the Art of Creating Solutions to Problems of Any Kind* (1993) ISBN 0-96-322210-4

Brainstorming *is a group activity designed to increase the quantity of fresh ideas. Getting other people involved can help increase knowledge and understanding of the problem and help participants reframe the problem.*
Edward de Bono *has published numerous books that promote an approach to creative problem solving and creative thinking called* ***lateral thinking.***
The ***Creative Problem Solving Process*** *(CPS) is a six-step method developed by* ***Alex Osborn*** *and* ***Sid Parnes*** *that alternates convergent and divergent thinking phases.*
Some of these skills should be applied when training the youth of this country to find out hteir effectiveness. Critical thinking is also one way of creatively solving problems.

3.3 Challenges

One of the greatest challenges of design education has been the attitude that stakeholders hold against design. Wagah et al. (2009) illustrate this in their analysis on "Attitudes of teachers and students towards art and design curriculum":

The findings of the study revealed that students who had dropped Art and Design Curriculum and Teachers of Art and Design Curriculum had negative attitudes towards the curriculum. Although students taking Art and Design liked the subject their reasons for this were not fully in line with the objectives of the curriculum. Some of the students were taking the subject for merely boosting their Kenya Certificate of Secondary Examination (K. C. S. E) result. Based on these findings, it is recommended that students be given proper career guidance on Art and Design Curriculum. The subject should also be made compulsory in Forms 1 and 2 to give early opportunity to students to identify their talents.

According to Mwiria (2002) there are more challenges facing vocational subjects training these are:

The biggest obstacle to the successful implementation of the new curriculum was its limited acceptance by most education stakeholders outside of government not only because they were not consulted on its introduction but also because it turned out to be an expensive system to implement for parents already burdened with other educational responsibilities with the onset of cost-sharing. In addition, the vocational curriculum has been criticized for overlaps in coverage between subjects, poor sequencing of teaching topics within individual subjects and for the limited time allocated for some subjects. Time constraints, lack of or inadequate infrastructure, facilities and books has resulted in a situation where the teaching of theoretical knowledge has dominated over practical content. Also problematic is the failure of the curriculum to impart new ideas focusing instead on the old and obsolete knowledge most teachers know best, as they have virtually no opportunities to update their knowledge. Moreover, school inspectors rarely visit vocational education teachers. A combination of all these factors means that graduates of vocational courses are not necessarily advantaged over their academic education counterparts with regard to entry into a fiercely competitive labor market and post-secondary training institutions.

Summary

Creative-problem solving skills will help the youth realize Kenya's vision 2030 and the millennium development goals as they become more innovative and creative thinkers. Creative problem solving enhances analytical skills which are necessary for pragmatic solutions. These skills should be encouraged at all levels of our lives, however for the youth to benefit more; they should be imparted at a tender age of human development. Children are born with an innate creative spirit of experimentation, playfulness and a disregard for social convention; however this natural creative spirit is often systematically rendered mute by the imposition of structured formal education and societal pressure.

Recommendation

In this fast-paced world of unrelenting change, it should be important that we develop a case for the incorporation of creative problem solving skill within the core of every training program not only in design; but within each subject or as a compulsory program of study.
The instructors should encourage students in exploration and curiosity which on most cases has given birth to inventions and innovations.
As a country we can emulate the countries which have succeeded using problem solving skills, by doing some relevant case studies.

REFERENCE

1. http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value Friday, October 22, 2010 at 5:09 pm
2. http://www.unesco.org/new/en/social-and-human-sciences/themes/social-transformations/youth/about-youth/ 4 April 2011
3. http://www.unesco.org/new/en/social-and-human-sciences/themes/social-transformations/youth/about-youth/ 4 April 2011
4. http://www.g-youth.org/main/images/youth.pdf retrieved on May 16, 2011
5. http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value 4 April 2011
6. www.worldbank.org/depweb/english/beyond/global/glossary.ht… May 21, 2011
7. http://www.creativeeducationfoundation.org/our-process/what-is-cps
8. http://www.wright.edu/~scott.williams/LeaderLetter/cps.htm May 23, 2011
9. http://www.odysseyofthemind.com/learn_more.php 4 April 2011
10. http://en.wikipedia.org/wiki/Creative_problem_solving 23 March 2011
11. http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value Friday, October 22, 2010 at 5:09 pm
12. http://www.awn.com/blogs/creative-transformation/creative-problem-solving-pt-1-discovering-originality-and-value Friday, October 22, 2010 at 5:09 pm
13. http://en.wikipedia.org/wiki/Creativity_techniques 4 April 2011 Richard Fobes, *The Creative Problem Solver's Toolbox: A Complete Course in the Art of Creating Solutions to Problems of Any Kind* (1993) ISBN 0-96-322210-4
14. Michael Roemer, July 1996 Harvard Institute for International Development
15. Mwiria, K. (2002) ***Vocationalization of Secondary Education: Kenya Case Study*, Regional Vocational Skills Development Review, Africa region, World bank.**
16. Wagah. M.O. Indoshi.F.C. and Agak. J.O. (2009) Attitudes of Teachers and students towards art and design curriculum: Implications for vocational education in Kenya. Educational Research and Review Vol. 4 (10), pp. 448-456, October, 2009Available online at http://www.academicjournals.org/err ISSN 1990-3839 © 2009 Academic Journals

Reflecting on the need for inclusion of interior designers to the multi disciplinary retail design discourse in South Africa

Ilse Prinsioo
Interior Design Department
Faculty of Art, Design and Architecture
University of Johannesburg
iprinsloo@uj.ac.za

Abstract

Retail design is a multi-disciplinary activity that involves various role players to translate a retail brand identity into a retail store. The interior design discipline is one of these role players since retail design involves the creation of an interior space where merchandise and services are promoted.

Retail design requires careful consideration of what makes the consumer's retail experience unique. It has become an acknowledged business tool for differentiation and branding for retailers. This is reflected in the growing economic significance and dominance in business as reflected in retail management, marketing and retail literature in recent years by researchers such as Ballantine, Jack & Parsons (2010), Grewal and Levy (2007), Grewal, Levy and Kumar (2009), Kent (2003), Petermans and Van Cleempoel (2009; 2010), Puccinelli, Goodstein, Grewal, Price, Raghubir and Stewart (2009) and Verhoef, Lemon, Parasuraman, Roggeveen, Tsiros and Schlesinger (2009). However, the interior design industry has not been adequately represented in this literature.

This paper argues that the role of the interior design discipline is not as well entrenched and understood within the multidisciplinary retail design field in South Africa. Data obtained through open-ended interviews with the managers and senior managers involved in the design and implementation of retail stores for three leading South African corporate clothing and footwear retailers reveal that while the design of retail stores is recognised as an important means of market positioning, the consideration of the contribution of interior designers to the success of South African retailers has largely been ignored. The paper will discuss the impact of this state of affairs on retailers and the interior design industry.

Key Words: *Interior Design, Retail Design, South Africa*

Introduction

While retail design is becoming an important force in the marketplace, the research to date has been limited in its scope and inclusion of interior design as role players that influence the articulation of a brand identity into a store. This paper will explore the impact that inadequate representation of interior designers in retail design research has on retailers -and the interior design industry.

The complexity of retail design

Retail design is a complex, multi-dimensional activity that involves various role players who interpret a retail brand identity into a physical store. Since retail design concerns interior space, it developed as a career option in interior design and it is currently a specialist area within the discipline. Petermans and Van Cleempoel (2010:172) explain retail design as a "fast-emerging discipline" that is associated with interior design.

The design of the interior of a retail store concerns itself with matters such as consumer motivation, traffic flow and crowd control, expenditure administration and management, operational efficiency and competitive differentiation (Bruce et al., as quoted by Doyle, 2004:78). The design of a store communicates the reputation of the retailer in the marketplace and will, as a result, enhance the overall performance of the retailer. Baker, Grewal and Parasuraman (1994:328) explain that retail design changes the store from merely being a transaction interface to being an entity which has distinct and unique characteristics which differentiates it from the competition. The interior designer can, through purposeful planning, use layout, lighting and colour to encourage the consumer to enter the store to make purchases "despite themselves" (Poldma 2009:171).

Two clear directions of thought exist on retail design. The strongest and most available reports on retail design exist in the realm of business management and marketing. The second, but much less accessible information exists within the design and architectural environment.

Retail design: a business management and marketing perspective

In the current global market, retailing has become highly competitive given that merchandise and related services are easily reproduced and repackaged (North, De Vos & Kotze, 2003:41; Van der Vyver, 2008:19). The tough competition requires retailers to reconsider their retail brand identity constantly in order to distinguish them from the competition, and in doing so, gain supremacy in the mind of the consumer (Janse van Noordwyk, 2008:10; Van der Vyver, 2008:19). According to Collins-Dodd and Lindley (2003:246) consumers placed among multiple options will always base their preferences on the inherent differences, whether implicit or explicit. These differences will ultimately motivate the consumer to select a specific product or service.

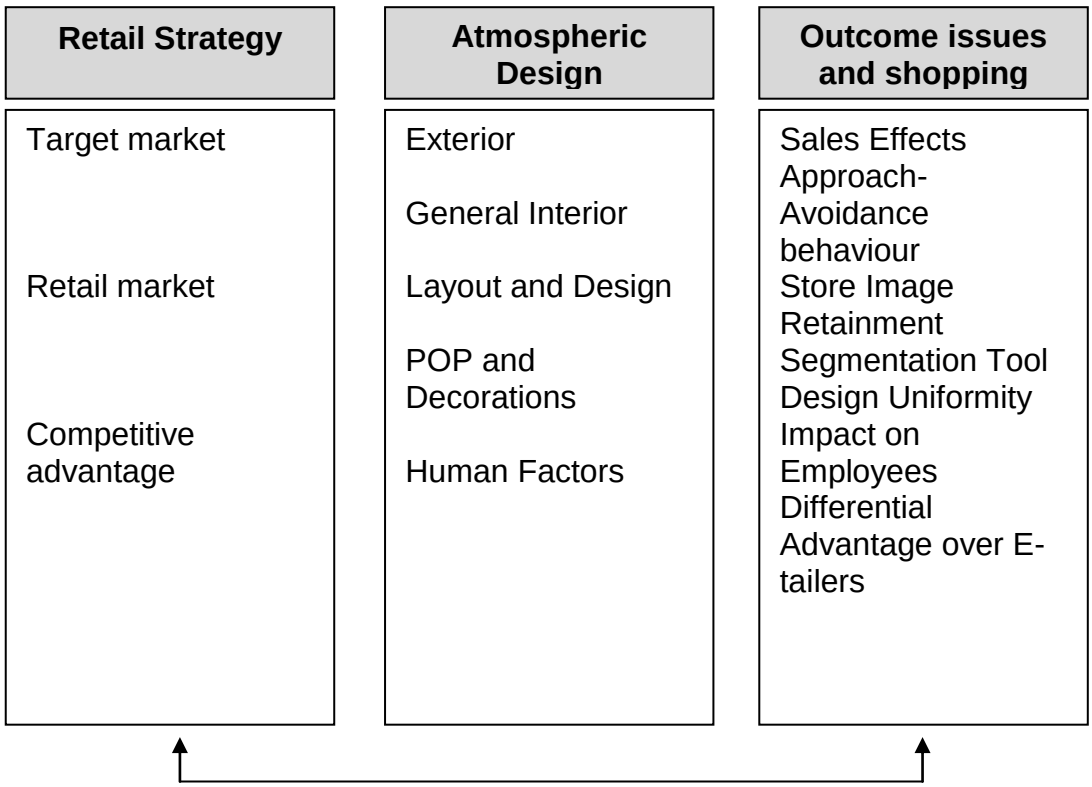
Retailers make use of differentiation as a strategic marketing tool to distinguish their products and associated services from that of their competitors. Consequently they become more attractive to a certain consumer market (North *et al.*, 2003:41; Van der Vyver, 2008:46). Retailers also differentiate themselves by representing their distinctive brand identity through the design of their retail stores because consumers attribute symbolic meaning to the retail brand identity and their experience thereof in the retail store (Baker *et al.*, 1994:328; Petermans & Van Cleempoel, 2009:171; Puccinelli, Goodstein, Grewal, Price, Raghubir and Stewart, 2009:18).

The retail store provides a significant opportunity for retail differentiation and is a good basis to secure customer loyalty. In fact, Turley and Chebat (2002:128) claim that the design of the retail store can serve as an important differential feature that can result in a competitive advantage. They claim that retail design ought to be an essential matter of importance for all retailers in competitive situations.

Moore and Lochhead (1998:123) defines [retail] design as the creation of an aesthetically pleasing store environment as the underlining means of value enhancement and differentiation within a market. He continues to describe how similar to marketing, the effective design of a store interior starts by identifying consumer market needs. Moore (1998) states that it is for this reason, that marketing and design are inter-dependable. The design becomes the instrument by which marketing objectives are achieved. He identifies the function of [retail] design to "interpret, translate and transform". Moore and Lochhead (1998:121) the market needs as identified by the retailer. It is the convergence of all dimensions related to the retail brand identity and it allows consumers to effectively interact and experience the promises associated with the particular retail brand identity. This relationship between the retail brand and the consumer is manifested in the retail store. The retail store is therefore the final test of a retailer's strategic marketing plan and the end of an extensive and costly process of consumer seduction (Kindleysides, 2008).

It is clear that literature from a retail management and marketing perspective acknowledge the retail store as the connection point between the retail brand identity and the consumer (Baker et al., 1994:329; Kent, 2003:532). Since retailers connect with their consumers directly, they integrate the needs of the consumer target market in their strategic thinking and planning. In their paper on linking retail strategy, atmospheric design and shopping behaviour, Turley and Chebat (2002:127) explain retail design as the element in the retail mix that allows a retailer to find a unique and effective way to distinguish themselves from their competition. To explain their viewpoint, they introduce a model that illustrates how retail design can benefit a retailer through retail differentiation and strategic leadership (Fig. 1).

Figure 1: A strategic view of the retail environment (Turley and Chebat 2002:127).



The model consists of three distinct stages that encapsulate the strategic planning associated with the retail design process. The first stage involves the development of a retail strategy that includes controllable variables such as identifying the target market, deciding on the position they want to hold in a specific retail market and determining the competitive advantage that they want to project. The second stage of the planning involves the manifestation of the retail strategy through the design and implementation of a specific atmosphere in their retail stores. This comprises the design of the exterior and interior of the retail store. Turley and Chebat (2002:129) briefly identify this as store layout and design, point of purchase (POP) design, application of ornamentation and the overall functionality of the design. The third and final stage of the planning evaluates the outcomes of successful retail design. Turley and Chebat (2002:131) argue that the results of proper strategic planning of the retail environment will become evident in consumer behaviour patterns. These outcomes comprise, among other things, the positive effect on trade sales, an increase in support, an agreeable store image, employee satisfaction, retention of the existing customer base and the differential advantage over internet retailing. In conclusion, Turley and Chebat (2002:128) argue

that employing a proper strategic plan will ultimately feed back into the retail strategy and influence the future strategies that will be set after the design of the retail store was implemented. This is indicated with the arrows between the third stage and the first stage of the model (Fig. 1).

Similarly, Doyle (2004:80) advocates an integrated approach to retail design in the strategic planning of a retailer. He recognises the strategic and commercial value of retail design as a means by which a retailer can design and implement a retail store that is not only visually appealing and practical, but also commercially viable for the retailer.

Retail design: the interior design perspective

As an area of expertise entrenched in the interior design discipline, retail design is seen as a multifaceted discipline where creative and technical solutions are applied within a retail store. The design solutions are functional and visually attractive while improving the quality of the retail experience for consumers, staff and management (Murialdo, 2008; Petermans & Van Cleempoel, 2010: 21). An interior environment, such as a retail store, is regarded as the setting or background where a retailer can express their personality, character and individuality (Mazarella 2010). The interior designer will therefore design an interior to represent the image of the retailer and can assist a client by linking an interior environment to business strategies and objectives

Kindleysides (2008) explains that retail design involves the careful consideration of a balance between the aesthetics and the performance of the space regarding the environment's functionality and commercial viability. Aspects such as shop frontage design, furniture, fixtures, illumination, in-store illustrations and graphics are therefore all part of retail design; all while complying with all relevant regulations and being constantly aware of implementing the design solution within the allocated budget.

The process of design is a visualisation of an interior space from nothing, while considering all the constraints and limitations. In his description of design, Lawson, (2006:4) groups the three-dimensional and environmental design fields comprising architecture, interior design, product and industrial design, urban and landscape design in the middle of the overall spectrum of design activities. He explains that designers in these disciplines are required to produce end products that are concurrently beautiful, practical and useful. According to Lawson (2006:4) this ability requires not only a sound technical knowledge, but also the aptitude to design while being visually imaginative. He proposes that design is the result of a combination of design problem solving, design process thinking, and the integration of technical processes. Edwards (2011:4) agrees with this notion and states that designing an interior involves the consideration of the purpose, visual appeal, the wellbeing of the users and the sustainability of the interior environment.

Correspondingly, researchers such as Gibbs (2009:9) and Mazarella (2010) confer that the complexity of the profession requires an interior designer to be resourceful, well-organized, adaptable, innovative, artistic and an excellent communicator. Interior design encapsulates a career landscape of "strategic consultant, change agent, environmental expert, communication consultant, project manager, workplace researcher, writer, speaker, and brand consultant; in addition to doing the creative space planning and specifying finishes, materials, furniture, etc" (Mazarella, 2010). Interior design also draws on other disciplines that add to the profession's complexity. Brooker and Stone (2007) gives a fitting definition of interior design as "an interdisciplinary practice that is concerned with the creation of a range of interior environments that articulate identity and atmosphere, through the manipulation of spacial volume, placement of specific elements and furniture and treatment of surfaces Brooker and Stone (2007:126).

The interior design discipline is creative, functional and valuable to strategic objectives such as increasing productivity; enhancing quality of life and selling merchandise. Like any other discipline, it responds to responds to change in "economy, organisation, technology, demographics and business goals of an organization" (Mazarella, 2010). Thus, by employing an interior designer, an organisation gains the benefits of their expertise that is especially applicable to the reduction of costs based on increased productivity within an interior environment, the lifecycle management of materials used in the environment and the energy conservation of the installation and maintenance of such an environment.

Retail in South Africa

Retail in South Africa is dictated by a number of large holding companies that make up the greater part of the leading retail brands in the country (Euromonitor, 2009). These holding retail companies operate in a range of retail categories and consumer target markets that exist in South Africa (Datamonitor, 2009). And while internet shopping is on the rise, personal computers are still a luxury owned by the middle and upper income consumer markets which mean that store-based retailing dominate the South African retail environment (Cobweb information, 2010).

The clothing, footwear and leather goods sector contributed 21,4% of total retail trade sales of South Africa in 2012, second only to the general dealer retail sector which holds 38.1% share (Statssa,2012). It is a specifically dynamic and constantly changing market since it is motivated by fashion, trend and style and "consumer needs [that] are changing at a more frequent pace, creat[e] a higher demand for newness" (Janse van Noordwyk, 2009:19). As a result, clothing and footwear retailers continually refurbish their retail stores to meet the changing expectations of consumers. In addition, clothing and footwear products and services are easily copied. In an attempt to differentiate them from the competition, retailers present consumer experiences that relate to their emotional needs and expectations through the design of their retail stores

The foremost clothing and footwear retail companies in South Africa are Edgars Consolidated Stores (Edcon), The Foschini Group (TFG), Woolworths Holdings and Mr Price (Euromonitor, 2009). Together, these companies make up more than 60 per cent of the clothing and footwear retail sales. These companies generate their primary turnover through consumer purchases concluded in retail stores and spent in excess of R900 million on store developments during the 2010 fiscal year (Edcon Holdings 2010; Mr Price Group 2010; The Foschini Group 2010; Woolworths Holdings 2010).

Retail design in South Africa

The body of research on retail design in South Africa is extremely limited and mostly restricted to consumer science and marketing research (Janse van Noordwyk 2008; North, De Vos & Kotze 2003; Van der Vyver, 2008). Therefore, with the intention of establishing the significance of retail design in South Africa, this researcher conducted a survey in August of 2011 with nine of the 11 interior design educational institutions registered with The South African Institute of the Interior Design Professions (IID) that offer full time courses in Interior Design and Interior Architecture. The results of the survey indicated that all of these institutions considered retail design as an important component of their interior design curriculum. All nine institutions confirmed that they include retail design in their third year curricula, while some include retail design at even earlier stages in their programme and continue with it into their final year of instruction.

These institutions indicated that they require the students to consider and master aspects of retail design that include both the business and design perspective. From a business perspective, all institutions expected their students to give careful consideration to the particular market segment

that the retail store will target as well as the application of a brand identity to the overall design. From an interior design perspective, all nine institutions had expected outcomes that students solve the space planning and layout for a retail store, while creating a suitable atmosphere, aesthetics and style. In addition, all nine institutions required the student to design the units or areas for the display of merchandise.

Since these educational institutions feed the interior design market of South Africa, it can be construed that retail design is significant to the interior design industry in South Africa.

The dilemma

In view of the fact that a retailer, such as the aforementioned clothing and footwear retailers, needs retail designers to design their stores; and educational institutions train interior designers to design retail stores, the two industries should be closely connected. However, it appears not to be the case.

A qualitative investigation into the role of interior designers in design and implementation of retail stores reveals that interior designers are not the obvious choice when managers and senior managers select candidates as retail designers (Prinsloo, 2011a:165; Prinsloo, 2011b:57). Data was obtained from six managers and senior managers who are involved in the design and implementation of retail stores tor Edcon, TFG and Woolworths. All respondents worked in the retail environment for more than five years and had qualifications that include marketing, retail management, property management and law. None of the respondents had any design related qualification.

During the interviews the term ‘interior designer’ was often misinterpreted and used interchangeably with ‘designer’, ’interior architect’ and ‘architect’. Half of the respondents also commented that it was difficult to find retail designers. Only one of the six managers interviewed understands retail design as a speciality of interior design.

In light of this and based on the review of earlier literature, it can be argued that retail design, as part of the interior design discipline, is not present in the multidisciplinary retail design discourse in South Africa.

Discussion

The absence of interior design from the multidisciplinary retail design discourse should be a matter of great concern to both the interior design industry and retailers in South Africa. Given that the clothing and footwear retail market spend multimillions on retail store developments each year, can the interior design profession afford not to be associated with this very lucrative and publically visible sector of business? Considering the multimillions that these retailers spend on retail store developments that should assist in the differentiation strategy, can they afford not to have the valuable expertise that can be a benefit to their marketing focus.

Interior designers must promote the industry and advocate the value of employing interior designers to businesses, especially to retail managers and marketers. The current professional association, the IID, can be instrumental in this endeavour through associations and collaborations with other professional bodies. In addition, academics can assist in providing opportunities for research in retail design from an interior design perspective. This can also be done in collaboration with retailers, retail management and retail marketing professionals. The review of literature indicates that most of the published research on retail design is in retail management, marketing and psychology. Future research can greatly affect the way in which the interior design industry is perceived in business sectors, such as retailing.

Retailers have to remodel and redesign their retail stores at regular intervals to keep them fashionable and trendy. However, little quantitative evidence exists on the effects of refurbishments on variables such as changes in consumer shopping patterns and resultant changes in trade sales. Such research can put a value on the role of interior design in retail design and indicate how retail design can reduce organisational risk. Retailers in South Africa often adopt retail design solutions from Europe or the United States of America without considering the impact on their intended consumer market. Retail store environments influence each type of consumer in a different way, yet there has been little published work in interior design that focuses on how to design a retail environment for different market segments. These market segments can include different genders, generations or culture groups. Retailers and other organisations can gain the benefits of interior design expertise. The knowledge that is especially applicable will be the reduction of costs based on increased productivity within an interior environment, the lifecycle management of materials used in the environment and the energy conservation of the installation and maintenance of such an environment

As our society changes, technology advances and the economic strategies are adapted, a new generation of consumers will evolve with different expectations and demands. These developments will ensure that retail design will continue to be an important and critical topic for interior designers, retail managers, marketers and academics who are interested in retail issues.

Retail design will always be a complex, multi-dimensional activity and will always involve a range of role players. As role players, interior designers need to take their rightful place in the line of professionals with confidence, dignity and distinction and participate in the multidisciplinary retail design discourse. Together with other professionals, interior designers can contribute to the development of retail design and through dialogue they can stimulate and strengthen the dynamic discipline of interior design in South Africa.

References

1. Baker, J, Grewal, D & Parasuraman, A. 1994. The influence of store environment on quality inferences andstore image. *Journal of the Academy of Marketing Science* 22(4):328-329.

2. Ballantine, PW, Jack, R & Parsons, AG. 2010. Atmospheric cues and their effect on the hedonic retail experience. *International Journal of Retail and Distribution Management* 38(8):641-653.

3. Bruce, M, Moore, C & Bristwistle, G (eds). 2004. *International Retail Marketing: a case study approach.* London: Butterworth-Heineman.

4. Brooker, G & Stone, S. 2007. *From organisation to decoration. An interior design reader*. London: Routledge.

5. Cobweb information. 2010. *SA Market Summaries: Clothing Retail.* Johannesburg: Gauteng Enterprise Propeller.

6. Collins-Dodd, C & Lindley, T. 2003. Store brands and retail differentiation: the influence of store image and store brand attitude on store own brand perceptions. *Journal of Retailing and Consumer Services* 10(6):345-353.

7. Datamonitor. 2009. *Apparel Retail in South Africa: industry profile*. London: Datamonitor.

8. Doyle, S. 2004. Retail store design, in *International Retail Marketing: a case study approach* edited by M Bruce, C Moore & G Bristwistle. London: Butterworth-Heineman:78-87.

9. Edcon Holdings. 2010. *Annual Report 2010.* [O]. Available WWW http://www.edcon.co.za/documents/AnnualResults/annual!20report2010.pdf (accessed 3 April 2011).

10. Edwards, C. 2011. *Interior Design: a critical introduction*. Oxford: Berg.

11. Euromonitor. 2009. *Retailing in South Africa.* [O]. Available WWW http://www.euromonitor.com/Retailing_in_South_Africa (accessed 3 March 2011).

12. Gibbs, J. 2009. *Interior Design*. London: Laurence King.

13. Grewal, D & Levy, M. 2007. Retailing research: past, present and future. *Journal of Retailing* 83(4):447-464.

14. Grewal, D, Levy, M & Kumar, V. 2009. Customer experience management in retailing: an organizing framework. *Journal of Retailing* (85):1-14.

15. Janse van Noordwyk, H. 2008. *The development of a scale for the measurement of the perceived importance of the dimensions of apparel store image*. Doctorate dissertation, University of Stellenbosch, Stellenbosch.

16. Kent, T. 2003. 2D 2 3D: Management and design perspectives on retail branding. *International Journal of Retail and Distribution* 31(3):131-142.

17. Kindleysides, J. 2008. *Retail Design.* [O]. Available WWW http://www.designcouncil.org.uk/About-Design/Publications/Retail-Design (accessed 10 May 2010).

18. Lawson, B. 2006. *How designers think: the design process demystified*. New York: Architectural Press.

19. Mazarella, F. 2010. *Interior design: Whole building design guide*. [O]. Available WWW http://www.wbdg.org/design/dd_interiords gn.php (accessed 22 July 2010).

20. Moore, CM & Lochhead, M. 1998. The management of retail design: demystifying the activity. *Journal of Economics* 22(3):121-130.

21. Mr Price Group. 2010. *Annual Report 2010*. [O]. Available WWW http://www.mrpricegroup.com/images/2010AnnualReport/index.html (accessed 3 April 2011).

22. Murialdo, F. 2008. Places and Themes of Interiors contemporary research worldwide. Paper presented at the Second *IFS International Interior Design / Interior Architecture Conference Edinburgh*. [O]. Available WWW http://www.interiorsforumscotland.com/userimages/Murialdo.doc (accessed 25 February 2010).

23. North, EJ, De Vos, RB & Kotze, T. 2003. The importance of apparel product attributes for the female buyer. *Journal of Family Ecology and Consumer Science* 31:41-51.

24. Petermans, A & Van Cleempoel, K. 2009. Retail design and the experience economy: where are we (going)? *Design Principles & Practices: An International Journal* 3(1):171-181.

25. Petermans, A & Van Cleempoel, K. 2010. Designing a retail store environment for the mature market: a European perspective. *Journal of Interior Design* 35(2):21-36.

26. Poldma, T. 2009. *Taking up space: exploring the design process.* New York: Fairchild.

27. Prinsloo, I. 2011a. Interior Designers: Unacknowledged role players in South African retail design. Sixth International Design Education Conference, University of Johannesburg; 7- 8 September.

28. Prinsloo, I. 2011b. The Role Of Interior Designers in Design and Implementation of Retail Stores: The Case Study of Edcon. MTech: Interior Design dissertation. University of Johannesburg.

29. Puccinelli, NM, Goodstein, RC, Grewal, D, Price, R, Raghubir, P & Stewart, D. 2009. Customer experience management in retailing: understanding the buying process. *Journal of Retailing* (85):15-30.

30. Statssa. 2012. *Statistics South Africa: Statistical Release P6242.1 Retail trade sales preliminary January 2012.* [O]. Available WWW http://www.statssa.gov.za/publications/P62421/P62421January2012.pdf on 12 June2012 (accessed 12 June 2012).

31. The Foschini Group. 2010. *Annual report.* [O]. Available WWW http://www.tfg.co.za/investor/annual_reports/ar_2010/download/downloads.asp (accessed 3 April 2011).

32. Turley, LW & Chebat, JC. 2002. Linking retail strategy, atmospheric design and shopping behaviour. *Journal of Marketing Management* 18:125-144.

33. Van der Vyver, J. 2008. *The importance of store image dimensions in apparel retail: customer and management perceptions*. MA dissertation, University of Stellenbosch, Stellenbosch.

34. Verhoef, PC, Lemon, KN, Parasuraman, A, Roggeveen, A, Tsiros, M & Schlesinger, LA. 2009. Customer experience creation: determinants, dynamics and management strategies. *Journal of Retailing* 85(1):31-41.

35. Woolworths Holdings. 2010. *Annual Report 2010*. [O]. Available WWW http://www.woolworthsholdings.co.za/downloads/downloads.asp# (accessed 3 April 2011).

Television Identity as a complex sign: moving images, sound and texts increasing the effectiveness of communication

R Ponte
Industrial Design Department | UniverCidade
Rio de Janeiro, Brazil
raquelponte@gmail.com

Abstract:

Television identity is the corporate identity of a broadcast station. Composed of interprogram identity vignettes, also called on-air vignettes, this piece of audiovisual design aims to identify the channel, organize the programs and especially convey its branding message. It seeks to create a solid organizational image, thus generating identification with the viewer in order to ensure audience engagement. Based on Peirce's Semiotics and on Santaella´s matrixes of language and thought – sound, visual and verbal –, this article comprehends television identity as a complex sign composed of sounds, images and texts, and aims to show how it conveys meanings. We give emphasis on its hybridism and how time appears not only in sounds but also in moving images, edition and camera movements. The significance of this study is to raise awareness that television identity communicates values, using different types of signs to enhance the effectiveness of communication. The designer should be aware of that in order to create vignettes in which verbal, visual and sound elements line up coherently to enhance the representation of the brand of a particular television channel. It is essential to develop systematic research on audiovisual design because of its growth as a promising field of work.

Keywords: Television Identity, On-air, Audiovisual Design, Semiotics

Introduction

Despite having been a rapidly growing field in recent decades, due to the maturation of the television medium and a resulting increase in its competitiveness (Semprini, 2006:74), television identity is still little explored as an object of study, which could be observed in bibliographic research.

There is little literature available in Brazil that addresses the specifics of audiovisual design. Even internationally, we have identified little material. Some authors, such as Colomer & Rafols (2006), Krasner (2004), Gallagher & Paldy (2007) present an overview of audiovisual design, in which design of television vignettes is included, explaining its distinguishing characteristics, highlighting the key moments of its history and presenting methodologies of project development. Lambie-Nairn (1997) tells his own experience with design television, discussing his projects and methods.

Because it is a multidisciplinary field, where image and sound engage in dialogue in temporal dimension, some authors cover part of the subject, electing one of its dimensions. Rodríguez (2006) and Chion (1994) talk about the sound in audiovisual media, emphasizing the importance of its relation to image to enhance the communication piece, in a medium in which the visual dimension is considered, by common sense, to be the dominant one.

Regarding the analysis of visuality, the Gestalt School, which emerged in the early twentieth century, for example, has a theory about the phenomenon of visual perception, suggesting that the

first sensation is the shape, global and unified, which is consequence of the structure of brain. Thus, the analysis of a shape depends on the characteristics of the object and the natural tendencies of the brain to establish certain relationships (Filho, 2002). Following another line, Semiotics analyzes the image from the point of view of its significance.

In the last decade, however, there has been an increasing interest in this field of research, considering the growth of the Brazilian academic production. Machado, in his research on television (1987 and 2003), discusses what he calls *televisual graphics*, covering "[...] a very broad set of features, which include titles and credits, all sorts of text and graphics [...], the promotional material [...] and the spots of 'identity' [...] "(2003, p.200). Frezza (2003) also investigated the audiovisual design in a broader sense, which he named *motion design*, defining the object of study. Velho (2008) analyzed the language of *motion graphics* as well as its technology. Aznar (1990) approached vignettes from a broad perspective, from early parchments to the use of video. In the same line of research, Freitas (2007) verified their adaptation to the communication media. Vianna (2002) carried out in-depth research into television vignettes, while Abreu (2007) studied the openings vignettes of soap operas. Costa (2006) and Sande (2009) understood the vignettes of MTV and Brazilian channel Futura, respectively, as the language and expression of their stations. Finally Costa (2007) analyzed how the Brazilian national identity was expressed in a series of vignettes of Brazilian channel Rede Globo.

One problem raised during the bibliographic research was the lack of uniformity of terms used in the moving image field. Therefore, structured interviews were conducted with key professionals in the Brazilian channel Globosat (Ponte, 2009) in order to systematize the nomenclature for the research, as well as understanding the specificities of each type of television vignettes. The selected group appears to be relevant as a reliable base of information, because Globosat is it is the largest programmer in Latin America and belongs to Globo Organizations, the largest media group in Brazil, which operates in open and closed television, in print journalism, in the radio, the music industry, in publishing, in the film industry and the Internet.

Due to its history of governmental incentives, Brazilian television has, until now, one of the highest penetration rates in the world. Given its continental dimensions, it is clear that Brazil is in a top position in the global television industry.

“Anchored at a high level of technical quality that enables it to compete in international markets, exporting its programs to dozens of countries, thus contributing new trends in a market that is increasingly globalized, the Brazilian television begins the millennium at full maturity." (Mattos, 2002:16).

Therefore, from the bibliographic research and structured interviews with key professionals, the chosen term *television identity* (Ponte, 2009:25) seeks to shed light on the medium in which this identity, which has audiovisual characteristics, occurs.

Television identity and its functions

Television identity is the corporate identity of a broadcast station, a very influential medium with a high penetration rate, mainly in Brazil (Mattos, 2002:89). It is composed of interprogram identity vignettes, also called on-air vignettes, transmitted during commercial breaks. These identity vignettes can be classified into 3 types: identification vignettes, retention vignettes and signatures. Identification vignettes are those which identify the channel, communicating the values of the brand, without the function of informing the public of the programming. Retention vignettes locate the viewer in the programming and aim to retain, as its name indicates, its audience. Examples:

next, today, we'll be right back, stay tuned etc. Signature vignettes emphasize the animated logo of the company, signing programs, and usually have shorter duration.

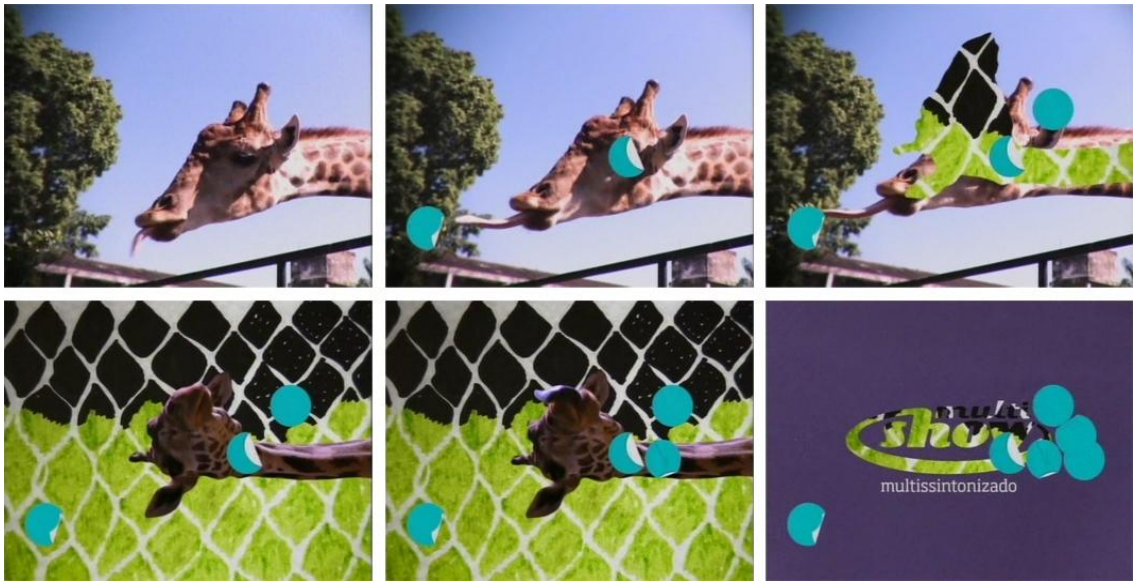


Figure 1: Identification vignette of Brazilian channel Multishow

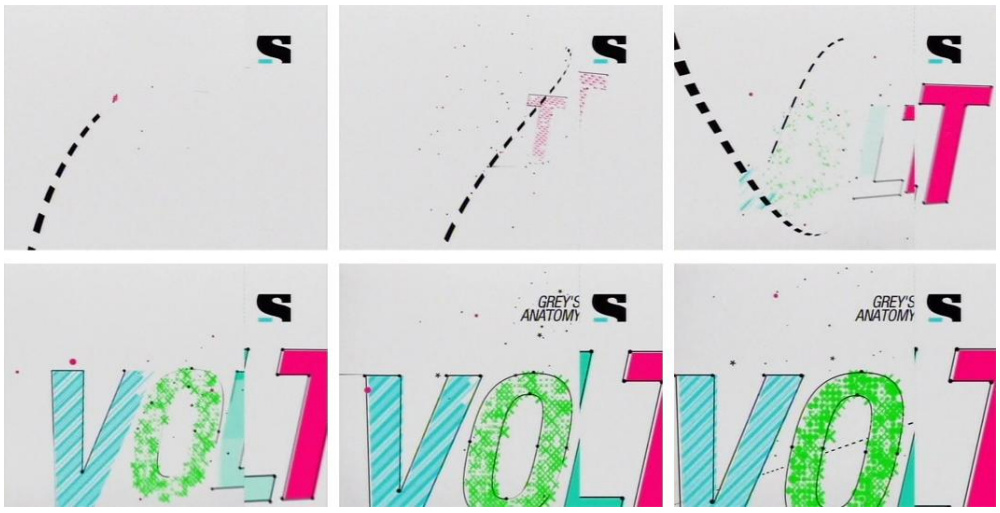


Figure 2: Retention vignette of Sony Entertainment Television

Figure 3: Signature of Universal Channel

The inclusion of sound as a communicative element is one factor that helps increasing the effectiveness of communication of the vignettes. The inter-relationships between sound and image extend the possibilities of interpretation further, making the picture more complex. Chion (1994:21) wrote that sound adds value to the image, but this "added value works reciprocally. Sound shows us the image differently than what the image shows alone, and the image likewise makes us hear sound differently than if the sound were ringing out in the dark". Moreover, discourse, subsumed to verbality (Santaella, 2005:117), increases the dynamism of television identity not only in the text, but in edition, in camera movements and in moving images.

Television identity is of particular interest to Design, as said before, because it is an area little explored theoretically, but has been developing rapidly and fruitfully in recent decades, accelerated by media convergence and the expansion of television. Nevertheless, the designers who work with this type of design do not have specific training for this. "[...] While contemporary graphic design has also become an audiovisual activity, much of the education in visual communication has not updated its curriculum in order to encompass the specificities of sound and moving image"(Las-Casas, 2008:2148). The major question is how the designer with the knowledge of the intrinsic characteristics of audiovisual media can, at the time of creation, articulate sound signs to visual and verbal signs, more familiar to their field of knowledge.

Television identity as a sign

Semiotics, in its American approach, understands that our thought occurs in signs. According to Charles Sanders Peirce (1839-1914), a sign is something which represents, in some respect or capacity, something (an object) to somebody (an interpreter) (*CP*, 2.228). The philosopher presents a triadic relationship between its elements: the object (whether material or immaterial), the representamen (the sign as presented) and the interpretant (or possibilities of interpretation that a sign can generate in an interpreter, not only a human mind, but any interpreting mind: computer, animal, etc..). This third element, the interpretant, opens the range of possibilities of interpretation that sign can carry. Peirce, based on its phenomenological categories of Firstness, Secondness and Thirdness, created a semiotics with abstract and general concepts logically structured, which can be applied to any type of sign, whether verbal, visual, audible, and their articulations.

But the sign cannot represent something in all its aspects. Thus, the sign can only partially represent its object. Otherwise, it would be the object itself and not its representation. It is possible, however,

to learn a little more about the object represented by collateral experience, i.e. by the mediation of other signs that refer to the same object. In the case of television identity, for example, we can have access to the concepts that the channel wants to transmit – its abstractive object – not only through visual signs, but also through sounds and texts, which contributes to a better understanding of the message conveyed by the broadcaster.

Television identity can be understood as a complex sign that represents the brand of a television channel – its object. It is a complex sign because it is composed of signs of sound, visual and verbal language, which are, to Lucia Santaella (2005:279), the matrixes of all the languages that exist.

Based on Peirce´s phenomenological categories and Semiotics, Lucia Santaella proposed a tripartite division of the matrixes of language and thought. She concluded that if there is no thought without signs, the former should follow the same organizational logic as the latter. We believe that this theory contributes to a strengthening of the analysis of television identity, because it consists of signs belonging to the three matrixes.

Santaella elected three languages as the matrixes for all other languages: sound, visual and verbal. Because Peircean Semiotics has an abstract concept of signs, which can be applied to any form in which it presents itself, whether text, image, sound, smell, taste or touch, Santaella proposes that we understand each of these matrixes by analyzing its specificities, without trying to understand the characteristics of a certain language based on another one. Unlike some lines of thought that elected verbal language as the reference for others, Santaella stipulates what is particular to each matrix: to the sound matrix, syntax (the combination of elements to form more complex units), to the visual matrix, shape (the external appearance of material bodies) and to the verbal matrix, discourse (the sequential organization of discourse). The author also shows that shape includes syntax, and discourse encompasses form and syntax.

The first matrix includes any kind of sound. Its fundamental axis is syntax, because it combines individual sounds, pitch, duration etc to form more complex elements. It has dominance of the iconic sign since it shows attributes such as fugacity, evanescence and indeterminacy. The icon is characterized by low referentiality to the object. This is sound: quality that is pure, immediate and highly evocative.

The second matrix of language and thought comprises fixed visual forms, that is, the images that have no intrinsic time, because time is related to the sound matrix, whereas space is inserted in the visual one. Thus, moving images would be a hybrid language, combining visuality to sonority. This second matrix has dominance of the index sign, which, in principle, may look strange, since image has often been associated with the iconic sign. But Santaella argues that the characteristic of the icon is the great emphasis on the sign itself and that the similarity demonstrates a fusion between the object and the sign. The index, on the other hand, refers to an object, highlighting it, either through a physical connection, or only as reference. Fixed visual forms, mostly, indicate their object and therefore are classified as indexes. It is important to point out that an index always has an icon embedded in it (Santaella, 2005:199).

The third and last matrix corresponds to written verbal language, since oral language incorporates elements of sound and gestures, being considered hybrid by Santaella. We can highlight arbitrariness and conventionality as key features of a linguistic sign. It is a law that allows a sign to be interpreted as referring to a particular object that in this matrix is characterized as an idea, a concept, an abstract element.

Sound signs

According to Ràfols and Colomer (2006:24), sound is not just music, but also embraces the spoken word and sound effects. Normally, in sound effects, there is a referential relationship between sound and the sound source, because sound effects technicians aim to revive the link between image and sound. In simple projects, a sound of a bird is recreated to represent the bird, and the sound of breaking glass is recorded to make a good representation of a glass that is broken. However, with the possibilities opened up by concrete music and electronic music and by acousmatization process, [...] we found ourselves able to not only listen to the sounds themselves, liberated from their original causal connection, and to layer them in new, formerly impossible combinations (Musique Concrète) but also […] to reassociate these sounds with images of objects or situations that were different, sometimes astonishingly different, than the objects or situations that gave birth to the sounds in the first place (MURCH *apud* CHION, 1994:XVI)

Thus, the different types of sounds that can manifest themselves in television identity associate with each other or with other matrixes, in a conventional or unexpected way, with the objective of increasing the interpretative effectiveness of a vignette. We can highlight some types of signs that convey meanings in sound effects: the sound intensity, the strength of the attack, the timbre, the height of the notes, among others. In music, the following convey meanings: the timbre, the intensity, the height, the attack, the fall, the tempo, the tone, the instruments, the speed, the duration etc. In the spoken word, we can emphasize the speaker's tone of voice, the cadence of speech, the intensity, the breathing of the speaker, the accent and the language of discourse itself, which is already borderline with the verbal matrix.

Each of the signs of the spoken word, of the sound effects and of music should be analyzed separately and in groups, always taking into account the whole semiotic process and the context of the message. Therefore, any semiotic analysis must consider, in order to understand the role of a sign, the context and the recipient of the message and not simply a sound out of a larger process that also includes two other types of signs: visual and verbal.

Visual signs

Television identity, by being in a medium that can incorporate various languages, can include illustrations, paintings, pictures, movies and graphics generated entirely by computer, among other possible ways. According to Santaella, non-representative images are abstract and have low connection with its object. Figurative images (realistic paintings, photographs, etc.) have more connection with the object, while representative images (mathematical symbols, chemical, etc.) are highly conventional. Therefore, the less referential an image is, the more possibilities of interpretation it can generate. The more conventional it is, the narrower its interpretive range is. The choice of a certain type of image in a vignette will be made according to the message the broadcaster wants to convey and to the target audience with which the broadcaster wants to communicate.

Any image can be decomposed into the primary elements that compose it: shape – the key to understanding the visual matrix –, the line – the fluid and restless articulator of form (Dondis, 2007:23), composed of dots –, direction, movement, texture, scale, size and color.

Besides these basic elements, we must remember that there is another issue to be considered when examining an image: the relationship between the elements. Harmony and contrast, cited by Dondis (2007:24), can be created through the balance or instability, the symmetry or asymmetry and the irregularity or regularity of the components. We should also consider, besides the components and their relationships, the style of composition because, just as a musical rhythm or its instruments in the sound matrix convey significations related to their history, their use, their habits etc, the visual

style also carries major interpretative possibilities. A vignette that has a grunge style, like the first ones shown by American channel MTV in the 1980s, communicate visually a completely different intention from futuristic style vignettes of Brazilian broadcaster Rede Globo.

Verbal signs

Verbal signs are present in on-air vignettes on three occasions: in the logo or visual signature of a broadcast station, in the programming announcements next, today, we'll be right back, stay tuned etc, and in the names of programs in vignettes of retention. Because they are conventional signs, words can only be interpreted by those who know their code. Thus, viewers familiar with the English language can only decode the information conveyed by an American subscription channel, which shows its television identity.

The verbal element in on-air vignettes has a tendency to merge with the sound and visual elements. The spoken word, in speech or music, is considered by Santaella to be a hybrid language, as it incorporates sound. Similarly, the graphic treatment that is given to the texts in vignettes and to the name of company in logos also includes visuality in the verbal matrix, because it becomes impossible to dissociate one from the other and because the visual matrix adds meanings to the verbal one.

Furthermore, what is typical of the verbal matrix, according to Santaella (2005:117), is discourse. If temporality and syntax are specific of sonority, but may appear in visuality and verbality, if spatiality and shape are essential to the visual element, but can also be reflected in sound and discourse, the sequential organization of the verbal matrix may also appear in the audible and visual world. The development of a musical piece, in its comings and goings, even if not using the language code, is full of the basic structuring of discourse. An animation with only images in which an action takes place is full of narrative. So we must concentrate not only on the arbitrary word in identity television, but also on the discourse structuring that it presents.

Television identity as hybrid language

The hybrid languages are those that merge two or three matrixes of language and thought. They predominate in the world rather than purely sound, visual and verbal languages. According to Santaella (2005:78), this derives from the fact that the matrixes of language and thought are based on perceptive processes, which means that they have similar dynamics to synesthesia in the interactions and overlaps of languages. They may arise from combining two arrays (audio-visual, audio-verbal, visual-verbal), or a combination of three (audio-visual-verbal), such as the cinema, video and television.

Santaella (2005:388) said that, of these multiple semiotic channels, television is the one that leads multiplicity to the limit of its possibilities. This occurs because television, due to its own constitution, is able to absorb into itself any other languages: radio, theater, cinema, shows, advertising, journalism etc. Certainly, when absorbed by the specific language that television is, such languages change, sometimes in a quite radical way. This, however, does not alter the nature of television language, which is made of these acquisitions and mixtures, in a syntax which is very particular to it.

The Verbal matrix and its relations with the visual and sound matrixes

According to Rodríguez (2006:334), from the moment we begin to learn an arbitrary verbal language, it becomes the main way of apprehending the world. As a person's learning process evolves, arbitrary languages acquire a special priority over all levels of sound recognition. From the moment we learn to speak, we start a stage of learning which is based mainly on the oral and

written forms of speech. From then on, everything around us will always be named, explained, interpreted, organized, studied, classified, accepted, refused, narrated and stored by the most hegemonic arbitrary language that exists: our mother-tongue.

These days, however, because of the development of the audiovisual media and the constant growth of the massive use of images in a lot of supports, we can say that the two arrays have achieved great communicative importance to human beings. Furthermore, the materialization of the abstraction of verbal signs into sound signs (speech) and visual signs (written) means that the three matrixes are even more interlinked. Thus we should see how they interact, how they reinforce or contradict each other in each piece of design.

In television identity, the text has usually an informative function. In signatures and retention vignettes, which end with the logo of the channel, the verbal signs aim to communicate the name of the channel we are watching. In the case of retention vignettes, they have the aim of announcing elements of planning, organizing the grid of the broadcast station and keeping the viewer tuned in to the attraction.

There are many variations in the design of retention vignettes that result from the communicative intention of the broadcaster, but we can highlight the most widely adopted standard: the use of a phrase that describes the programming, while images of the mentioned program appear.

TV channels know that commercials breaks are a crucial moment of dispersion for the audience, who will even leave the room in which the television is located in order to solve other tasks while the program does not return. The oral delivery of the text, which can also be viewed on screen, can be heard even by the viewers who are a few meters away from the television set. Thus, the audio-verbal sign has the function of calling the audience to the channel, signposting the programming. Other channels, however, design pieces that differ from this pattern, using the written word, without speech and without reference to any image of the program announced.

We can see that there are many possibilities of relationship between the verbal and the visual signs which can be exploited. Everything depends on the purpose which the station assigns to a certain vignette, within a broader context that considers the target audience, the values of the channel and its coherency with the entire television identity.

Finally, besides the verbal sign materialized into words, we must be aware of the fact that discourse, key to the understanding of the third matrix of language and thought, permeates the visual and sound matrixes, as mentioned previously. Both the evolution of a musical form and of a sequence of images bring discourse in themselves. As Chion says about the cinema and can be extended to television – because it incorporates many of its constituent elements – language is present in how the images are designed, filmed and edited to constitute discourse. And a take or a gesture can be similarly understood as words which compose a bigger whole.

The audiovisual language

The relationship between image and sound on television could not be ignored, since this is an audiovisual medium, where there is equality of importance between these two bands. While the cinema, even though audiovisual, has in the image the key to its existence – we can conceive a silent film, but we cannot understand, a soundtrack without images as cinema – TV has emerged, mainly in Brazil, from radio, so that the sound reaches the same importance as the image. Thus, in audiovisual design, the sounds are linked and coordinated with the images and this convergence of

sensations will have a multiplier effect, so that sound and video will form part of a unit of meaning (Ràfols; Colomer, 2006:16).

The major interaction between these two matrixes, that is, the composition of sound and image as a unit instead of separate parts, derives from the need for consistency that our perceptual system seeks to establish between the simultaneous perceptions. This occurs because the senses never act alone: hearing, vision, touch, smell and motor sensations, among others, perceive the external stimuli at the same time. We do not only see a car that approaches, but we hear its engine running and the friction of the tires, we feel the smell of burned oil, we see that the noise becomes more intense and more precise when the car approaches (Rodríguez, 2006:263). This simultaneity was a key factor in animal evolution, which enabled a better adaptability of beings to the world, providing greater opportunity to perpetuate the species. Perceiving signs of risk and danger, through all possible senses, as well as the proximity of prey and other food, ensures the survival of a group.

Such a physiological attribute promotes the perception of the audiovisual synchrony phenomenon. It occurs when there is a coincidence in time between given acoustic oscillations and certain visual changes. Because our organism, over the years of perceptual learning, learned that a change in the sound source is tied to changes in the sound, there is an immediate association between sound and object when they are synchronized, even if the object is not naturally its sound source. For example, in a science fiction movie, we associate the sound of laser shots with the glow that leaves the weapon when they occur simultaneously. Even if in the shared world there is no sound of a laser gun because it does not exist, the sound created by sound effects technicians to represent it is automatically interpreted as derived from the sound source. This occurs because it is highly improbable that the beginning and end of a sound phenomenon coincide exactly in time with the beginning and end of a visual phenomenon; only by coincidence is this possible (Rodríguez, 2006:318).

Synchrony is a phenomenon that highlights both image and sound when they occur at the same time. In a moving image, with a number of elements in action, our vision tends to select those which are larger or those that occur in the foreground. However, if we associate one of the different elements to a sound, we underline that figure. Even a tiny point in the background has its effect enhanced if synchronized with a sound. Similarly, in a composition of sound effects or in a music piece in which several different sounds occur in time, we will pay more attention to a specific sound in synchrony with an image.

The extreme use of the effect of synchrony is used in children's animation. In the cartoons of Walt Disney, especially in the older ones, there was a symbiotic relationship between music and action. A character’s walk, for example, was at all moments stressed by the sounds of instruments, rhythm, musical notes or other sound resources. The animation The Opry House, in 1929, and the film Fantasia, in 1940, are two examples of how the sync effect can be used to achieve a particular result – in the case of Fantasia, by associating the moving images to famous classical music. This extreme use of synchrony is called mickeymousing, in a reference to this kind of animation (Chion, 1994:121).

In television identity, an image can be created according to a sound effect, speech or music in order to achieve the effect of synchrony. But the most common is that music is designed to emphasize certain elements of the vignettes, because the initial creation usually starts from the group of designers to be further worked on by musicians and sound effects technicians.

There are major differences between the visual and sound perceptions. While hearing enables us to recognize the nearest environment, vision helps us understand the space that is also far from us. It

alternates, in a very short period of time, the immediate and the distant environment, and because of this constant change, it is more unstable in time than hearing. Hearing can never stop acting, even consciously, because we do not have eyelids to the ears. Besides enabling us to choose not to see – if we close our eyes – vision is a framed perception. In the case of human beings, the frontal location of the eyes makes it possible to gain in depth, but it loses in angle. Sound, in turn, is omnidirectional. Perhaps, it is due to these characteristics that sound has such a strong impact on feelings, because it represents the perception of what is closest to the listener, and what may even be behind him/her, and it is the only sense that never stops working completely. "[...] Basically, the ear analyzes, processes, and synthesizes faster than the eye" (Chion, 1994:10).

Take a rapid visual movement – a hand gesture – and compare it to an abrupt sound trajectory of the same duration. The fast visual movement will not form a distinct figure, its trajectory will not enter the memory in a precise picture. In the same length of time the sound trajectory will succeed in outlining a clear and definite form, individuated, recognizable, distinguishable from others.

This is not a matter of attention. We might watch the shot of visual movement ten times attentively (say, a character making a complicated arm gesture), and still not be able to discern its line clearly. Listen ten times to the rapid sound sequence, and your perception of it will be confirmed with more and more precision (Chion, 1994:10).

Therefore, sound constantly acts as a unifier of different visual sequences, juxtaposed in editing, organizing the narrative. With a sound incorporated, a sequence of images that have had a more fragmented edition can be better understood as a unit of meaning than one without audio. And it also has the function of better recording a stimulus in memory, because it is processed fast and increases the emotional charge in communication.

Conclusion

The one distinctive element for the television graphic designer is the ability to plan and produce images with sound and movement. Combining words, music and sound effects and then timing them precisely to pictures, frame-by-frame, is the essence of the craft, and this combination has proved to be one of the most compulsive ways of gaining attention (Merritt, 1987:11).

Television identity uses the signs that the medium allows in order to increase the effectiveness of communication when conveying the values, concepts and promises of the channel brand. This occurs, according to Ràfols and Colomer (2006:83) because television is not a static and immutable organism. It is just the opposite: its essence is mutable and presents different faces constantly. The consequence of this is the impossibility to conceive its branding image as an immutable value, because it must be flexible, fluid and sensitive to the changes that occur in its environment.

When images acquire motion, having an implicit time, and as a result become hybrid, they gain dynamism, which is maximized by the edition and camera movements. When there is an association of sounds and texts with images, this link reinforces the message because, from the perspective of Peircean Semiotics, we can understand the success of the use of different significations in a product because of the greater access to the object that different articulated signs may establish.

This constant anchoring of the sign to an object is what enables a coherence not only between the different signs of the same piece of design – the sound, visual and verbal signs of the same on-air vignette – but also between the various vignettes that form a more complete television identity. Whenever the signs refer to the same concepts of brand, they will have a unity among themselves, because they will be representing the same object. Thus, they can generate meanings consistent with

the represented object, always taking into account the repertoire of the public to which the identity television is intended.

Thus the use of hybrid languages helps the viewer have greater access to the brand of a channel, in a relationship that will be established by the habit of use. Therefore, we agree with Santaella and Nöth when they declare (2005:69) that the hegemonic code of this century is neither in the image nor in the oral or written word, but in their interfaces, overlaps and intercourse.

Keeping this in view, it is the designer who will set the signs that constitute the vignettes that make up television identity. Sound signs (the spoken word, sound effects and music, each one with all its constituting elements), visual signs (shapes, colors, textures, lines, etc.) and verbal signs (in a visual hybridity in the case of written text, and sound hybridity in the case of spoken word) must be articulated in a consistent manner so that the audience learns even more the object of this sign: the concepts of brand of a TV channel. The challenge for the designer is to go beyond visuality only. It is the articulation of these three elements, these three matrices of language and thought, that characterize so unique and engaging a medium as television.

References

1. Aznar, Sidney Carlos. (1990). *Vinheta: do pergaminho ao vídeo*. 286 p. (Doctorate in Communication Sciences) – Escola de Artes e Comunicação, Universidade de São Paulo (USP), São Paulo.
2. Chion, Michel. (1994). *Audio-vision: sound on screen*. New York: Columbia University Press.
3. Costa, Mannuela Ramos da. (2007). *TV Espelho: identidade cultural, cultura nacional e ambivalência nas vinhetas do Plim-Plim*. 193 p. Dissertation (Master's in Communication) – Universidade Federal de Pernambuco (UFPE), Recife.
4. Dondis, Donis A. (2007). *Sintaxe da linguagem visual*. São Paulo: Martins Fontes.
5. Dorneles, Rogério de Abreu. (2007). *O design na teledramaturgia: um olhar sobre as vinhetas de abertura das telenovelas da Rede Globo*. 162 p. Dissertation (Master's in Design) – Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio), Rio de Janeiro.
6. Filho, João Gomes. (2002). *Gestalt do objeto*. 2. ed. São Paulo: Escrituras.
7. Freitas, Leonardo Fialho. (2007). *A vinheta e sua evolução através da História: da origem do termo até a adaptação para os meios de comunicação*. 119p. Dissertation (Master's from the Faculty of Media) – Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre.
8. Frezza, Cristiano (2003). *Design em movimento*. 75p. Monograph (Visual Communication and Expression Course) – Universidade Federal de Santa Catarina, Florianópolis.
9. Gallagher, Rebecca & Paldy, Andrea Moore (2007). *Exploring motion graphics*. Nova Iorque: Thomson Delmar Learning.
10. Krasner, Jon. *Motion graphic design & fine art animation*: principles and practices. Oxford: Focal Press, 2004.
11. Lambie-Nairn, Martin. (1997). *Brand identity for television*. London: Phaidon.
12. Lyra, Guilherme (2008). *MTV*, a única com design pós-moderno: análise da influência da pós-modernidade nas vinhetas da MTV**.** *InfoDesign Revista Brasileira de Design da Informação*. v.5 , n. 1, p. 52-61.
13. Machado, Arlindo (1987). *A arte do video*. 176p. Dissertation (Master's in Design) – Pontifícia Universidade Católica de São Paulo (PUC-SP), São Paulo.
14. _____. (2003). *A televisão levada a sério*. 3. ed. São Paulo: Senac São Paulo.

15. McDowell, Walther & Batten, Alan. (2005). *Branding TV*: principles & practices. Oxford: Elsevier.
16. Merritt, Douglas. (1987). *Television graphics: from pencil to pixel*. New York: Van Nostrand Reinhold Company.
17. Mizuguti, Denise Vianna. (2002). *Videodesign na era digital*: o formato visual das vinhetas de televisão. 107 p. Dissertation (Master's in Communication) – Universidade Paulista (UNIP), São Paulo.
18. Peirce, Charles S. (1994). *The Collected Papers of Charles Sanders Peirce*. Electronic edition. Virginia: Past Masters. *In* http://library.nlx.com/.
19. Ponte, Raquel (2009). *Reflexões sobre o processo semiótico da identidade televisiva: o sonoro, o visual e o verbal nas vinhetas.* Rio de Janeiro, 211 p. Dissertation (Master's in Design), Escola Superior de Desenho Industrial da Universidade do Estado do Rio de Janeiro (ESDI-UERJ).
20. Ràfols, Rafael & Colomer, Antoni. (2006). *Diseño audiovisual*. Barcelona: Gustavo Gili.
21. Rodríguez, Ángel. (2006). *A dimensão sonora da linguagem audiovisual*. São Paulo: Senac São Paulo.
22. Sande, Axel H. 20109. *Canal Futura: Um projeto de identidade para a população Brasileira*. 143 p. Dissertation (Master's in Design). – Universidade do Estado do Rio de Janeiro (UERJ), Rio de Janeiro.
23. Santaella, Lucia. (2004). *Teoria geral dos signos: como as linguagens significam as coisas*. São Paulo: Pioneira Thomson Learning.
24. Santaella, Lucia. (2005). *Matrizes da linguagem e pensamento: sonora, visual, verbal*. São Paulo: Iluminuras.
25. Santaella, Lucia & Nöth, Winfried. (2005). *Imagem: cognição, semiótica, mídia*. São Paulo: Iluminuras.
26. Semprini, Andrea. (2006). *A marca pós-moderna*. São Paulo: Estação das Letras.
27. Teixeira, Carla Cristina da Costa. (2006). *A linguagem visual das vinhetas da MTV:* videodesign como expressão da cultura pós-moderna. 174 p. Dissertation (Master in Design) – Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio), Rio de Janeiro.
28. Velho, João. (2008). *Motion graphics*: linguagem e tecnologia, anotações para uma metodologia de análise. 193 p. Dissertation (Master in Design) – Universidade do Estado do Rio de Janeiro (UERJ), Rio de Janeiro.

Evaluation of some indigenous tree species for street planting in the city of Kumasi, Ghana.

Sam Sarkodie Mensah
Department of Architecture,
Kwame Nkrumah University of Science and Technology,
Kumasi. Ghana

Hannah Vic Adzraku
Department of Architecture,
Kwame Nkrumah University of Science and Technology,
Kumasi. Ghana

Introduction

Trees are a familiar sight to most people, even in large cities, however a few people pause to consider how they became established, managed and the benefits they bestow on man. In reality people often take them for granted (Tree Council, 2007). Choosing planting sites, selecting the trees and ensuring their survival are critical to the health of an urban tree population, as without trees the population will eventually decline (Tree Council 2007). Among the most important conservation and amenity reasons for planting trees, in urban areas for instance , are to improve landscape amenity, screen buildings, provide shelter in open areas, diversify wildlife habitats and to stabilise easily eroded soils (Tree Council, 2007).

Different sites constitute the urban environment, and may have different tree needs. The Tree Council (2007) gave categories of urban sites as roundabouts, traffic islands, housing estates, parks and open spaces, school grounds, nature reserves, hospital and industrial estates. Similarly, the World Forestry Centre (WFC) and Morgan (1993), in their Technical Guide to Urban and Community Forestry, gave a similar account by dividing urban landscapes into four broad land use categories namely, natural reserves, parklands and campuses, residential property, and streets and fragmented spaces.
In Ghana, exotic tree species, constitute a greater proportion of amenity trees in cultivated urban landscapes (Abbiw, 1995), especially on the streets. Many urban foresters, horticulturists and landscape architects in Ghana are of the view that indigenous species may have comparatively desired characteristics if adequately researched into and promoted for cultivation.

Most of the indigenous tree selection or domestication in the tropics have been in the direction of agro forestry (Simons and Leakey, 2004: Moore, 2003; Hines and Eckman, 1993) as a result exotic trees dominate the Ghanaian urban environment while indigenous trees remain underappreciated and underutilized. Some of these introductions were made from pre –independence times (before 1957), resulting in introduced trees such as *Cassia siamea* (Siamese Cassia from Malaysia), *Polyalthea longifolia* (Mast tree from India), and *Azadirachta indica* (Neem tree) from India. For instance, over fifty percent of trees in Kumasi (from homes, streets, parks and nature reserves) is made up of *Cassia* (*Senna*) *siamea*, and in Accra, it is the Neem tree.

The urban populace and commercial nurseries will continue using these trees as far as they are found useful. In addition, no attempt has been made to evaluate the landscape potential of indigenous trees of Ghana, as the foresters have done on wood properties for commercial timber production (Oteng – Amoako 2006). Unfortunately, local landscape designer and urban foresters have no choice but rely on these exotics for their projects. For example, a riverine conservation area (planted in 2003) from The Kumasi Officers' Mess to the Golden Tulip Hotel generally is under *Cassia siamea* cover. Such a cover will likely attract less wildlife because it is foreign to the natural environment and it is a mono-culture. Furthermore, many of urban tree planting locations are not

appropriate, in that spreading trees with aggressive roots are planted as streets trees and narrow-crown trees planted as park shade trees.

Though evaluation of landscape potential of the indigenous trees have not been carried out, attempts have been made by some organizations PROTA (2008); and individual foresters and botanists (Hawthorne and Gyakari, 2006; Oteng–Amoako, 2006; Quashie-Sam, et. al., 2004; Dokosi, 1998; Abbiw 1995; and Burkhill, 1995) to categorize local trees into various landscape uses. Trees have generally been categorized under, for example, shade, avenue, hedge and decorative purposes from ethno-botanical methods such as observation and user preferences. Though the works were impressive, they lacked the evaluation element (physical, ecological and growth characteristics) which enables one to select a tree to fit a particular part of the urban landscape. The main objective of this study was to systematically select some indigenous trees of Ghana for urban street landscape design, with particular reference to the city of Kumasi. Research questions to be answered are as follows:

a. What are the current exotic and indigenous tree populations and uses in Kumasi?
b. What indigenous trees have the potential to be evaluated, selected and added to the exotic stock for urban street planting in Kumasi?
c. How well could the selected indigenous trees match the exotic species?
d. Which current exotics street trees in Kumasi are fit or not fit for use?

Material and methods

Study area

Kumasi was chosen as the city for a case study for familiarity and effective data collection. In terms of physical development, Kumasi ranks second to Accra, the capital city of Ghana. In addition to the current Kumasi trees, the study considered the characteristics of indigenous trees of Ghana that have been listed by PROTA (2009), Hawthorne and Gyakari (2006), Oteng-Amoako (2006), Abbiw (1995), and Burkhill (1985, 1994, 1995) to have amenity landscape uses and belonging to the semi-deciduous forest of Ghana in which Kumasi lies. The need to evaluate or domesticate and use local trees was found necessary to minimize reliance on exotic trees and importations duties and restrictions. Social attachment to the local and comparative ecologically fitness also formed part of the justification.

Assessment of urban street tree population and selection

A 100% site assessment of all tree species was carried out on a purposively sampled 1.2 km Old Bekwai Road in Danyame, from the Ridge Police Station to Ahodwo roundabout, to determine indigenous tree species diversity. Danyame is a Kumasi neighbourhood that has all four major landscape categories that make up a city (WFC and Morgan, 1993) namely streets, natural reserve area, residential and park landscapes A desk study of some indigenous trees that belonged to the semi–deciduous forest, in which Kumasi lies was carried out to select a collection called the Kumasi tree list. Further, this Kumasi list was added to the Danyame indigenous tree species diversity list to come up with a complete Kumasi tree list. This list was then passed through a general but ranked street tree selection criteria of leaf fall behaviour, wood density and growth rate to come up with a general street tree selection list, (Roshetko and Verbist, 2000; WFC and Morgan, 1993).

Following that, Kumasi streets were categorized into four based on tree location and its closeness to the street side and whether the position is under a power line or not (Bloniaz and Ryan, 1991). The resulting categories were locations;

(a) close to street (up to 6m from street edge) with overhead utility lines,
(b) close to street (also up to 6m from street edge) but without overhead utility lines,

(c) away from street (over6m from street edge) with overhead utility lines and lastly,
(d) away from street (over 6m from street edge)but without overhead utility lines.
Another ranked tree selection criteria, based on form, height and stem base characteristics were built for these locations and the general street tree list sieved through them to get a specific selection for the four street categories above. SPSS software was used for all statistical operations e.g. ranking and sorting.

Results and discussion

Danyame indigenous street tree diversity

In the indigenous street tree diversity count, there were 205 exotic trees (nine species in all) and only one indigenous tree called *Milletia thonningii. Cassia (Senna) siamea* constituted 68% of the exotic lot, followed by *Cedrella odorata*, *Poiciana regia* and *Polyalthea longifolia* with 7% each. The showed the dominance of exotic trees in the Kumasi streetscape and gave rise to the need to evaluate indigenous trees. *Cassia (Senna) siamea'*s popularity as street tree could have come from its narrow fastigate crown form that fits into narrow strips, non-buttress stem base, flower colour and availability of seed planting materials.

Table 1: Danyame indigenous street tree diversity count

No	Scientific name	Origin	Count
1	***Cassia fistula***	**exotic**	**2**
2	***Cassia (Senna) siamea***	**exotic**	**139**
3	***Cedrella odorata***	**exotic**	**15**
4	***Mangifera indica***	**exotic**	**6**
5	***Pithecellobium dulce***	**exotic**	**4**
6	***Poinciana regia***	**exotic**	**15**
7	***Polyalthea longifolia***	**exotic**	**16**
8	***Terminalia catappa***	**exotic**	**7**
9	***Terminalia mantaly***	**exotic**	**1**
10	***Milletia thonningii***	**indigenous**	**1**
		total	**206**

General street tree selection

The general street criteria was set based on characteristics that affected all street tree needs, namely leaf fall (extent of littering), wood density (for accidental limb shear) and rate of growth. As tree leaves absorb pollutants and offer constant shade, street tree leaf fall characteristics in the tropics do not need to be deciduous, but evergreen and semi-deciduous. Evergreen broad-leaf trees do shed leaves but not as noticeable as in deciduous or semi-deciduous species, therefore evergreen and semi-deciduous leaf fall behaviour were chosen as appropriate for selecting Kumasi trees in the criteria. In the temperate regions the reverse is the case (Davies, *et al.* 2004).

For streets, limb shear must be guarded to prevent trapping vehicles and pedestrians, so trees with low wood strength such as *Gmelina arborea* and *Persea americana* were excluded (Davies, *et al.* 2004). Most often, it is wind storms that cause limb shear and so eliminating trees with low wood strength (low modulus of elasticity) gives an amount of safety. The need for selecting high or quick rate of growth for trees too, stems from the fact that street landscape construction and expansion programmes are shorter than the life span of the tree which is normally over fifty years. It is in these early decades too that trees with quick growth exhibit desirable characteristics, for example form, height and non–buttress stem bases, for street use. Among such general trees are indigenous species

such as *Blighia sapida* and *Milletia thonningii* which have been planted as street trees in Ghana specifically in Accra and Kumasi. *Spathodea campanulata* has also been reported by Invasive Species Specialist Group (ISSG, 2006) to be used as street tree throughout tropical and subtropical

	Trees Selected	
General Street Tree Selection Criteria	**Names**	
	Scientific	**Common**
1 .Leaf-fall :	**Indigenous**	
evergreen,	***Acacia nilotica***	**Scented thorn**
semi- deciduous	***Allanblackia floribunda***	
	Alstonia boonei	**Alstonia**
	Anogeissuslei carpus	**Anogeissus**
	Anthonotha macrophylla	
	Antrocaryon micraster	**Antrocaryon**
	Beilschmiedia mannii	
	Blighiasapida	**Akee Apple**
	Canarium schiveinfurthii	**African Canarium**
2. Wood density:	***Carapa procera***	**African Crabwood**
medium to very high	***Cassia sieberiana***	**African Laburmum**

regions.

3. Growth rate: high	***Celtis mildbraedii*** **Celtis** ***Chrysophyllum subnudum*** **Chrysophyllum** ***Cola gigantea var glab.*** ***Drypetes floribunda*** ***Ekebergia capensis*** **Cape Ash** ***Guarea cedrata*** **Scented Guarea** ***Hura crepitans*** **Sandbox Tree** ***Khaya anthotheca*** **African Mahogany** ***Kigelia africana*** **Sausage Tree** ***Lonchocarpus sericeus*** **Senegal lilac** ***Milletia thonningii*** **Milletia** ***Monodora myristica*** **African Nutmeg** ***Newbouldia laevis*** **Newbouldia** ***Parkia bicolor*** **Parkia** ***Parkia biglobosa (clappert)*** **African Locust Bean** ***Parkia filicoidea*** ***Pentaclethra macrophylla*** **African Oil Bean** ***Spathodea campanulata*** **African Tulip Tree** ***Tabernaemontana crassa*** **Adams Apple Flower** ***Trichiliae metican*** **Natal Mahogany** **Exotic** ***Cassia siamea*** **Siamese Cassia** ***Mangifera indica*** **Mango** ***Pithecellobiumdulce*** **Madras Thorn** ***Polyalthea longifolia*** **Weeping Willow**

To get trees from the general street tree list, specific criteria were set to select trees to fit the specific uses.

Specific Street Tree Selection Criteria

Specific street tree selection has been done based on tree locations and tree characteristics. The tree locations are basically those close to the street side (up to 6m) and those over 6m away from the street side. In both locations, the tree can be either under a utility line or away from it. Thus, there are four locations namely:

Close to street side and under power cable.
Close to street side but not under power cable.
Away from streetside and under power cable.
Away from streetside but not under power cable

The tree characteristics considered were height, form and stem base. The location was however a determining factor in the selection for street planting since it has a bearing on the form, height and stem base (buttress development).

Figure 1 :Typical Tree Forms
Source : N.Y. State Dept. of Transp.(1999)

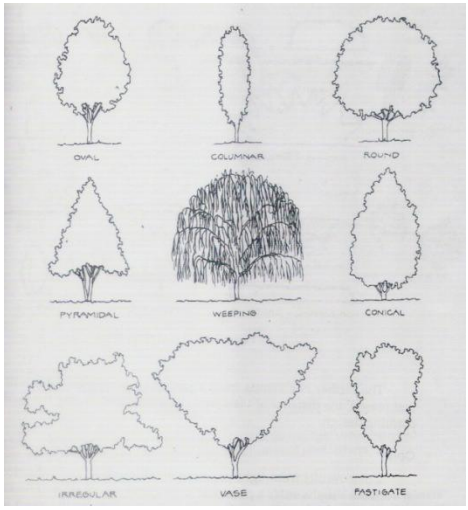


Figure 2 : Typical Tree Forms
Source : Hannebaum (1994)

Trees Close to Street and Under Power Line

The avoidance of root damage potential is a key factor considered in the selection of trees for close to street locations, (CSU, 2006; CSSTMP200, 2004). Thus non buttressed trees are desired here. Critical height of utility line of 8m given by the Electricity Corporation of Ghana (ECG) and 6.5 m. by VODAPHONE Ghana determine the mature height of trees to use, but a better reference height here is the ECG's since damaged telephone line are not considered harmful . In order not to physically obstruct vehicular and pedestrian movement, desired tree forms should fit into the narrow street side space which falls between 2 to 6 m. in the city centre and close to city centre situations. In this case, column, oval and fastigate forms with no buttresses and not more than 8m high would passed the test (Fig. 3).

None of the general trees could be selected for the 8.0 m. height limitations, but because fastigate forms could safely grow and arch over utility line *Ekebergia capensis, Newbouldia laevis, Spathodea campanulata* indigenous species and *Cassia siamea* an exotic tree were selected. In overlooking the height issue, tall trees could be selected which would at maturity undergo top pruning to allow line passage through the canopy (Fig. 4). This though may not be cost effective and would also not be aesthetically pleasing (Bloniarz and Ryan, 1991).

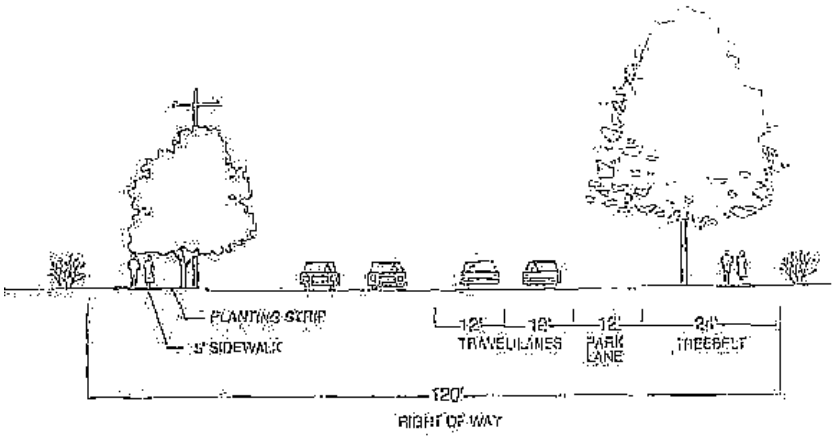


Fig.3 : The ideal street tree selection when tree is below 8m and in right form.

Source : Bloniarz and Ryan (1991)

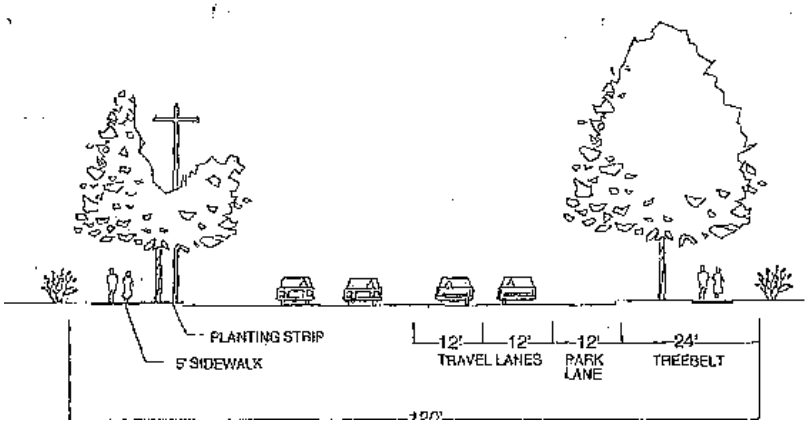


Fig.4: Top pruning spreading and tall trees close to street and under utility line.
Source : Bloniarz and Ryan (1991).

Trees Close to Street but Not Under Overhead Power Line

Similar to the situation close to street and under utility location, the critical issue here is with the available width of space which inevitably require narrow crown forms as columnar, conical, oval, and fastigate. Furthermore, because of the close to street side location, buttressed trees are not desired, but since utility lines are absent on this case, tree height is not critical but scale with nearby buildings and street must be taken into consideration. Examples of indigenous trees that met the criteria were *Allanblackia floribunda, Carapa procera, Ekebergia capensis* and *Pentaclethra macrophylla*. The selected exotic trees were Cassia *siamea* and *Polyalthea longifolia*

Trees Away from Street and Under Power Line

When the tree is far from the street, the root damage potential is not considered a threat as tree would be growing in a spacious bare land without pavement. As such, all manner of tree bases would pass the test. Mature tree height remains 8m or below but the form can be opened to all because the location is no more in a restricted horizontal space. Thus round, vase, picturesque and spreading forms are acceptable, for example *Beilschmiedia manni.* Taller and fastigate tree such as *Ekerbergia capensis, Pentaclethra macrophylla and Spahtodea campanulata passed as they can arch over the power lines.*

Trees Away from Street but not Under Power Line

The situation for trees away from street and not under any utilities location (Fig. 5) presents no horizontal or vertical restriction level as space available is large enough to contain all forms, heights and stem base types. As a result, the criteria selection picked all trees considered to be potential street trees in the general considerations (Table 2). This particular location occurs in a wider right of way situation. At the ground level, such locations are grass strips, and so choice over here has to do with the scale of the setting. Scale determinants for the tree in this instance, are height and spread. In Plate 1, the round-shaped indigenous *Milletia thonningii* has enough space to spread its crown in its away from street situation.

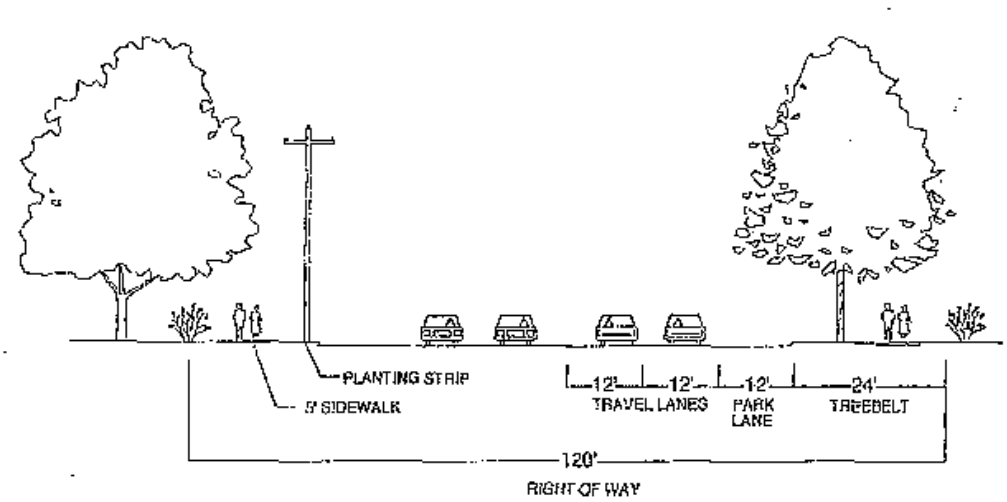


Fig. 5 : Diagramatic situation of a round tree in an away from street and not under utility line situation.
Source : Bloniarz and Ryan (1991)

Plate 1: Round shaped indigenous *Milletia thonningii*. planted away from street and not under utility on KNUST campus, Kumasi.

Conclusion

In response to the research questions, it was found out that exotic trees constitute nearly 100% of Kumasi street trees. One hundred and thirty five indigenous and nine existing exotic street trees were evaluated. The evaluation of indigenous and current exotic street trees for rightful placement was carried out by sieving them through ranked criteria of wood density, rate of growth, leaf fall behaviour, height, form and stem base character. Twenty three percent (23%) of the indigenous trees evaluated passed for street tree use and these were among them, *Blighia sapida*, *Milletia thonningii*, *Newbouldia laevis*, *Spathodea campanulata.* With the exotic species, four out of nine qualified as street trees, for example Cassia (Senna) siamea, *Pithecellobium dulce* (Madras Thorn) and *Polyalthea longifolia*. (Mast Tree).The rest of five, namely *Cassia fistula*, *Cedrella odorata*,

Poincianaregia, Terminalia catappa and*Terminalia mantally.* Indigenous *Ekebergiacapensis, Pentaclethra macrophylla, Newbouldia laevis* and *Spathodea campanulata* were found capable of meeting all street requirements passed by the ever popular *Cassia (Senna) siamea.* In effect, there are some indigenous trees that have the potential to be used as urban street landscape trees and are also at par with the dominating exotic amenity species.
The tropical rainforest in West Africa is comparatively ecologically the same as the Amazon and Monsoon areas and it is expected that trees selected in the study can grow well there. Incidentally, *Cassia siamea, Polyalthea longifolia* (Mast tree) and *Terminalia catappa* (Indian Almond) which have naturalised in Ghana originated from India and the Pacific rim.

Recommendations

In this study, the attempt has been made to isolate and classify urban landscape uses for some indigenous and existing exotic trees. Future work is recommended on the selected trees, for example, tolerance to flooding, dry and wet and low nutrient soils in reserve area trees. Street trees need to be looked further into for tolerance against drought, heat, and air pollution. Further research also needs to be done to find more narrow canopied trees below 8m high and even small shrubs that can grow into small trees to fit into tight spaces under utility lines.

In secondary literature, mature heights are given for all trees. Regional ecological differences in height can cause regional discrepancies, for instance height or size of *Garcinia cola* in the wet evergreen forest of Ghana may not be the same in the semi deciduous zone, so heights may have to be referenced to where the source tree was picked or an average found for all zones. From World Agroforestry Centre, *Mangifera indica* is a large evergreen tree that grows 20 m high with a dark green, umbrella or round shaped crown, but it has been observed that the tree in Kumasi matures at a height less than 15 m..

Many trees in their youthful stages of five to over ten years, possess striking features eg. non buttressed stem bases and other forms, therefore, it is recommended that youthful heights, sizes and forms are recorded to aid species selection for use into short-lived urban landscapes such as streets. For example, *Khaya senegalensis* whose mature height is 35 m (seven to nine floors) can grow beautifully as a shade tree in a car park and later be removed if found growing out of control or at the next road construction. So also can *Spathodea campanulata* be enjoyed for its youthful height and size for over ten years of age other than in its mature outlook. From the home selections made, more work could also be carried out to look for species with striking flower colours and / or sweet fragrances to enhance their popularity.

Lastly, in the current era of global warming, additional effort is suggested to evaluate the atmospheric carbon dioxide reduction capacity of the selected tress for the purpose of reducing global warming.

REFERENCES

1. Abbiw, D. K. 1995. Useful Plants of Ghana. Intermediate Technology Publications and
2. the Royal Botanic Gardens, Kew.
3. Bloniarz, D.V. and Ryan, D.P. 1993 (online). Designing Alternatives To Avoid Street Tree Conflicts. Journal of Arboriculture 19(3): May 1993.
   a. Available WWW:http://www. joa.isa-bor.com/request.asp?JournalID=1&ArticleID=2557
4. **(accessed 11 November 2009)**

5. Burkill, H.M. 1985. The Useful Pants of Tropical West Africa. Vol.1. Publ. Royal Botanic Gardens, Kew.
6. Burkill, H.M. 1994. The Useful Pants of Tropical West Africa Vol. 2.Publ. Royal Botanic Gardens, Kew.
7. Burkill, H.M. 1995. The Useful Pants of Tropical West Africa. Vol. 3. Publ. Royal a. Botanic Gardens, Kew.
8. Davies, S., Johnson, L., Kathleen, N., Robinson, D., Smyth, B. and Sweeney, K. 2004.
9. (online). City of Sydney Street Tree Master Plan 200.Vol 3 Part B : Tree Species
10. Selection.AvailableWWW:http://www.cityofsydney.nsw.gov.au/council/document/selectTree (accessed 28 November 2008)
11. Dokosi, O.B. 1998. Herbs of Ghana. Publ. Ghana University Press, Accra.
12. Hannebaum, L. 1994. Landscape Design: A Practical Approach. 3rd ed. Prentice Hall, NJ. USA.
13. Hawthorne, W.D. and Gyakari, N. 2006. Photoguide for the Forest Trees of Ghana: A tree-spotter's guide field guide. Publ. Oxford Forestry Inst. UK. 432pp
14. Hines, D.A. and Eckman, K. 1993 (online). Indigenous Multipurpose Trees of
15. Tanzania: Uses and Economic Benefits for People. Cultural Survival Canada Available WWW:http://: www.inkinghub.elsevier.com/retrieve/pii/S0254629905000207
16. (accessed 28 November 2008)
17. Invasive Species Specialist Group, 2006 (online). *Spathodea campulatum*
18. Moore ,G.M. (2003). Indigenous Trees: The Value of Selection. Treenet Proceedings of the a. 4th National Street Tree Symposium: 4th and 5th September 2003.
19. New York State Department of Transportation 1999 (online). Typical Tree Forms
20. Available WWW:https://www.nysdot.gov/divisions/engineering/.. (accessed 09 March 2010)
21. Oteng-Amoako, A.A. (ed) 2006. 100 Tropical African Timber tree from Ghana: Tree Description and Wood Identification with Notes on Distribution, Ecology, Silvicultutral, Ethnobotany and Wood Uses.Publ. Dept. of Publishing Studies, KNUST, Kumasi.
22. Plant Resources of Tropical Africa -PROTA- 2008 (online). Tropical Plants Database.
23. Available WWW:http://www.prota.org (accessed: 2008 – 2010)
24. Quashie-Sam, S.J., Oppong, S.K. and Abruquah, E. 2004. Traditional Ecological Knowledge in Northern Ghana. Ghana-Canada in Concert Programme. a. Publ. SOSFAG Gh. Ltd, Ghana.
25. Simons, A.J. and Leakey, R.R.B. 2004.Tree Domestication in Tropical Agroforestry. Journal of Agroforestry Systems. Vol. 61-62, No. 1 – 3. Publ. Springer, Netherlands. p 167-181.
26. Tree Council. 2007 (online). Tree Planting Guide. Available WWW:http://
27. www.treecouncil.org.uk/info/packng2 (accessed: 31 August 2008**)**
28. World Forestry Centre (WFC) and Morgan, R. 1993. (online). A Technical Guide to Urban and Community Forestry. World Forestry Centre, Portland, Oregon, USA. a. Available WWW:http://www.na.fs.fed.us/Spfo/Pubs.uf/techguide
29. (accessed: 28 November 2008)

Setting up a curriculum-integrated design-build research studio: planning and lessons learnt so far

Rudolf Perold
Industrial Architectural Technology
Cape Peninsula University of Technology
Cape Town, South Africa
peroldr@cput.co.za

Hermie Voulgarelis
Industrial Architectural Technology
Cape Peninsula University of Technology
Cape Town, South Africa
voulgarelish@cput.co.za

Abstract

During 2011, the Department of Architectural Technology at CPUT included a design-build project into the second year work-integrated learning (WIL) curriculum. This project, at the St Michael's Primary School in Grabouw, Western Cape, will be discussed in a separate paper by the same authors. Based on the success of the project, a decision was taken to set up a design-build studio in the department.

Due to the unavailability of seed funding for this venture, the design-build studio had to be set up within the existing departmental framework of work distribution, enabling the two studio coordinators to justify the time spent outside of their normal teaching roles. To circumvent this problem, a decision was taken to integrate the design-build projects into the curriculum of each year group, enabling the two design-build studio coordinators to teach across all years of study.

In this paper, the planning for the integration of the design-build studio projects into the curriculum of each year of study will be presented, and the projects that have been completed will be discussed briefly to evaluate the degree to which they have been successfully integrated into the curriculum. The curriculum of the third year of the National Diploma will also be discussed in depth, as this is where the integration of the design-build studio into the curriculum is most intense. This integration has been achieved by means of a six week elective that facilitated the inclusion of two small-group design-build projects into the curriculum.

Several lessons have been learnt so far, and these have provided interesting perspectives on how the design-build studio might develop in the future, especially as far as obtaining funding and sponsorship for the construction of the projects are concerned. In conclusion, the lessons learnt so far will be used as a basis to propose an overall vision and specific guidelines for design-build studio planning for 2013 and beyond.

Keywords
Design-build research, architecture, curriculum integration, work-integrated learning

Introduction

The Rural Studio Programme at Auburn University in Alabama, USA, has sparked a world-wide interest in design-build studios and following this example, numerous international institutions are now offering some sort of design-build programme. During 2011 the Department of Architectural Technology at

CPUT included a design-build project into the second year work-integrated learning (WIL) curriculum. This project, at an underprivileged multi-grade school in Grabouw, Western Cape, involved the construction of an outdoor classroom by the architectural technology students themselves. From the learning opportunities presented to the students, and the experience of the CPUT staff and school community at the St Michael's Primary School, it became clear that such projects could potentially lead to the development of an alternative model for socially responsible architectural education. Based on the success of this project, a decision was taken to set up a design-build studio in the department.

Duggan (2004:71) describes the studio as the key setting for architectural education, while also noting that it is coming under increasing pressure to prove its value. We contend that by taking learning activity from the studio into the real world, the value of studio-based teaching can be consolidated and expanded. The move towards curriculum-integrated design-build projects is made possible by the space for pedagogic experimentation which has been opened up by the recurriculation process underway at Universities of Technology in order to align their academic programmes with the new Higher Education Qualifications Framework (HEQF). Our contention about the relationship between the real world and the studio is echoed by Erdman *et al* (2006:174), who state that only recently has architectural education begun to recognise the potential of a more intensive relationship between the tasks of designing and building. In this context, design-build denotes more than simply an expansion of professional services and opportunities, and instead describes integrative approaches to architecture whereby the act of building becomes an essential critical and pedagogical tool.

However, architecture schools in South Africa have not yet embraced this pedagogy as an integral part of their curricula. As mentioned at the onset, numerous international institutions now offer design-build programmes, all of them with a strong link to the vision that the late Samuel Mockbee of the Rural Studio Programme had of "architecture that embraced not only practical architectural education and social welfare but also the use of salvaged, recycled, and curious materials and an aesthetics of place" (Dean: 2010:15). Given the inherent sustainability focus of design-build - both in societal and environmental terms - a strong argument can be made for its use as an exclusive methodology for training architects and architectural technologists.

In this paper, we will present our planning for the integration of design-build studio projects into the curriculum of each year of study which forms part of the National Diploma in Architectural Technology, and the projects which have been completed to date will be discussed briefly to evaluate the degree to which they have been successfully integrated into the curriculum. Two sets of concerns with regards to planning for integration will be discussed first, after which the year-specific planning will be presented chronologically.

Planning for integration: pedagogical concerns

The design-build research studio will facilitate the integration of design-build projects into the departmental curriculum as part of our service learning (SL) and work integrated learning (WIL) engagement. As discussed earlier, the traditional architectural studio is an interactive project-based learning environment that is almost universal in its approach to the training of architectural students. Although the projects might imitate real-life scenarios or even be set in response to actual problems or opportunities, students very seldom (if ever) get to see the final, built product. Solutions to the problem

set are usually presented graphically, as it is obviously impractical, if not impossible, to build all the solutions which have been designed.

Over and above the "normal" theoretical outcomes of student projects, design-build projects enable students to value and to start understanding the narrow link between designing and building, and the relevance of design-build in their formal education. Abdullah (2011:n.p.) is of the opinion that the difficulty and complexity which students experience during the construction process emphasises this link between designing and building; especially the idea that their drawings must communicate their intentions to a wide audience (the client, end users, builder and the various subcontractors) in a clear and concise manner.

Other very specifically described outcomes, either in handouts to students or on websites devoted to design-build projects, include dealing with problems in real time; developing skills in management, communication, team work, brief development and consultation skills; involvement in creative and collaborative design; the improvement of representation abilities; realising the value of process rather than exclusively prioritising the final product (University of Sheffield School of Architecture, 2012:n.p.). In the context of a University of Technology, the creative problem solving and technical skills transfer inherent to the construction process, especially when implementing a collaborative design, amplifies the technological focus of existing curricula.

As far as international practice is concerned, where and how design-build fits into the curriculum seems to be almost incidental. Design-build programmes with a clear strategy of integrating projects into the curriculum in a manner that relates to the rest of the studio projects are an exception to the rule (University of Sheffield School of Architecture, 2012:n.p.). The two design-build coordinators at the Department of Architectural Technology at CPUT (AUTHOR and CO-AUTHOR) have developed their design-build project briefs together with the relevant studio coordinators in each year of study in order to ensure that the learning outcomes fit into the existing curriculum.

Planning for integration: administrative concerns

Abdullah (2001:n.p.) states that other than project-based integration into existing curricula, there are no subjects at mainstream schools of architecture that are devoted specifically to the understanding of design-build construction. The same is true at the Department of Architectural Technology at CPUT. Due to the unavailability of seed-funding for this venture, the design-build research studio had to be set up within the existing departmental work distribution framework, enabling the two coordinators to justify the time spent outside of their "normal" teaching duties.

There were several administrative challenges which were clear from the onset. Some of these were well described in the literature relating to design-build: "the academic live project is quite complicated to administer and manage" (Jann, 2009:n.p.); the presence of "a number of legal and liability issues not normal to the education of students" (Rice-Woytowick, 2011:16); and the fact that "as educators, we must refuse to be satisfied by easy or quick results; if not replicable under similar conditions, the results of any experiment are of limited value" (Christenson and Srivastava, 2005:233).

Other challenges which we encountered ourselves included the amount of time spent on new administrative tasks such as project planning and management; the preparation of professional working drawings; the costing and ordering of materials; sourcing of funding and sponsorships for materials; and the coordination with stakeholders and end-users. These planning-phase challenges were followed by challenges on the site during construction: the briefing of students so that everyone is engaged in the

learning process; ensuring the safety of students; finding pro-active responses to problems which arise on site; and the procurement and sourcing of additional material due to design changes made on site.

To circumvent the fact that there are no dedicated design-build subjects in the departmental curriculum, the decision was taken to integrate one or more design-build projects into the main studio subject of each year group, thereby enabling the two coordinators to teach across all years of study within the National Diploma. This decision also facilitated the allocation of design-build teaching hours within the existing departmental work distribution framework. If a design-build project overlapped with the "normal" teaching duties of one of the coordinators, a lecturer from the year group concerned took over the coordinator's "normal" teaching duties in order to minimise disruption to other subjects. The design-build year planner was overlaid onto the different year groups' planners to ensure that these overlaps were kept to a minimum.

The design-build planning for each year of the National Diploma in Architectural Technology will be discussed now, with a brief reflection on the projects completed to date in order to establish if they have been successfully integrated into the curriculum. Each year has only one design-build project, with the exception of the third year, which has two.

Expanded Curriculum Programme (ECP) planning

The Extended Curriculum Programme (ECP) is in its first year at the Department of Architectural Technology, and as such the design-build coordinators were able to provide input while the curriculum was being developed. As the students in this year of study are inexperienced, it was decided that their design-build project must be kept as simple as possible. They were to complete the project at St Michael's Primary School in Grabouw, which was initiated by the first group of second year students who participated in a design-build project during 2011. Thus the design had already been done, and the students would enlarge the stoep in front of the school with decking and screens built from recycled apple crates. The learning outcomes of this project were to gain an understanding of the design-build process; to develop construction solving techniques; to develop group working skills; to develop model building techniques; and to develop graphic presentation techniques.

The students received a project brief which introduced them to the notion of design-build and to the work which had already been done at the school. The students were divided into groups of three and asked to design their own construction solution for expanding the stoep. Clear design parameters were provided: extra space for group work had to be provided, as well as extra seating; and the extension had to be at the same level of the existing stoep. The technology of the design had to be the same as the previous year's work, thereby encouraging the students to analyse the physical intervention and to develop an understanding of its structure. Drawings and models were produced by the groups, which were subsequently discussed by the entire class.

Once on site, a workshop was held to develop a project timeline and to define specific tasks, each with a task leader who would be held responsible for the progress of the task during the week and a half spent on site. Planning sessions were held each morning, with feedback sessions at lunch and at the end of the day to ensure that all the students were aware of what was happening on site. Based on the progress made, students were moved between different tasks to ensure that all the work remained on schedule. When the coordinators made decisions which impacted on the building process (such as replacing a portion of the structure which proved to be structurally unsound as it was made of sub-standard recycled wood), the entire class was briefed and the necessary changes made.

Two important lessons were learnt with this project, the first being that the complexity of the project must match the skill level of the students. As the project was done early in the year (at the end of March), the students had not yet learnt how to set up a drawing with right angles, and as such struggled when asked to measure out the positions for the decking structure. The second lesson almost prevented the project from being completed on time, and that was that when using recycled materials, the materials must be inspected properly to ensure that they are suitable for use. As both these lessons had a direct impact on the progress of the work on site, the students appreciated the impact that such an occurrence can have on the success of a building project.

First year planning

The design-build project for the first year class formed the basis of a theoretical project for a trail hut at the Hoerikwaggo Trail at the base of Table Mountain. During the week set aside for the design-build introduction, the students were exposed to different aspects of sustainable design and natural building. These included a presentation by a group of third year students on a trail hut they had designed collaboratively using locally sourced materials; a visit to the SEED sustainable homestead as well as a lecture on permaculture; and two lectures by earth-building specialists.

On the last day of the week the students participated in a mud brick making workshop, where they were shown how to identify suitable types of soil, how to mix the required straw, sand and water with the soil, and how to shape the bricks by using moulds. The mud bricks are being kept in the first year studio to dry out completely, and will be subjected to a variety of tests later in the year in order to show the students how they compare with conventional building materials.

We found that the students engaged well with the different alternative building technologies that they were exposed to, and feel that it is beneficial to expose them to conventional and natural building construction at the same time. Whereas some of the theory that the students were exposed to forms part of other subjects, we found that condensing the lectures and practical activities into one week resulted in an integration of technology and practical experience which would not have occurred otherwise. In the light of the challenges which were experienced with the ECP students on site, we will most likely introduce a design-build primer similar to the first year project in the ECP year, and undertake the actual building work in the higher years.

Second year planning

Our second year design-build project is a continuation of the work which the second year class of 2011 and the current ECP students have done, and will be conducted as a two-week block. We will be using similar technology as with the previous projects at the St Michael's Primary School, and the students will develop designs collaboratively.

(This portion must be expanded upon once project brief has been set - will be updated during August)

Third year planning

The design-build projects in the third year are fully integrated into the curriculum, by means of a six week elective (April to mid-May) which facilitated the integration of two small-group design-build

projects into the curriculum. Two of the earlier projects in the year were adapted to prepare the students for the design-build electives, thereby extending the period dedicated to design-build by providing a head start to the students who chose to be part of these electives. As there were several external factors which impacted on the planning of the two design-build electives, these projects were the most challenging we have had to date.

The first design-build elective started out as a temporary timber pavilion which would form part of the SPAZA Urban Innovation Festival which was to be held during May. In preparation for this elective, the entire class undertook two two-week projects: one in the design studio (PAD3) and one in the technology studio (STW3). In the design studio they were introduced to the different sites identified in The Fringe (previously referred to as the East City) and were to design a temporary timber pavilion for the pavement and parking bays in front of the businesses at these sites to facilitate interaction between the business and the people who would be attending the SPAZA Festival. In the technology studio the students had to prepare a building manual which would enable them to determine the material required for their pavilion, as well as the way in which it was to be assembled.

When the elective commenced at the start of April, we had still not been able to secure funding for the construction of such a pavilion, and the SPAZA Festival had been postponed until a later date. In the light of the AZA Architecture Biennale which is co-hosted by CPUT during September 2012, we then adapted the brief so that the temporary timber pavilion was to be redesigned for the courtyard in the building which houses the Department of Architectural Technology. Our intention was to spend four weeks doing a collaborative design with the twelve students in the elective group, after which we would spend two weeks constructing the pavilion. However, as the construction date approached it became clear that we would not have secured funding from CPUT for this pavilion, and due to the slow progress of the students we spent the last two weeks of the project on refining the design of the pavilion in groups of three students.

The second design-build elective was also preceded by a project for the entire class, based on a project which is done every year. In the design studio, the class was divided into four groups who each had to prepare individual designs for a rural retreat in a specific climatic region. We also adapted the brief of this project so that students would be able to enter their projects into the yearly PG Bison competition. As the design-build elective was to design an overnight hut on a farm outside Sutherland, one of the climatic regions given was that of the Karoo.

During the April recess the eight students who were selected to do this elective visited the farm outside of Sutherland, and spent two days in the veld to the most suitable site for the overnight hut. They also met the clients and had several discussions with them in order to establish a comprehensive brief for the project. When the elective commenced in April, the students worked collaboratively to assimilate all the information gathered as a point of departure for the design process. Under the direction (and sometimes, mediation) of the coordinators, the students developed individual designs and combined these into first three and then into one design. At each stage during this paring down process there would be a group discussion to establish principles which would guide the next design iteration. We found that one of the most valuable lessons learnt during this process was how to negotiate the process of collaborative design, and the final product - a booklet which documents the entire process as well as the completed design - attests to this success of this elective.

Our intention is to do the preparatory work on site during the September recess, and to test the assumptions which were made with regards to the usability of the natural building materials found on site. Due to financial constraints on the part of the clients, the project will be completed in phases and we hope to engage several groups of students with this process over the next few years.

(This portion will be supplemented with graphic information from the student booklets concerned).

Conclusion: lessons learnt so far

Several lessons have been learnt so far, and these have provided interesting perspectives on how the design-build studio might develop in future. As the incorporation of new projects into the existing curriculum can be disruptive, it is foreseen that most of the design-build projects can be introduced into the studio as an elective for a selected number of students, as has been done in the third year. The main benefit of this is that the number of students who participate in the project is more manageable. The six weeks allowed for the electives this year also proved to be too short for a full fledged design-build project, and in future we will develop one of the options for the major integrated project, which is twelve weeks long, for this purpose.

Obtaining funding and sponsorship for the construction of the projects proved to be a major challenge. With the third year elective projects the fact that we were unable to obtain funding for the building work prevented us from completing the project as we intended. It is our intention to do the building work on these projects as soon as funds have been secured, most likely as a third year elective next year. We will seek sponsorship both on a project-basis and on a more holistic basis, hence the need to establish a cost centre for the Design Build Research Studio.
Even where funding is available, the process involved in accessing these funds through CPUT is too cumbersome. This is especially true when it comes to the purchasing of additional material during the construction process, which we eventually had to pay ourselves and claim back afterwards. We foresee that the only solution will be to set up an independent non-profit (section 18) company to manage the funding for these projects.

References:

Abdullah, Z.B. 2011. Getting their hands dirty: qualitative study on hands-on learning for architectural students in design-build course. *Journal of Design and Built Environment*, 8(1). Available from http://umrefjournal.um.edu.my/filebank/published_article/ 3283/Vol% 208-4.pdf (accessed 2 May 2012).

Christenson, M. and Srivastava, M. 2005. A proposal for a cross-disciplinary design pedagogy: generative full-scale investigations. *International Conference on Design Education: Tradition and Modernity*, 95:231-238.

Duggan, F. 2004. The Changing Nature of the Studio as an Educational Setting. *CEBE Transactions*, 1(2):70-76.

Hinson, D. 2007. Design as research learning from doing in the design build studio. *Journal of Architectural Education*, 61(1):23-26.

Perold, P.R. and Voulgarelis, H. 2012. Design-build programme 2012. [Handout]. Cape Peninsula University of Technology, Department of Architectural Technology, Cape Town, January 2012.

Rice-Woytowick, P. 2011. *Academic design/build programs as mechanisms for community development.* A report submitted in partial fulfillment of the requirements for the degree Master Of Science In Community Development, Department of Landscape Architecture/Regional and Community Planning College of Architecture, Planning and Design, Kansas State University: Manhattan, Kansas.

University of Sheffield School of Architecture. 2012. About Live projects. [Online]. Available from http://www.ssoa.group.shef.ac.uk/?page_id=2&page=3 (accessed 1 April 2012).

Voulgarelis, H. 2012. Investigating design-build as an alternative model for architectural education. ACSA International Conference CHANGE, Architecture, Education, Practices. 20-22 June 2012. Barcelona, Spain.

Mapping ADDIE to the entrepreneurial process: a teaching approach for design students in a business studies programme

M A Barnes
Dept of Personal and Professional Development, Faculty of Informatics and Design,
Cape Peninsula University of Technology,
Cape Town, South Africa
barnesm@cput.ac.za

J Barnes
Dept of Information Technology, Faculty of Informatics and Design,
Cape Peninsula University of Technology,
Cape Town, South Africa
barnesj@cput.ac.za

Abstract:

For many design students the business and entrepreneurial skills programme within the curriculum is merely a compulsory peripheral study in which they have little or no interest. However, as the South African government (and indeed governments world wide), focuses on job creation due to the pressing unemployment problem, it is becoming increasingly important that South African universities start to produce entrepreneurs who will create employment or be self-employed, rather than simply become employees. This initiative has become an important educational theme, especially in the creative disciplines which lend themselves to the small business form. It can be difficult for design students to grasp the importance of, and the basic principles of entrepreneurship. Their talents and their goals are (generally) focused on designing and producing tangible objects. Similarly, their creative mindset tends to reject the business world as being pre-defined and inflexible, the very antithesis of the creative mindset.

This paper takes the analyse-design-develop-implement-evaluate (ADDIE) model and maps it to the entrepreneurial process. The aim is to use the already familiar and accepted ADDIE model to help make the process of starting a business more readily academically accessible to the creative mind, and to help stimulate students to think about business in a new, creative way. This will help produce graduates who both want to and can start their own businesses.

Keywords:
Entrepreneur, design thinking, teaching and learning, creative, job creation

Introduction and background

At a time when unemployment rates are at record highs and job creation seems so elusive, educators need to consider whether they are skilling graduates to be able to earn a living. South Africa in particular has always had high unemployment, now officially at 24.8% (StatisticsSA, 2012) but realistically is much higher.

In South Africa young people in particular are finding it hard to find employment. South Africa has suffered historically from "structural unemployment" - a simultaneous shortage of skills coupled with high unemployment, due to the mismatch between skills available and skills required. Added to this, cyclical unemployment occurs due to the vicissitudes of supply and demand within business cycles, which is a common feature of capitalism

Given this backdrop, many South African high school leavers are opting for tertiary training to improve their chances of employment. Because of the poor learning platform in the primary and secondary schooling system many of these students are ill-prepared to enter universities and they opt for more

generic certificates, diplomas and degrees in business or humanities rather than career-specific qualifications like engineering. Employers are understandably reluctant to take on inexperienced and socially unskilled graduates with unrealistic expectations of their worth to an employer, when older and workplace-attuned candidates are available especially in a depressed economy. (Pauw, Oosthuizen, & van der Westhuizen, 2006; Kraak & Press, 2008; Moleke, 2005)

The extant economic system used world-wide is characterised by large multi-national corporations that frequently merge to boost the "bottom line" (profit levels) or simply to survive in the fiercely competitive environment in recessionary times. The merging process perforce implies job reduction as can easily be observed in trade union reaction to the suggestion of any merger by large corporations.

Discussion

With the above in mind, discussion on employability and promoting job creation and entrepreneurship follows. For this a common understanding of entrepreneurship is required; Rwigema and Venter (in Nicolaides, 2011) provide an accessible one:

> "… a process of conceptualising, organizing, launching and, through innovation, nurturing a business opportunity into a potentially high growth venture in a complex, unstable environment".

Why be an entrepreneur or self-employed?

The modern assumption of having a paying job after leaving school and university historically has been with us since the industrial revolution. Job seekers have the expectation of being given employment on leaving school, or certainly after graduating from a tertiary institution. Many have not adjusted to the reality of the last four decades where increasingly employees no longer have one job for life, or even three or four, but now may have three or four careers in their working lifetime. Adding further instability to this situation as neo-liberal capitalism has taken deeper hold, there has been a casualisation of jobs everywhere. There are now many more casual and contract jobs positions the world over (Brown, 2009). Cultivating tendencies that promote self-reliance has become a necessity in this environment (Clarke, 2008).

This income-earning insecurity naturally leads job seekers to consider creating their own employment. Entrepreneurial education text books of a decade ago typically tell us that characteristics like being a hard worker, fast learner, wealth seeker, socially isolated and a risk taker are shared by entrepreneurs[29]. Katz and Green (2009: 57) indicate that the modern entrepreneur is hard working, self-sufficient, *socially connected,* a fast learner, a wealth seeker and a *risk manager*. The influence of a technologically connected world is seen as useful by the entrepreneur, as is the understanding that risk is a manageable part of the entrepreneurial process.

Graduate employability

Employability for the university graduate is not merely about qualifying as an expert in a specific field. According to Yorke & Knight (2006) employability;

- encompasses the potential of the graduate to succeed at post-graduate levels
- recognises success in co- and extra-curricula activities
- goes beyond key skills to include generic skills such as emotional intelligences, the ability to work with others as well as practical intelligence
- implies a life-long learning attitude.

They propose a useful definition of employability as;

[29] Interestingly enough, this is not quite true of all small business owners, many of whom may not be entrepreneurial in the classic sense, for example, the family plumbing business or corner convenience shop owner who is likely to be risk averse and only an average learner. (Katz & Green, 2009)

> "… a set of achievements – skills, understandings and personal attributes – that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy."

Business studies programmes within design curricula commonly have promoting employability and increasingly now sowing the seeds of entrepreneurship in the minds of students, as their *raison d'etre* (Carey & Matlay, 2010).

No matter what any politician tells us, if job creation were easy there would be little unemployment; it is as elusive as "world peace". According to Tovey (2009), Carey and Matlay (2010), and Naidoo (2003), high entrepreneurial activity supports increased economic growth both in South Africa and worldwide. Small, medium and micro enterprises (SMMEs) are expected to be the incubators for entrepreneurial activity and where job creation occurs. South African research (Grundling & Kaseke, 2010) shows that only the largest enterprises within the SMME group, creates work for more than one person. Small enterprises are essentially self-employed individuals and micro enterprises are informal and do not give full employment even to one person. The Finmark Trust research survey of 2010 found that 60% of SMMEs provide work for only one person and only 1% of SMMEs employ ten or more people (Grundling & Kaseke, 2010); these two concepts are contradictory.

In February 2011, President Zuma announced the creation of a R9 billion "Jobs Fund" special initiative to create 5 million jobs by 2020 and to bring down unemployment to 15% (Zuma, 2011), but due to the global economic doldrums already mentioned, it is difficult to assess whether any progress has been made.

SMME initiatives

The Finmark Trust survey mentioned earlier collected data from over 5 600 small business owners in 2010 and found SMMEs very diverse with only the most sophisticated of them being registered businesses and fully tax-compliant. Over 50% of business owners in this segment have a tertiary qualification and almost all (99%) have matric. The data indicate that any job creation initiative should concentrate on the provision of formal secondary and tertiary education rather than on short courses for informal traders. Hadebe (2010) found that skills training for inner city informal traders boosted their income by only about R 1 600 per month. This is more in line with poverty alleviation than job creation or business growth.

It appears that graduates are in the best position to be job creators and employers. There is not yet a comprehensive longitudinal study available that tests the causal link between entrepreneurial education and new business formation, a fact lamented in various countries (e.g. Matlay, 2006; Fairlie, 2009; Nicolaides, 2011).

The problem with current business studies programmes

Typically what has occurred is that non-business students are taught that a standard "business plan" is sufficient to be entrepreneurial, (Parker, 2006; Nieman & Nieuwenhuizen in Nieman & Bennett, 2006). This business plan approach includes an introduction, executive summary, marketing and financial plans with product costing models and staffing and capital requirements, and attached appendices.

Many workbooks, entrepreneurial self-help books and online courses say more-or-less the same thing. They are by nature generic and while they give examples, they cannot guide the would-be entrepreneurial studies student in the details of a specific business plan or how to identify a worthwhile opportunity. A careless non-business student in a compulsory business class may well use an on-line generic outline of such a business plan and try to adapt it in such a way that the examiner will pass them. This is often a hit-and-miss affair as the student has little interest in starting a business but needs the course credits to graduate. Student learning in such instances is at a minimum and barely rates on the bottom rung ("remembering") of Bloom's learning taxonomy (in Krathwohl, 2002:p213), and patently contributes very little to the graduate being entrepreneurial.

It is easy to see how the "business plan" model, also called the "bank manager's model" arose (Carey & Matlay, 2010). It is standard practice for an entrepreneur hoping to raise funds to follow these steps. It developed as a useful model for bankers to assess the likelihood of earning interest and recovering capital lent to the funding applicant. The business plan model is well-accepted within business generally, it follows a logical course through the various aspects required and therefore can be justified as a teaching tool within the curriculum.

This approach unfortunately gives little attention to the generic skills mentioned in 0 on graduate employability. It also lacks any entrepreneurial skills learning as the process does not engage the learner in the mental space he inhabits. As s/he has little or no experience of the entrepreneurial process they cannot relate theoretical lectures and reading to practice (Kolb & Kolb, 2008).
Prescribed business management text books especially of the last few years (such as Nieman & Bennett, 2006) place emphasis on understanding the entrepreneurial process as follows:

- identifying an opportunity
- being innovative and creative
- gathering resources
- starting and growing a business
- looking at risks versus reward, and
- managing the business

This sounds like Martin's "knowledge funnel" model used in design thinking where there is a "mystery" phase (finding opportunities), "heuristics" phase (being innovative and gaining understanding) and an "algorithm" phase (starting and growing a business) (Martin, 2009). Because of the commonalities mentioned between these two models, this may be a better way to engage the design student with the entrepreneurial studies programme.

1.1. Teaching and learning

As tertiary education is one of the indicators for increased job creation by entrepreneurs, it makes sense to facilitate entrepreneurial behaviour in students through teaching and learning practice. Perhaps the most important thing about teaching is recognising the need to meet the student where s/he is mentally, and not where the lecturer is or thinks the student ought to be. This thought has taken deeper root over recent decades where "student centred learning" and "peer learning" (Cross & Carpentier, 2009), "experiential learning" (Kolb & Kolb, 2008) and "engaged learning" (Brüssow & Wilkinson, 2010) are all efforts to facilitate better learning. The recent concept of "design thinking" also reminds those in creative fields that one must centre a design on the client needs just as the lecturer should on the student's needs (Brown & Katz, 2011), a notion to which we shall return later.

Behind the abovementioned learning theories and ideas lies the concept began by education psychologist Lev Vygotsky. Vygotsky called this the "zone of proximal development" (ZPD)(Vygotsky, 1978), and precipitated a great volume of research within education around this notion. Wood and Wood (1996) describe the ZPD as the gap between what a learner can achieve alone by independent problem-solving and what s/he can achieve with guidance. Coupled to this is the fact that where learning is considered too small (easy) no development occurs and where the ZPD is too large (difficult) it is dismissed and the learning opportunity is lost. As educators have paid attention to the ZPD, many improved learning outcomes have been achieved. Approaching a student in his/her ZPD leads to effective learning; the student "acts, thinks, feels and participates" (Tinsley & Lebak, 2009), and is transformed in the process. Any learning essentially changes the student insofar as the student is different from before the learning occurred (Kolb & Kolb, 2005). From this we may understand that a design student is able learn about the entrepreneurial process and being entrepreneurial, if met in the ZPD.

The conceptual framework behind the above thinking is *constructivism* which stems from developmental psychology and the work of Jean-Pierre Piaget and Jerome Bruner. Epistemologically it views knowledge as structured and built on previous knowledge because learning is individualistic. Its antithesis is *behaviourism* or programmed learning as championed by B.F. Skinner. Behaviourism's stance is that learning is additive and that we can learn independent little bits of information which are not necessarily related to previous learning. Behaviourism is perhaps best illustrated by the "drill and practice" method of drumming multiplication tables into a primary school pupil where Constructivism builds higher order thinking, produces meaning and enables the learner to abstract concepts from previous learning (Lee, Kolodner, & Goel, 2011).

Research from the UK (Carey & Matlay, 2010), indicates that the way creative disciplines are taught may be successfully used to develop entrepreneurial education. The creative disciplines' concepts of a "crit" which includes a discussion with small groups of students, student presentation of their work for critique by lecturer and peers and exhibiting work for discussion with others, is transferable to entrepreneurial education and gives the design student a foothold into understanding the entrepreneurial process .

The designer is by nature considered creative; designers recognise the joy, spirit, power, beauty, strength, relevance and passion that is design, and increasingly their role in sustaining an abused and over-extended planet (Fuad-Luke, 2009).

De Bono (1977) and Carey and Matlay (2010), tell us that creativity is everywhere and creative people are found in all fields. Creativity can be promoted by understanding that it has three related aspects: humour, insight and lateral thinking. Whilst humour concerns the temporary linking of ideas to make an absurd point, lateral thinking takes our usual brain "self-organising system" of pattern recognition, , and asks us to look at the challenge outside of that pattern in a lateral way and so come up with a very different solution. Lateral thinking can be cultivated and has been used for the last four decades to promote creative thinking and ideation in many spheres. The third aspect of creativity (insight) arises where one's inherent cultural outlook and knowledge is in conflict with a new thought or idea. This new idea needs to be assimilated into the existing body of knowledge, and in so doing the learner, *gains insight* and is transformed. This concept is core in education science and is the basis for much learning theory.

Books and articles linking the entrepreneur and creativity are commonplace. The entrepreneur potentially could be as creative as the designer and Martin (2009) and Leavy (2010) remind us that "design thinking" can and should be applied to all aspects of business, from strategy and tactics to operations and service.
The following qualities are considered desirable in the entrepreneur (Katz & Green, 2009; Nieman & Nieuwenhuizen, 2009):

- Being innovative
- Recognising an opportunity
- Being entrepreneurially alert

These concepts link back to de Bono's thoughts on creativity, seeing things in a different way (lateral thinking), making previously unthought of connections and identifying overlooked concepts (insight). The thought of the entrepreneurial process as being creative should be emphasised to design students to encourage them to pursue their creative talents entrepreneurially. Facilitating "entrepreneurial thinking" in design should be as encouraged as pursuing "design thinking" in business.
Brown and Katz's (2011) concept of the "three spaces of innovation" (inspiration, ideation and implementation), and Martin's (2009) concept of the "knowledge funnel" both describe how businesses can combine analytical and intuitive thinking to create design thinking. Martin terms this "dynamic interplay"- first an idea may be a mystery but as an idea passes through the "funnel" via observation and

study, heuristics develop, and some understanding occurs until finally an algorithm, (a pattern, formula or code) is found. Katz and Green (2009) also see this thinking in the entrepreneurial process. Combining these thoughts into an entrepreneurial teaching model for design students may promote a synergistic relationship for design, entrepreneurship and teaching.

1.2. A personal experience

I inherited the previously described "business plan model" for teaching entrepreneurial skills to information technology (IT) students some years ago. I observed that there was no true engagement of students with the subject and I felt stuck with the business plan model. The business plan model includes marketing, product costing, vision and mission, financing and cashflow analysis etc in which the majority of students showed no interest. The submissions of full time students in particular were very mediocre; part time students however, showed remarkably more insight As the programme was taught in the first year of study, for one year only, I believe it added nothing to the student ability to be entrepreneurial on graduation.
I also taught a course in accounting skills to public relations (PR) students. Most PR students avoid numbers of every kind and initial test scores were appalling. As the accounting concept of the "double-entry" requires a debit for every credit it is essentially logical. I hit on the idea of playing the Japanese puzzle Sudoku as a way to develop logic. The class was taught to play Sudoku, some becoming so enthusiastic they played Sudoku on their mobiles between classes. What this did was mitigate some of the "fear" of numbers that many students had, turning numbers into a "fun thing" to do. It also created a positive attitude in the class. Many would never be good at accounting but they did need enough understanding to pass and from a dismal 27% average for the first test, we managed a 70% pass rate by year end. I realised students had been engaged at a point where they could understand, in their ZPD as it were.

I moved on to lecturing design students in entrepreneurial studies, a course known as "Professional Practice". This is a similar course to the one taught in IT, but taught over three years. I realised that engaging students in the entrepreneurial process in such a way that they could recognise the creativity in the entrepreneurial process and so recognise *themselves* as potential entrepreneurs, held promise. Students would then be more receptive to pursuing entrepreneurial ideas where previously they may have discarded them as being something they could not do. As a result of this experience, weekly classroom lectures have largely been discarded and assessments are given as "briefs", with interim feedback sessions, (crits) at which the whole class is present, well before any final submission is required. This meets the student in the learning space he can recognise, as will be explained in the example in section 5, below.

1.3. ADDIE

The following quotation about the origins of ADDIE is by Michael Molenda when he was researching ADDIE origins for an encyclopaedia entry (Molenda, 2003),

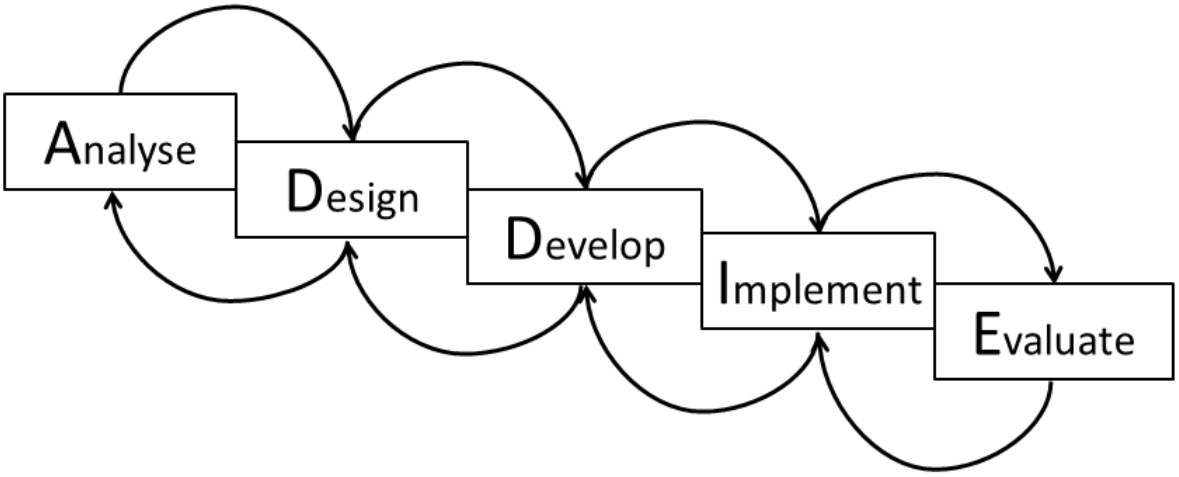
> " I am satisfied at this point to conclude that *the ADDIE Model* is merely a colloquial term used to describe a systematic approach to instructional development... The label seems …to have evolved informally. There is no original, fully elaborated model … just models that share a common underlying structure. What everyone agrees on is that ADDIE is an acronym referring to the major processes that comprise the generic ISD process: Analysis, Design, Development, Implementation, and Evaluation."

Though the origin of the term remains vague it does refer to a sequential and iterative procedure which may be followed in various disciplines. Figure 1 below is based on Grafinger (in Molenda, 2003), and is frequently used in Instructional Design and Instructional Systems Procedure.

Its uses and acceptance

Simmons (2012) supports Molenda's view and shows in tabular form how various US universities have mapped each of the words underlying the ADDIE acronym to various aspects of learning theory. She further demonstrates the trend to use it for online educational programmes in universities and corporate training. Because of its iterative nature, it allows continual refinement of the process and is thus suitable for many fields, for example education, manufacturing and administration.

Figure 7: The ADDIE model (adapted from Grafinger in Molenda (2003)



The Business ADDIE (BADDIE) model

Using Nieman and Nieuvenhuizen's (2009:22) model, the ADDIE model can be mapped to the entrepreneurial process and is expanded on below.

1.4. Analysis

Instead of being presented with a brief, entrepreneurs must create their own.

The entrepreneur must undertake a variety of tasks in order to assess the potential for the new business e.g.,

a. Market analysis. The questions to be answered here include: what direct/indirect competition exists?; where will I start this business?; where will I raise funds?; etc.
b. Business environment analysis. There are many models for this (e.g. de Bruyn & Kruger in Nieman & Bennett, 2006:26-48). This step will include evaluating how the financial and political environments will affect the business, what statutory laws specifically apply, etc.

An in-depth analysis of this kind is essential. Entrepreneurs must understand the business environment in which they are competing.

1.5. Design

The "concept" of the business can now be developed. This should include, *inter alia;*

a. the type of business (sole proprietor, Pty Ltd, etc)
b. the vision, mission and goals of the business
c. the target market for the business / product, and
d. a detailed business plan.

The entrepreneur should now be in a position to decide whether the business venture is a "go" or "no go".

Note that the iterative nature of the ADDIE model already becomes important. If the business design is out of reach of the entrepreneur then the analysis will have to be re-thought in some way.

1.6. Develop

By this stage, the business should be in the "go" phase, and it is time to start developing the resources that the business will need. This will include:

a. Hiring staff
b. Find premises
c. Securing finance
d. Initiating product / service delivery
e. Initiating marketing plan

1.7. Implement

This will be the start-up of the business. It could include such items as registering the business with the appropriate authorities, establishing business processes, organising the layout of the business premises, planning the initial marketing of the company and/or product, securing funding, etc.
This is where the business is declared "open for business". The processes planned in the development stage must now be implemented.

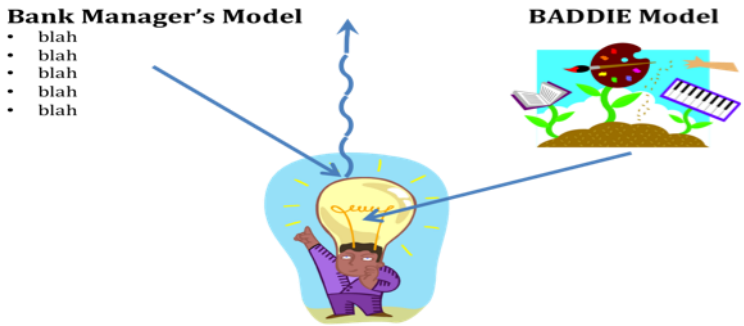
1.8. Evaluate

This is the on-going process of monitoring and growing the business to ensure its on-going success. This will entail, *inter alia*, financial reporting and control, testing market penetration and acceptance, etc.
The iterative nature of the original ADDIE is essential for BADDIE. For instance, experience gained in the "implement" phase may well necessitate a review of the "develop" phase, and indeed may reflect all the way back to the "analyse" phase as may be seen in the example below.

Business ADDIE (BADDIE) – a current classroom experience with design students

Students were asked to list their skills, talents and interests (ANALYSIS) and design their "dream job" (DESIGN) and create a webpage poster advertising what they do (DEVELOP and IMPLEMENT). The class viewed the posters and students had to find three classmates whose own interests aligned with theirs and form a team (ANALYSIS). In workshop mode De Bono's "Six Thinking Hats" method was used to refine each group's business idea into something they believed would work as a commercial enterprise (DESIGN). (The different coloured hats method allows ANALYSIS of what's good, bad, neutral, positive etc, about an idea by the group together, thus avoiding the common destructive meeting strategy of everyone supporting their own idea or that of the most forceful personality). After a few marketing lectures to understand basic principles the groups were asked to research and present findings on local and foreign businesses which were similar to theirs and ANALYISE where they differed and where they were the same and thus try and uncover what is known as "the unique selling point" (the DESIGN), for their business, without which any venture will fail. From here they did some market research and produced a draft marketing plan, (a formative assessment) which was marked quickly and returned to them within a week with suggestions on improvements in preparation for a final marketing plan, (summative assessment) which included designing and testing a marketing survey on members of the public. The final plan was submitted a month later, (another opportunity for ANALYSIS, DESIGN, DEVELOP, IMPLEMENT and EVALUATE). Currently the class is testing their business ideas: their assignment is to experience "earning a living" from their business idea and to document and report their experience to the class at the end of the term, (IMPLEMENT and EVALUATE).

Figure 8 - BADDIE and the ZPD



The practical nature of ADDIE has meant the student is engaged in the mind space he inhabits (Figure 8 - BADDIE and the ZPDFigure 8) – his own skills, talents and interests, in such a way that his raw ideas may be refined into a workable business concept. Thus the entrepreneurial process becomes embedded in his thinking; he has gained insight into himself as an entrepreneur, which he will certainly require on graduation.

Conclusion

We have discussed the underlying need for job creation in South Africa and that the most promising way to do this is through encouraging entrepreneurial activity. Generally, university graduates are not adequately prepared to be entrepreneurs; the subject is often taught at an inappropriate level in the curriculum, and in an inappropriate way.

Experience has shown us that non-business students struggle to engage with the business studies program as it is traditionally taught. The often-used "business plan model" is ineffective as it does not hold students' attention.

It is possible to create new ways to engage students in a business studies programme by approaching them in their ZPD. For students in the creative fields, one possibility is to adapt the familiar ADDIE model, facilitating the student embracing the entrepreneurial process as part of the design process. The acceptance of this notion may encourage designers to be more entrepreneurial which in turn will promote economic activity and job creation.
Further study on the efficacy of this model as an effective teaching method is required. In particular, a longitudinal study on design graduates taught using the BADDIE model is required. Measuring their entrepreneurial activity would give further clarity on the usefulness of this model. Similarly new models that approach the student in their ZPD could be devised for other disciplines, for instance adapting the "software life-cycle" model to help teach business studies to information technology students.

References

1. Brown, T. (2009). The desire for something better: Learning and organising in the new world of work. In L. Cooper & S. Walters (Eds.), *Learning/Work: Turning work and lifelong learning inside out* (pp. 270 – 283). Cape Town: HSRC Press.

2. Brown, T., & Katz, B. (2011). Change by Design. *Journal of Product Innovation and Management*, (28), 381–383.

3. Brüssow, S. M., & Wilkinson, A. C. (2010). Engaged learning : A pathway to better teaching. *South African Journal of Higher Education*, *24*(3), 374–391.

4. Carey, C., & Matlay, H. (2010). Creative disciplines education: a model for assessing ideas in entrepreneurship education? *Education and Training*, *52*(8/9), 694–709.

5. Clarke, M. (2008). Understanding and managing employability in changing career contexts. *Journal of European Industrial Training*, *32*(4), 258–284. doi:10.1108/03090590810871379

6. Cross, M. I., & Carpentier, C. (2009). " New students" in South African higher education: institutional culture, student performance and the challenge of democratisation. *Perspectives in Higher Education*, *27*(1), 6–18.

7. De Bono, E. (1977). *Lateral thinking: a textbook on creativity* (pp. 6 – 30). London: Pelican Books.

8. Fairlie, R. W. (2009). *Kauffman Index of entrepreneurial activity 1996-2008*. *Kauffman Index of Entrepre enurial Activity*. University of California.

9. Fuad-Luke, A. (2009). What design is. *Design Activism* (pp. 1 – 25). Earthscan, London, UK.

10. Grundling, I., & Kaseke, T. (2010). *FinScope South Africa Small Business Survey 2010*. *Finmark Trust* (pp. 1–8). Midrand, Gauteng, South Africa.

11. Hadebe, T. (2010). *Township home-based enterprises: the case of Pimville*. University of the Witwatersrand: Faculty of Engineering and the Built Environment, Johannesburg.

12. Katz, J., & Green, R. (2009). *Entrepreneurial small business* (pp. 54–114). New York: McGraw-Hill/Irwin.

13. Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces : enhancing experiential learning. *Academy of Management Learning & Education*, *4*(2), 1–18. doi:10.5465/AMLE.2005.17268566

14. Kolb, A. Y., & Kolb, D. A. (2008). Experiential Learning Theory: a dynamic, holistic approach to management learning, education and development. In S. J. Armstrong & C. Fukami (Eds.), *Handbook of Management Learning, Education and Development* (pp. 1–59). London: Sage Publications.

15. Kraak, A., & Press, K. (Eds.). (2008). *Human resources development review*. HSRC Press.

16. Krathwohl, D. R. (2002). A revision of Bloom's Taxonomy: an overview. *Theory into Practice, 41*(4), 212 – 218.

17. Leavy, B. (2010). Design thinking – a new mental model of value innovation. *Strategy & Leadership, 38*(3), 5–14. doi:10.1108/10878571011042050

18. Lee, C.-S., Kolodner, J. L., & Goel, A. K. (2011). Creative design: Scaffolding creative reasoning and meaningful learning. *Journal of Education Technology & Society*, *14*(1), 3 – 15.

19. Martin, R. (2009). The design of business: why design thinking is the next competitive edge. *The design of business* (pp. 1 – 5). Harvard Business School Press.

20. Matlay, H. (2006). Researching entrepreneurship and education: Part 2: what is entrepreneurship education and does it matter? *Education + Training*, *48*(8/9), 704–718. doi:10.1108/00400910610710119

21. Moleke, P. (2005). *Employment Experiences of Graduates*.

22. Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvememnt*, (June), 1–4.

23. Naidoo, D. (2003). *An investigation into the financial support available to South African small and medium enterprises*. University of Natal (Durban).

24. Nicolaides, A. (2011). Entrepreneurship- the role of Higher Education in South Africa. *Educational Research*, *2*(April), 1043–1050.

25. Nieman, G., & Bennett, A. (Eds.). (2006). Business Management, a value chain approach. *Business Management, a value chain approach* (2nd ed., pp. 49 – 63). Pretoria, South Africa: Van Schaik.

26. Nieman, G., & Nieuwenhuizen, C. (Eds.). (2009). Entrepreneurship A South African perspective (2nd ed., pp. 1 – 55). Pretoria, South Africa: van Schaik Publishers.

27. Parker, E. (2006). *Road map to business success: a workbook for entrepreneurial studies*. (J. van der Heever, Ed.) (pp. 1 – 300). Johannesburg: Frontrunner Publishing (Pty) Ltd, through PanMacmillan SA.

28. Pauw, K., Oosthuizen, M., & van der Westhuizen, C. (2006). Graduate unemployment in the face of skills shortages: a labour market paradox. *Development Policy Research Unit Conference, UCT* (pp. 1 – 25).

29. Simmons, S. E. (2012). The origins and descriptions of ADDIE. Retrieved from http://www.shelbyesimmons.me/uploads/1/0/4/1/10414302/simmonsseaddiepaper.pdf

30. StatisticsSA. (2012). *Statistical release Quarterly Labour Force Survey*.

31. Tinsley, R., & Lebak, K. (2009). Expanding the zone of reflective capacity: taking separate journeys together. *Networks: An On-line Journal for Teacher Research, 11*(2), 1–11.

32. Tovey, A. M. (2009). *Entrepreneurial team formation in the craft sector in South Africa : the case of the Ekurhuleni crafter groups*. University of Pretoria, Pretoria, South Africa.

33. Vygotsky, L. S. (1978). *Mind in society: the development of higher psychological processes*. (M. Cole, Ed.) (pp. 1–159). Harvard Business School Press.

34. Wood, D., & Wood, H. (1996). Vygotsky, tutoring and learning. *Oxford Review of Education, 22*(1), 5–16.

35. Yorke, M., & Knight, P. T. (2006). *Embedding employability into the curriculum: Series 1*. (M. Yorke, Ed.) (pp. 1 – 32). York, UK: The Higher Learning Academy.

36. Zuma, J. (2011). *State of the nation address*. Pretoria, South Africa. Retrieved from www.info.gov.za

Engineering and Technology Students Cognitive and Learning Styles

Oanthata J Sealetsa
Industrial Design & Technology Department,
University of Botswana, Botswana.

R. Moalosi
Industrial Design & Technology Department,
University of Botswana, Botswana.
Moalosi@mopipi.ub.bw

Abstract:

This study was conducted to determine whether University of Botswana admissions criteria and students learning styles were predictors of academic performance and degree completion at the Faculty of Engineering and Technology. Field dependence/field independence is a dimension of cognitive style that influences students learning styles. The Group Embedded Figures Test was administered to 77 University of Botswana second year Engineering and Technology students. The students Grade Point Average score and the Group Embedded Figures Test were used for analysis to determine students' achievement scores against their cognitive learning styles. SPSS was used in the analysis stage. The results indicate that Faculty of Engineering and Technology students attract the right calibre of students as the majority of them were highly field independent (analytic) but their academic performance in terms of the Grade Point Average was rather moderate.

Keywords: Cognitive Learning Styles, Group Embedded Figures Test, University of Botswana, Engineering Students.

Introduction

The way people learn and deal with problems largely depends upon the link between personality and cognition. This link is called cognitive styles. Cognitive styles can be described as the manner in which information is acquired and processed by the brain. There are many cognitive styles such as spatial visualisation, sequential or parallel processing, hemispheral lateralisation (left versus right brain). This study is focussed on one such cognitive style being field dependence/field independence. The Group Embedded Figures Test (GEFT) was administered at the University of Botswana to second year Engineering and Design students to determine whether they are field dependent (FD) or field independent (FI). The field dependence/field independence is more related to the process of learning than the aptitude for learning. This aspect is important because students are expected to apply higher cognitive skills such as collecting, analysing, evaluating, summarising and synthesizing information. The categorisation of learners was then mapped against their end of semester Grade Point Average (GPA) to determine their cognitive style's influence on their academic achievement. Altun and Cakan (2006) report that research has shown that cognitive skills are an important indicator of success. The overall foci of the study were to determine a potential indicator of success in an engineering and technology faculty, to improve curriculum and instruction.

Theoretical framework

Human cognition including cognitive styles is highly relevant to many educational concerns involving teaching and learning (O'Brien et al., 2001). These researchers opined that cognitive styles and learning are so important that they may hold important implications for education in general. Cognitive styles represent the core elements of the teaching and learning process as they influence the academic achievement of learners. Cognitive styles describes the information processing habits representing the learner's typical mode of perceiving, thinking, problem solving and remembering (O'Brien et al., 2001).

Most studies in cognitive styles are based on the widely researched Herman Witkins et al. (1971) field dependence model. This model uses the Group Embedded Figures Test (GEFT) to assess whether a learner is a field independent (analytical thinker) or field dependent (global thinker). Field Dependent (FD) learners process information globally. These learners are less analytical and they do not pay much attention to details and view the perceptual field as a whole (Ruttun, 2009; Chen & Macredie, 2002). Learners have a tendency to resist analysis or decomposition. FD learners use social frames of reference to determine their own attitudes, feelings and beliefs (Ruttun, 2009). They prefer group projects and need more assistance from the educator.

On the other hand Field Independent (FI) learners are highly analytical in perceiving and processing information. They can easily break the field down into its component parts. These learners are not influenced by the existing structure and can make choices independent of the perceptual field. Garton et al. (1999; 2005); O'Brien et al. (2001) argue that these learners exhibit a tendency to organise information into manageable units and appear to possess a greater capacity for retention of information. They prefer situations that allow them freedom in working towards their goal and solving problems as well as working individually. As educators it is important to understand and appreciate these individual differences so that an attempt can be made to match students with their academic capabilities.

The next section therefore discusses how individual differences impact upon teaching styles. Garger and Guild (1987) summarised the characteristics of FD and FI with regard to teaching styles as shown in Table 1.

Table 1 Teaching styles of field dependent and field independent learners

Teaching Styles	
Field dependent	**Field independent**
Prefers teaching situations that allow interaction and discussion with other learners.	Prefers impersonal teaching situations such as lectures. Emphasise cognitive aspects of instruction.
Uses questions to check on student learning following instruction.	Uses questions to introduce topics and following learner answers.
Uses learner-centred activities.	Uses a teacher-organised learning situation.
Viewed by learners as teaching facts.	Viewed by learners as encouraging the application of principles.
Provides less feedback, avoids negative evaluation.	Gives corrective feedback, uses negative evaluation.
Strong in establishing a warm and personal learning environment.	Strong in organising and guiding student learning.

It is emperative for educators to recognise students learning styles (field dependent/ field independent). Using this information will help them meet their learner's individual needs effectively through the application of appropriate responsive teaching styles. These styles are an essential indicator of success in an educational environment. Therefore, educators need to balance their teaching styles so that they may cater for both groups of learners in class. Understanding of student individual differences presents such an opportunity.

Research has shown that engineering and accounting courses tend to attract students who exhibit concentration and analytical skills (Murphy et al., 1997; O'Brien et al., 2001; Jones & Wright, 2010). For example, Murphy et al. (1997) investigated a group of 89 undergraduate students from a cross section of business courses using the GEFT and found them to be moderately Field Independent. O'Brien et al. (2001) also investigated cognitive styles patterns among students in engineering courses and related differences in the academic performance of those students. The impetus of this study involved the concerns among engineering educators with regard to the difficulty students experienced in the

programmes provided. In this study, students categorised as middle and analytic scored significantly high on the end of course examinations.

The GEFT measures problem solving and analytical abilities such as those necessary for engineering and accounting careers (Jones & Wright, 2010; Clark et al., 2000; Lunt, 1996). Clark et al. (2000) argue that the ability to 'pull out' a specified object from a given background is a necessary trait for individuals interested in engineering careers. Despite several studies globally conducted on cognitive styles and learning using the GEFT, few of those explain the cognitive abilities in the context of African University students.

It was expected that students enrolled at the Faculty of Engineering and Technology of the University of Botswana would tend to be field independent. Based on these expectations, the authors believe that students, who choose engineering related disciplines without first establishing their cognitive styles, would experience difficulty in coping with the demands and pressures of their programmes. This is due to the fact that they lack the necessary problem solving and analytical abilities required for such courses.

Relationship between teaching styles and learning styles

The relationship between the cognitive style and learning performance is based on the premise that both the educator and students should be knowledgeable about their styles so that they can consciously adjust, adapt or modify them in order to increase learning. The first step in reaching this goal is to make a personal assessment of once own learning and teaching style. The educator's learning style has an effect on his/her teaching style. Kolloffel (2012) observes that, we tend to teach the way we learn, unless there is a conscious reason to, or otherwise. The more educators learn about their own teaching style the more they can explain what happens in their classroom and why. By making explicit their teaching and learning style, the educators have taken a step towards realising that not all of their students learn as they do and perhaps some problems students might have such as lack of motivation are a result of the mismatch between their teaching and students learning styles. Once educators gain an appreciation of the variety of learning styles, they can respect learning styles differences and adapt their teaching styles for different situations. Furnham et al. (2009) and Jackson et al. (2009) argue that the learning style is critically important in laying the groundwork for understanding students learning performance. This provides educators with an opportunity to be alert to situations in which students learning styles limit their success in academic areas. Teaching and learning style matches have been found to increase satisfaction and mutual regard among educators and students (Huang et al. 2012). Mismatch can be detriment to affective style aspects, producing anger, frustration, unruly behaviour, procrastination, and even major emotional problems.

Use of media in teaching and learning

The search for a better solution to teaching and learning should be a challenge to every educator. Research has shown that if media is used properly and in the right place, it can contribute to purposeful teaching and learning (Kallstrom, 2009). In order to overcome some of the aforesaid issues, the dramatic growth of the social media creates new opportunities for engaging students. An e-learning environment provides flexibility for students to learn across different times and locations, allows self-paced learning, and provides a non-traditional learning alternative (Graff, 2003; Latham, 2012). These include social networking sites such as Facebook, MySpace, LinkedIn and Twitter along with blogs. This type of media is rapidly changing the way people interact with one another and it challenges the way teaching and learning have previously been done. Social media can be used as an effective teaching tool as it is changing teaching and allowing different learning practices. This media requires that the educator step outside of the traditional lecture method and facilitate learning by encouraging students to learn through the media. Studies has shown that using media makes programmes more relevant to students, increases attention, motivation, confidence, satisfaction, class attendance and raises examination scores (Girardi, 2008; Watts, 2003; Medcalfe, (2010); Chan, 2009). Social media is good for cognitive reasoning as it

provides the opportunity for students to practice all the six Blooms cognitive domains of recall, comprehension, application, analysis, synthesis and evaluation.

In a research conducted by the Educause Centre for Applied Research, Dahlstrom et al. (2011) report that more than 30% of students said they use sites such as Twitter, My Space, LinkedIn and Google+ and they wish their instructors could incorporate these sites into the curriculum more often. The survey also indicated that students preferred using e-mail, learning management systems and e-books and they want their lecturers to use these media more frequently. Even though these technologies are available to most universities, some students felt that their lecturers do not use them effectively or they don't have the skills to use them effectively.

Research from elsewhere also shows generally that there are a number of barriers to accepting the use of technology in teaching for example, a number of studies reported that time, resources, both financial and physical, as well as lack of training and institutional support are the most significant barriers to accepting the use of technology in teaching (Rogers, 2000; Passmore, 2000; Al-Senaidi et al., 2009). Furthermore, Al-Senaidi et al., (2009); Redman et al, (2003) indicate that, there is resistance to change which prevents full integration of ICT in the classroom as well as negative attitude of lecturers and lack of confidence. For example, the major barriers in UK institutions are lack of time and workload (O'Donoghue, 2006; Heaton-Shrestha et al., 2006). Other barriers however seem to be associated with lecturers' attitude to accepting new technologies in teaching. For instance some lecturers question the appropriateness or effectiveness of the e-learning or struggle to identify its purposeful use (Heaton-Shrestha, 2006; Davies & Smith, 2006; Maròn-Garcia, 2006).

In addition Maròn-Garcia (2006) found that some lecturers are concerned that the use of online activities might adversely impact on non-attendance at lectures. Awidi (2008) observes that some lecturers prefer the old to the new methods of instruction, for example, they will seek to find faults with any new system proposed. Newland et al., (2006:40) also observes lack of recognition and encouragement for using technology in teaching by suggesting that *"...it is still the case that in the majority of institutions, recognition and promotion is linked to research activity rather than innovative teaching developments."*

Hypothesis

Field Independence is thought of as a necessary trait requisite for individuals interested in engineering related careers (Lunt, 1996; Clark et al., 2000). Therefore, the main interest was to investigate whether or not the Faculty of Engineering and Technology is able to attract students with the required traits. The hypotheses of the study were as follows:

There is a strong relationship between scoring high on the GEFT and obtaining a high GPA;
Students with high GPAs will score high on the GEFT;
Students in the Faculty of Engineering and Technology at the university of Botswana are more Field Independent than Field Dependent;
Males students are more Field Independent than Female students;
The GEFT can be used to identify students with superior problem solving and analytical skills requisite for Engineering and Technology careers.

Research Method

A survey research design was used for the study because the research problem required an explanation of the relationship among variables. Creswell (2002) opined that quantitative research is used where the research problem can best be answered by a study in which the researcher seeks to establish the overall tendency of responses from individuals and note how this tendency varies among participants. By studying a representative sample of participants, the survey approach seeks to discover relationships that are common across participants and hence to provide generalisable statements about the object of study (Gable, 1994; Saris & Gallhofer, 2007). Surveys can accurately document the norm, identify extreme

outcomes, and delineate associations between variables in a sample. The interest of the authors was to find out whether one or more variables might influence another variable.

After the survey phase, qualitative in-depth interviews with ten purposive sampled students across all departments were conducted to unearth some of the underlying reasons to some responses. This method was found suitable for this phase because describing a trend means that the research problem can best be answered by a study in which the researcher seeks to establish the overall tendency of responses from individuals and to note how this tendency varies among people (Creswell, 2002). The study can inform the researchers about how the student population views an issue under investigation and how diverse their views are about the issue.

Population Sample

The study involved 77 undergraduate second year students in the Faculty of Engineering and Technology of The University of Botswana. Of these students 57 (74%) were male while the remaining 20 (26%) were females. The study covered students from 7 programmes offered by four departments namely; Civil Engineering, Electrical Engineering, Industrial Design and Technology and the Department of Mechanical Engineering. The programmes the study covered were Construction Management, Design and Technology, Industrial Design, Industrial Engineering, Electrical Engineering and Mechanical Engineering. However, for purposes of fitting the programmes into the faculty structure, some programmes were merged and assigned to a relevant parent department. For example, Construction Management (COM) was merged with Civil Engineering (CIV) while Design and Technology (DT) was merged with Industrial Design (ID). Industrial Engineering (IEN) was merged with Mechanical Engineering (MEC) and Electrical Engineering (ELE) was unchanged. Table 1 shows the frequency distribution and valid percentage of student enrolment across the merged programmes.

Table 1 Frequency distribution of students across the departments

Programmes	Frequency	Percentage (%)
COM +CIV	28	36.4
DT + ID	9	11.7
ELE	14	18.2
IEN + MEC	26	33.8

Table 1 illustrates that The Civil Engineering had the highest number of students with 28 students (36.4%) followed by the Department of Mechanical Engineering with 26 students (18.2%). The Department of Electrical Engineering had 14 students (18.2%) while the Department of Industrial Design and Technology had the least number of students at 9 (11.7%).

Instrument

The Group Embedded Figures Test (GEFT) was used to collect information on students' cognitive styles. GEFT is a perceptual test which requires participants to locate a previously seen figure within a large complex figure (Witkin et al., 1971). There are three sections to this instrument. Section 1 is a two minutes practice session which is composed of seven easy figures to be located. Section 2 and 3 both contain nine items each which need to be completed in 30 minutes. An item is deemed correct if the simple item is correctly outlined within the complex figure (Clark et al., 2000). Scoring is based on the number of simple figures correctly traced and may range from 0 – 25. Students who obtain a high score (18 -25) are described as being Analytic or Field Independent. Average scorers are referred to as Middle (10-17) while those scoring low (0-9) are described as being Global or Field Dependent. Much research on the GEFT has been generally supportive of its psychometric properties (Lunt, 1996; O'Brien et al., 2001; Jones & Right, 2010; Clark et al., 2000; Murphy et al., 1997). Therefore, for this study the authors considered that GEFT was adequate to assess students' cognitive styles. Furthermore, semester 1 and 2

students Grade Point Average (GPA) were used as a measure of students' achievement. Although most researchers prefer the 0-18 item score of the GEFT, the authors opted to use all figures available (0-25) so that students could have more items to work on.

Procedure

The researchers informed students about the study's aims and objectives. Consent forms were provided for the students to sign; thereafter each GEFT booklet was distributed to students to identify the figures. Students were required to write only their student identity numbers, department, sex and date of birth in the spaces provided. Students were also assured of anonymity and confidentiality of their responses. Furthermore, students received verbal and written instructions for the GEFT and were not given practice time for purposes of keeping the exercise original and more challenging and also to keep all items of the booklet as the challenge. In this regard, students were allowed to complete all the 3 sections of the booklet within the given time. Following completion of the booklets, students were dismissed. Students were also informed that the results would be made available to them once the study has been completed.

Data Analysis

To determine students cognitive styles, the GEFT scores were used and coded into 3 categories namely 1 = Not Analytical/Global (score from 1-9) , 2 = Average/Middle (scores from 10-17) and 3 = Analytical (score from 18 - 25). This coding is premised on the general interpretation of the standard distribution curve where most individuals are expected to be somewhere in the middle exhibiting both cognitive styles while individuals on the two extremes ends are expected to exhibit traits congruent with those espoused by the theory of field dependence and field independence. This standard coding was also used by eminent scholars such as Clark et al. (2000). In this regard the basic descriptive statistics were relevant to illustrate frequency distribution of students by cognitive ability.

To determine student performance, the average GPA from semester 1 and 2 were computed and coded into two categories namely; high (3.5 to 4.33) and low (0 to 3.49). Thereafter, these were cross tabulated with GEFT to determine proportion of gender and correlation between GEFT scores and GPA scores. The Spearman's Rho (r) was then used to establish correlation between the variables. Finally, the authors attempted to ascertain whether the GEFT can be used as a tool to identify students with superior problem solving and analytical skills that are requisite skills needed in Engineering and Technology careers. In this regard the mean of the total scores on the GEFT were used. The Statistic Package for Social Scientists (SPSS) was used for analysing the data.

Results

GPA scores

The GPA scores showed a mean value of 3.13 and a standard deviation 0.76. 59 students (76.6%) had a low GPA while 18 (23.4%) had a high GPA suggesting that students' performance at the Faculty of Engineering and Technology was rather moderate. The low GPAs were found among female students. For example, only 2 female students out of a total of 20 (10%) scored above a GPA of 3.74 compared to 17.5% male students. This indicates perhaps that gender was a determinant of success at this faculty. However, this is consistent with other studies conducted by O'Brien et al. (2001) where it was shown that male students in Engineering Education outperform their female counterparts.

The results further indicate that 96% of the students have had their GPA declining from the first to the second semester. If the faculty is attracting the right students, what could be the causes of such a huge decline? In this regard there was need to investigate further some of the reasons which contribute to this scenario. In our investigation, participants advanced several reasons which range from lack of motivation, excessive workload, use of appropriate teaching media and negative attitude to learning.

Lack of motivation

Lack of motivation was cited as one reason why students GPA declined. Participants indicated that the following are some of the reasons which lead to lack of motivation:

Materials which have little relevance to the professional growth...

Some courses are irrelevant to my career development because there do not stipulate how they will help me in the future.

There is lack of motivation hence students lose interest...

Use of appropriate teaching media

The commonly used teaching media in the faculty include e-learning packages (blackboard and moodle), PowerPoint, video and video conference. Participants pointed out that using inappropriate teaching media also contribute to lack of motivation to learn and hence the decline of the GPA. Participants stated that:

Some lecturers are not using innovative teaching media in their course delivery.

Our lecturers are not using the Facebook and Twitter in teaching.

The traditional teaching methods used make us get bored and lose interest in the course.

It de-motivates me in attending my lectures because the material presented is already posted in blackboard.

The last point requires that lecturers should be careful when posting and giving access to students using blackboard. It will be advisable for students to get access to the material that has already been covered. Students can then use the same for revision purposes or as reference material.

Too much workload

Some participants have indicated that too much workload from their different programmes of study also contributes to their declining GPA. For example, these participants expressed that:

My programme has too much workload.

There is a lot of work for very little credits thus affecting my motivation to learn.

There is always an assignment to submit or a test to write, this does not give us time to learn for the improvement and growth of our skills.

Attitude to learning

Some students' attitudes towards learning play an integral part in improving their academic performance. Some of the echoed sentiments by participants do not demonstrate a positive attitude towards learning. Participants stated that:

Students do not care about how high is their GPA, provided it allows them to proceed from one semester to the next.

We want to survive and cross the bridge so as to graduate.

We want to be successful tenderprenuers.

My role model is a tenderprenuer.

Tenderprenuers are those individuals who win some lucrative tenders either from government or the private sector. The tenderprenuers are not appropriate academic role models to emulate. Most of them have not acquired any higher education qualification or they dropped out of university. However, they are now running successful private companies. The responses show that most students view acquiring an academic qualification as waste of time since their role models are successful people in the society who do not have a university degree. This conflict of interest act as a de-motivating factor for some students.

GEFT scores

In contrast, the GEFT scores indicated a mean value of 19.2 and standard deviation of 5.68. In total four students (5.2%) were *'not analytic'* while those regarded as *'average'* accounted for 20.8% (16 students). There were 57 analytic students (74%). This indicates that the majority of students at the faculty are

analytic (74%) and as such possess the requisite traits for Engineering and Technology careers. This is consistent with other studies conducted elsewhere on Engineering and Technology students' analytic learning abilities (Clark et al., 2000). However, in this study, the high score on the GEFT did not necessarily reflect high GPA as was expected.

Correlation

A Spearman's Rank Order Correlation was run to determine whether a relationship between GEFT scores and GPA scores existed. The results of this analysis revealed that there was a positive correlation between GEFT and GPA scores (r = .276). However, this correlation was not statistically significant.

Discussion and Conclusion

The GEFT scores suggests that the Faculty of Engineering and Technology attracts students with analytical skills of which many researchers imply are traits essential for an engineering career (Mean score 17.5 in the GEFT scale out of a total of 25). On the other hand, it is clear that the same students have generally low average GPA (3.13) contrary to expectation (of 3.5 - 4.33). This scenario raises one fundamental question, that is; why are students at this Faculty not performing satisfactory despite having the right traits for Engineering and Technology careers. In our qualitative in-depth interviews, students advanced the following as reasons which led to a decline in their academic performance. These were; lack of motivation, too much workload, attitude towards learning and the use of appropriate teaching media. The educator's ability to use appropriate media for teaching and learning plays a pivotal role in this instance. Research shows that most of today's educators are not at the same communicative level with students because university students are reported to be taking social media to a new level through the use of websites such as Facebook, Twitter and LinkedIn. Most educators are perhaps unable to cope with these challenges. The use of social media facilitates learning to take place beyond time prearranged for lectures. Wagner (2011) argues that Facebook and Twitter offer an opportunity to connect with students outside of the classroom in a way that is unprecedented. These media allow real-time collaboration and everyday teaching and learning. In this research, students reported that their educators are not yet in a position to embrace social media in learning and teaching.

The use of social media encourages collaboration, creativity and mastery of ideas and concepts. This approach also encourages non-linear learning. Interaction using social media provides students with a sense of belonging and creates bonds between the students and their peers, and between students and the educator (Kallstrom, 2009). Social media can be used as an effective teaching tool and it has the following advantages:

Increasing learning motivation – Lecturing is the least effective method of student learning. Social media allow students to be more motivated because they participate in the learning activity. For example, showing video or virtual field trip allows students to view it at their own time and reflect on the presentation before they can respond. The reflection time may produce a more complete understanding of the content. Technology can make learning a more immerse, engaging and relevant experience (Dahlstrom et al., 2011).

Collaborative learning – Collaboration is a common feature because the educator, students and peers rely on other experts or professionals to present current accurate content, unique material and links for teaching and learning. These professional will provide more complete information than the educator alone. Discussion groups can be created for class projects or tweet about a concept and the educator can keep track of students' participation, provide guidance and monitor progress.

Location and timing of learning – when links to resources, assignments are available, students will not be tied to location or time schedule for learning (Latham et al., 2012). This allows students held up to read and understand content that they will respond to outside of the physical classroom. The students become more independent.

Learners become content suppliers – Learners become participants in deciding the content. If students are networking with experts, they may find information that they are interested in learning about that goes beyond what the curriculum defines as the requirements. Instead of the educator being the only presenter of content, he/she can use experts to deliver the content. Thus making students to become more productive.

Increased communication – the flow of information is enhanced since students get to practice written communication skills they will regularly use in the world of text communication. Furthermore, the communication is no longer coming from the educator to students but a two-way communication link is established. Social media allows the posting of reminders, upcoming events, schedules changes, posting of documents for easy access to students. Technology helps students feel connected (Dahlstrom et al., 2011).

Therefore, educators need to make better use of technologies that students' value and this can easily be integrated into their learning experiences. These technologies should be used in a more transformative ways such as participatory and collaborative interactions and for high level teaching and learning that is engaging and relevant to students lives and future professional development. Educators need to move strategically toward blended/hybrid learning environments to meet students' preferred styles of learning. They should offer many different ways for students to engage in learning using technology and meet differentiated needs. Perhaps doing so will address the declining students' performance and the issues students raised.

In this study we have been able to appreciate that Field Dependent (FD) and Field Independent (FI) students tend to favour different learning approaches. The learning approach favoured by one kind of a student might simply not work for another different student. In addition, whether one approach will lead to better learning outcomes than the others seems to depend on three fundamental aspects. These are; the specific characteristics of the learning task, the particular circumstances of the learning tasks and the particular circumstances under which learning takes place. Therefore, it is not unreasonable to assume that educators should be aware of the ways in which FD and FI students learn concepts. This is so because such awareness can assist educators to become more effective in adapting and aligning instructional procedures to the needs of these different kinds of learners. Educators may also find ways of helping students diversify their learning strategies. The Faculty of Engineering and Technology at the University of Botswana attracts students with appropriate traits for Engineering and Design careers. However, it is evident that though students' have the suitable traits, their GPA are far from reflecting that as 96% of the students have had a declining GPA since first year and this is raising apprehension. Several factors have been advanced as possible contributors to this occurrence. For example lack of motivation to earn high marks.

There was also a positive correlation between GPA and Learning Style. However this correlation was not significant. The lack of a significant correlation does not suggest no correlation at all as other factors for example small population, might have contributed to this. But since there is a positive correlation perhaps a more extensive research with more individuals as subjects could yield better results. Finally most students at The Faculty of Engineering and Technology at the University of Botswana are analytic and this has to be converted into good academic achievement. Therefore, it is imperative for the University of Botswana to address these challenges as failure to address them could ultimately reflect badly on the reputation of the University as producing half cooked and incompetent graduates.

References

1. Al-Senaidi, S. Lin, L. & Poirot, J. (2009). Barriers to adopting technology for teaching and learning in Oman. *Computers & Education 53*(3), 575-590.
2. Altun, A. & Cakan, M. (2006). Undergraduate Students' Academic Achievement, Field Dependent/Independent Cognitive Styles and Attitudes towards Computers. *Educational Technology & Society,* 9(1), 289-297.
3. Awidi, I. T. (2008). Developing an E-learning strategy for public universities in Ghana. *EDUCAUSE Quarterly, 31*(2), 66-70
4. Chan, L. J. (2009). Applying motivational analysis in a wed-based course. *Innovation in Education and Teaching International Journal, 46* (1), 91-103.
5. Chen, S. Y. & Macredie, R. (2002). Cognitive modelling of student learning in web-based instructional programmes. *International Journal of Human–Computer Interaction, 17*(3), 375-402.
6. Clark, S., Seat, E. & Weber, F. (2000). The Performance of Engineering Students on the Group Embedded Figures Test. *Proceedings of the 30th ASEE/IEEE Frontiers in Education Conference*, October 18-21, 2000. Kansas City, USA.
7. Creswell, J. W. 2002. Educational Research: Planning, conducting, and evaluating quantitative and qualitative research. London: Pearson Education
8. Dahlstrom, E., de Boor, T., Grunwald, P. & Vockley, M. (2011). National study of undergraduate students and information technology, 2011 research report. Boulder, CO: EDUCAUSE Center for Applied Research, Available from http://www.educause.edu/ecar.
9. Davies, A. & Smith, K. 2006. Drivers and barriers to the uptake of learning technologies: Staff experiences in a research-led university, 125-145. In J. O'Donoghue (Ed.) Technology supported teaching and learning: A staff perspective, London: Information Science Publishing.
10. Furnham, A., Monsen, J. & Ahmetoglu, G. (2009).Typical intellectual engagement, big five personality traits, approaches to learning and cognitive ability predictors of academic performance. *British Journal of Educational Psychology, 79,* 769–782.
11. Gable, G. G. (1994). Integrating case study and survey research methods: an example in information systems. *European Journal of Information Systems, 3*(2), 112-126.
12. Garger, S., & Guild, P. (1984). Learning styles: The crucial differences. *Curriculum Review,* 9-12.
13. Garton, B. L., Kitchel, T. & Ball, A. L. (2005). University Admission Criteria and Learning Style: Predictors of Academic Success? NACTA Journal, Retrieved on November 18, 2011. Available at http://findarticles.com/p/articles/mi_qa4062/is_200506/ai_n13643624/?tag=content;col1
14. Garton, B. L., Spain, J. N., Lamberson, W. R., & Spiers, D. E. (1999). Learning styles, teaching performance, and student achievement: A relational study. *Journal of Community development Education, 40*(3), 11-20.
15. Girardi, G. (2008). Extended case study: Teaching and learning economics through cinema. *Economics Network.*
16. Graff, M. (2003). Learning from web-based instructional systems and cognitive style. *British Journal of Educational Technology, 34* (4), 407–418
17. Heaton-Shrestha, C. (2006). Introducing a VLE into campus based undergraduate teaching: Staff perspective on its impact on teaching. *International Journal of educational Research 43,* 370-386.
18. Huang, E. Y., Lin, S. W. & Huang, T. K. (2012). What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. *Computers & Education, 58* (1) 338-349.

19. Jackson, C. Baguma, P. & Furnham. A. (2009). Predicting grade point average from the hybrid model of learning in personality: consistent findings from Ugandan and Australian students. *Educational Psychology, 29* (7) 747–759.
20. Jia-Jiunn, L., Ya-Chen, C., Shiou-Wen, Y. (2012). Designing an Adaptive Web-Based Learning System Based on Students' Cognitive Styles Identified Online. *Computers & Education, 58* (1), 209-222.
21. Jones, S. & Wright, M. (2010). The Effects of a Hypertext Learning Aid and Cognitive Style on Performance in Advanced Financial Accounting. *Issues in Accounting Education, 25* (1), 35-58.
22. Kallstrom, L. (2009). *Blogging: Five advantages of teaching using a blog.* Retrieved on April 27, 2012. Available at http://voices.yahoo.com/blogging-five-advantages-teaching-using-blog-3076890.html
23. Kolloffel, B. (2012). Exploring the relationship between visualizer-verbalizer styles and performance with visual or verbal learning material. *Computers & Education, 58* (2), 697-706.
24. Latham, A., Crockett, K., McLean, D. & Edmonds, B. (2012). A conversational intelligent tutoring system to automatically predict learning styles. *Computers & Education, 59* (1), 95-109
25. Lunt, B. M. (1996). Predicting academic success in Electronics. *Journal of Science Education and Technology, 5*(3), 235-240.
26. Maròn-Garcia, S. (2006). What lecturers say helps and hinders their use of virtual learning environment to support face-to-face learning, 15-33. In J. O'Donoghue (Ed.) *Technology supported teaching and learning: A staff perspective*, London: Information Science Publishing.
27. Medcalfe, S. (2010). The relationship between music and student enjoyment of economics class: how to compete with grand theft auto, crack and chlamydia! Journal of Economics and Economic Education Research, Retrieved on April 30, 2012. Available at http://findarticles.com/p/articles/mi_qa5529/is_3_11/ai_n56345706/?tag=content;col1
28. Murphy, H. J., Casey, B., Day, D. A., & Young, J. D. (1997). Scores on the Group Embedded Figures Test by undergraduates in information management. *Perceptual and Motor Skills, 84*, 1135-1138.
29. Newland, B. Jenkins, M. & Ringan, N. 2006. Academic experiences of using VLEs: Overarching lessons for preparing and supporting teaching and learning, 34-50: In J. O'Donoghue (Ed.) Technology supported teaching and learning: A staff perspective, London: Information Science Publishing.
30. O'Brien, T. P. Bulter, S. M. & Bernold, L. E. (2001). Group Embedded Figures Test and Academic Achievement in Engineering Education. *International Journal of Engineering Education*, 17(1), 89-92.
31. O'Donoghue, J. 2006. Technology supported teaching and learning: A staff perspective. London: Information Science Publishing.
32. Passmore, D. L. (2000). Impediments to adoption of wed-based course delivery among university faculty. *Proceedings of EdTech 2000.* Available online at http://train.edu.psu.edu/documents/edutech/edt.pdf. (Retrieved November 16, 2011).
33. Redmann, D. H., Kotrlik, J. W. & Douglas, B. B. (2003). Factors related to technology integration in instruction by marketing education teachers. *Journal of Carer and Technical Education, 19*(2). Available online at http://scholar.lib.vt.edu/ejournal/JCTE/v19n2/redmann.html . [Retrieved November 16, 2011].
34. Dahlstrom. E. De Boor, T. Grunwald, P. & Vockley, M. (2011). National study of undergraduate students and information technology. Retrieved on November 21, 2011. Available at http://net.educause.edu/ir/library/pdf/ERS1103/ERS1103W.pdf
35. Rogers, P. L. (2000). Barriers to adopting emerging technologies in education. *Journal of Education Computing Research, 22*(4), 455-472.

36. Ruttun, R. (2009). The Effects of Visual Elements and Cognitive Styles on Students' learning in Hypermedia Environment. *World Academy of Science, Engineering and Technology*, (49), 963-971.
37. Saris, W. E. & Gallhofer, I. N. 2007. Design, evaluation, and analysis of questionnaires for survey research. New Jersey: John Wiley & Sons.
38. Wagner, R. (2011). Educational technology: social media tools for teaching and learning. *Athletic Training Education Journal*, *6* (1), 51-52.
39. Watts, Michael. 2003. *The Literary Book of Economics: Including Readings from Literature and Drama on Economic Concepts, Issues and Themes.* Wilmington, Delaware: ISI Books.
40. Witkin, H. A. Oltman, P. K. Raskin, E. & Karp, S. A. 1971. Group Embedded Figures Test Manual. Palo Alto: Consulting Psychologist Press.

Relevance and philosophical views of design science research

Christian Sita Mampuya
Cape Peninsula University of Technology
Cape Town, South Africa
206024835@mycput.ac.za

ABSTRACT

The purpose of this paper is to review the philosophical aspects of the author's master's research which is still in progress. Design Science Research has been advocated as the alternative solution to the reliance gap within information technology research community. Despite its wide acceptance among researchers in various fields such as Management studies, education studies, etc, philosophical demarcations of this relatively new research paradigm remain unclear. In this paper, I have demonstrated the much debated relevance of Design Science Research as the most practical paradigm to create tested practical solutions to practical problems while generating practical knowledge along the process. On the philosophical side, my findings pointed out to the existence of a pluralistic nature in the Design Science Research that would allow any research approach to be used in a "plug-and-play" fashion.

Key words: Design Science Research, Research Evaluation, Design Theory.

INTRODUCTION

The main discussion of this paper is articulated in three sections. In the first section of this article, we explore the relevance of Design Science Research as a research paradigm in IS research field. It stands out that prior to the adoption of Design Science Research in IS, the traditional research paradigms, namely positivism and interpretivism, had their fair share of what has been termed as "relevance problem" in the sense that research outputs were not practice-friendly. The practitioners in the IS field felt that academics produced knowledge that did not address their concerns. Therefore, they could not have any interest in knowledge that was not relevant to them. With the use of Design Science Research, practitioners had a sense of gaining knowledge that was produced with practical utility. In this sense, Design Science Research has proven to be a very relevant paradigm in the IS-based research community.

In the second section, we look under the hood of Design Science Research to get a sense of its philosophical underpinnings. Design Science Research cannot be described as a traditional research paradigm (positivism or interpretivism), since it builds its understanding of the world and of how to know the world on the traditional paradigms. Therefore, its philosophical underpinnings accept a pluralistic approach and will allow the researcher, based on his or her creativity and experience, to choose the philosophical assumptions that best suit the research project.

In the third section, as a result of the pluralistic nature of the philosophical underpinnings of Design Science Research, methodological pluralism has been advocated as the most suitable methodology to conduct and evaluate Design Science Research. Methodological pluralism lets the researcher integrates a number of theories and methods into his or her research project.

RELEVANCE OF DESIGN SCIENCE RESEARCH

The relevance debate within the IS (Information System) research community has prompted a number of scholars to seek means and ways of effectively addressing it. It is in line with such quest that researchers began exploring the concept of Design Science Research (DSR) as an alternative research paradigm in IS. In quite a number of research fields, the relevance between practice and academia has been the focal

point of most heated debates and tend to be a universal research problem. For example, Worrall et al. (2007) raised the relevance issue in Management studies, Ross et al. (2010) address the Relevance issue in Educational Technology Research, Nwokah et a. (2009) evoked the question of relevance in Marketing information research. It is worth noting that the real purpose of the relevance versus rigor debate in IS study field is to put a particular spotlight on the necessity of researchers to ensure that their research projects adhere to scientific principles and methods while they focus on a wider audience that would absorb their research findings based on their relevant and practical merits. Researchers in the IS field need to be conscious of the burden on them of achieving a certain balance between relevance and rigor. Therefore, given this much-spoken-about issue, I argue that for a research paradigm to be more viable within the IS research field, it has to offer a certain balance between relevance and rigor, meaning it has to provide researchers with tools to produce or create practical knowledge, which tools should exhibit scientific connotation in the process of creating such practical knowledge.

With its strong orientation towards artefacts creation, unlike its traditional counterparts which are widely used in IS research field (i.e. positivism, interpretivism, etc), Design Science Research stands tall as the research paradigm that provides more relevance through the creation of artefact that embeds practical knowledge. Carlsson (2005) argued that "the aim of IS design science research is to develop practical knowledge for the design and realization of different classes of IS initiatives, where IS initiatives are viewed as socio-technical systems and not just IT artefacts". In the same line of thoughts, Hevner et al. (2004), when explaining the key role played by the phase of evaluating DSR outputs in the form of artifacts, mentioned that "the second important design process involves the evaluation of the created artifact to provide feedback and generate new knowledge about the problem at hand. The newly generated insights serve to improve both the quality of the artifact and the design process". Also Hrastinsk et al. (2008) wrote that "unless we have a technologically deterministic view, the aim of IS design science research should be to develop practical knowledge not only for the design and improvement of IS and IT artefacts, but also for IS use and management". Hrastinsk et al. (2008) have in their attempt to clarify the purpose of DSR, put a particular emphasis on the production of practical knowledge through the creation of artifact in DSR. Such knowledge will benefit not only the IS or the design of the artifact, but other design-oriented research fields such as management. It is quite clear that the artifact as a research output from DSR embeds practical knowledge that serves as a strong pillar of its relevance.

The practical usability of knowledge created through DSR has a direct impact on the environment where it is implemented. In this regard, Design Science encompasses a certain degree of pragmatism which corroborates its much anticipated and now widely recognised relevance. Exactly two decades ago, Fuller (1992) suggested that "the function of - what I call - design science is to solve problems by introducing into the environment new artifacts, the availability of which will induce their spontaneous employment by humans and thus, coincidentally, cause humans to abandon their previous problem-solving behaviors and devices. For example, when humans have a vital need to cross the roaring rapids of a river, as a design scientist I would design them a bridge, causing them, - I am sure, - to abandon spontaneously and forever the risking of their lives by trying to swim to the other shore". This illustrated perspective justifies the relevance of DSR by highlighting the impact that it has upon the envrionment or the domain of application of its artifacts. Also, Hovorka (2009) specified that "design (as an artifact) can be seen as contributing to knowledge as it can be applied in the service of action and then is evaluated based upon value-driven goals measured over time. Design shifts from a predictive mechanism to a generative process incorporating system dynamics, because the design process incorporates information technologies as a component embedded in complex social processes. The information system is not simply an artefact to be designed and then appropriated "as is", but rather is an assembly of things and people whose selection, configuration, implementation, and use is a generative process itself. This notion aligns with the emerging body of literature which views information systems design as a situated social action". DSR enjoys the particularity of being, through its very nature, a paradigmatic research type that is intimately intertwined with the context in which its artifacts are going to be deployed, which context is

the very environement from which problem requirements were generated. This particular privilege arms DSR with the abitlity to have practical impact on the context (or evironment) components, thus proving its practicality and relevance.

Given its intrinsic focus on the production of practical knowledge through the creation of artifact, coupled with its strong pragmatic impact on the environment or social context of its artifact implemantion, DSR can be legitimately perceived as the research pradadigm that provides more relevance in IS research field.

PHILOSOPHICAL ASSUMPTIONS OF DESIGN SCIENCE RESEARCH

Since DSR complements existing research paradigms through a special focus on utility and not the discovery of truth, it is quite interesting to note that it does not embed specific ontological and epistemological views of its own. The researcher is entrusted the responsibility of chosing an approach or methodology for the evaluation, which will consequently inform the philosophical beliefs underpinning the whole research project. This view is clearly supported by Smith (1995) who stated that "design science attempts to create things that serve human purposes, as opposed to natural and social sciences, which try to understand reality". Later on, Hevner et al.(2004) in their desicription of the duality of Design Science and Bahavioural Science, have noted that "truth (justified theory) and utility(artifacts that are effective) are two sides of the same coin and that scientific research should be evaluated in light of its practical implications". This dichotomous position clearly sets DSR on a trajectory that cannot across natural sciences domain in which philosophical stances are clearly spelled out. Though, we are not going to entertain the preoccupation of whether utility can constitute valid science, we assume that the search of utility as advocated in DSR does not hurt its scientific claim of being a valid research paradigm since the consumption and production of truth (the other side of the coin) would utilise known scientific methods based on the chosen philosophical approach or orientation.

Considering that DSR is not confined within the demarcations of any philosophical system of beliefs since it accepts different research approaches or orientations (which bring on underpinning philosophical stances in terms of ontology, epistemology, methodology, axiology, etc.) to be plugged and played into it, I therefore argue that DSR is to be viewed as a pluralistic research paradigm that leaves the researcher with the crucial liability of defining and framing the research philosophical orientation based on his or her choice of the research approach to be plug into DSR. My viewpoint is better subtantiated by Niehaves (2007) who supports a "pluralistic philosophical approach that does situate Design Science Research as a third paradigm, completing positivism and interpretivism".

Firstly, the Grounded Theory Method (GTM) has been quoted as a possible philosophical orientation that should drive DSR. GR Wayne (2010) compared Design Science Research to Grounded Theory in order to contrast similaries and dissimilarites with the possibility of pinpointing potential avenues of joint use in a resarch project. It is interesting to note that he started by advocating for a pluralistic approach in Design Science Research and ended up affirming that the two (DSR and GTM) complement each other. He later on stated that "Grounded Theaory enables researchers to develop grounded substantive theory and make a contribution to the knowledge base. The goals of solving a real-world problem to achieve practical relevance and developing a theoretical contribution to achieve scientific rigor can be combined. To avoid possible pitfalls, researchers combining DSR and GTM into a pluralistic research design must take great care in combining the different research strategies in a way that is consistent with the characteristics of each single strategy".

Secondly, Action Resarch can be put at contribution to leverage the philosophical orientation deficit of DSR. Jarvinen (2005) and Livari & Venable (2009) have done a thorough comparison of DSR and Action Research. Though the two articles seem not to look eye to eye, but both recognise the beneficial

possibility of combining the two in such a fashion that Action Research, with its set of ontological and epistemological views, will strengthen and make scientific the process of research in DSR.

Thirdly, Pragmatism has emerged as a privileged philosophical orientation to be seriously considered in DSR as it encompasses a practical dimension that meets the requirement of relevance which is a core element of the acceptance of DSR in the IS-based research field. Andriessen (2007) wrote that "Design-based research (Design Science Research) is a particular type of research that:
(a) is aimed at answering design questions,
(b) that can be based on a variety of conceptions of reality,
(c) that is based on a pragmatic epistemology, (d) and that can make use of different research methodologies".

Fourthly, Critical realism has been also proposed in order to support the philosophical orientation of DSR. Carlsson (2005) argues for a broader view on IS design science research and for grounding IS design science research in the philosophy of critical realism. In his academic dissertation on the use of e-learning, Koponen (2009) wrote that "critical realism can be regarded as an underpinning philosophy for design science, as critical realism have implication for what can be said about how to design, i.e., develop and implement solutions, and how this knowledge can be developed". Johnston and Smith (2010) pointed out the usefulness of critical realism in writing that "critical realism presents a number of insights that profoundly clarify a discussion of validity in practitioner-oriented theory-testing research". They have elaborated extensively on how critical realism has leveraged the issue of validity in theory-testing research, which is one of the principal facets of DSR.

We may infer that since DSR can be combined with other research approaches (Grounded theory, Action Research, Critical Realism, and so on) which possess accepted philosophical views (ontology, epistemology, methodology, and so on) needed to conduct appropriate scientific inquiry, DSR should be regarded as a pluralistic research paradigm.

DESIGN SCIENCE RESEARCH METHODOLOGY AND FRAMEWORKS

Given the fact that our analysis of the philosophical orientation of DSR led to the recognition of its intrinsic pluralistic nature, it would be inaccurate to specify beforehand a certain methodology which should naturally flow from ontological and epistemological views accepted within the paradigm. DSR pluralistic nature, in simple terms, entails the liberty of choice of the researcher to "plug and play" any research approach (orientation) that would better match the subject of inquiry. Wether there must be objective and independent indicators that should dictate the researcher's choice of research approach to incorporate within DSR, would consitute a good topic of investigation and is beyond the scope of this article. With that mind, we rather focus on frameworks that outline possible courses of actions (research activities) that need to be taken for achieving the overall aim of a research project, regardless of which research approach or philosophical orientation has been chosen by the researcher.

Literature on proposed framewoks for conducting and evaluation valid DSR is quite abundant. Of all the frameworks used in Design Science Research project, I argue that the Hevner et al.'s framework (Fig. 1) is the best research framework for conducting and evaluation DSR research based on its relevance, rigour and wide acceptance within the broader design-oriented research community.

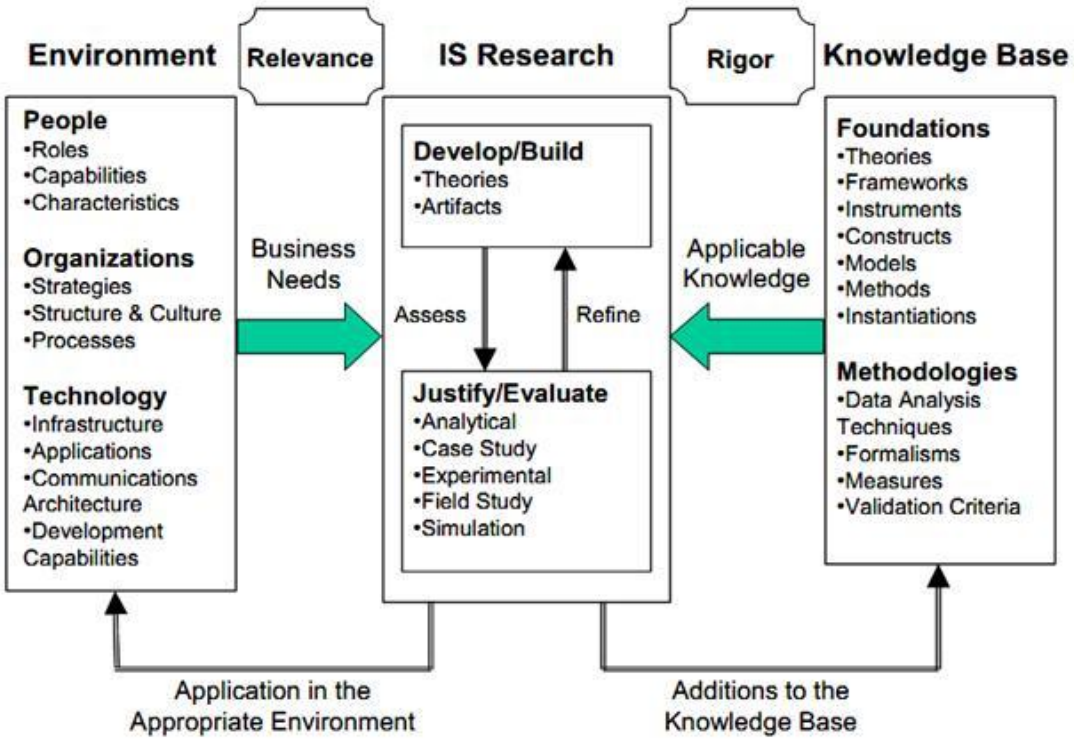


Fig. 1: Design Science Research Framework (source: Hevner et al, 2004)

Hevner at al (2004) have extensively detailed a three-cycled framework that shape any DSR project, from its inception to the dissemination of its findings. Later, Hevner (2007) brings more clarity in defining the role each of the three cycles (Fig. 2) is intended to accomplish by stating that "The Relevance Cycle inputs requirements from the contextual environment into the research and introduces the research artifacts into environmental field testing. The Rigor Cycle provides grounding theories and methods along with domain experience and expertise from the foundations knowledge base into the research and adds the new knowledge generated by the research to the growing knowledge base. The central Design Cycle supports a tighter loop of research activity for the construction and evaluation of design artifacts and processes."

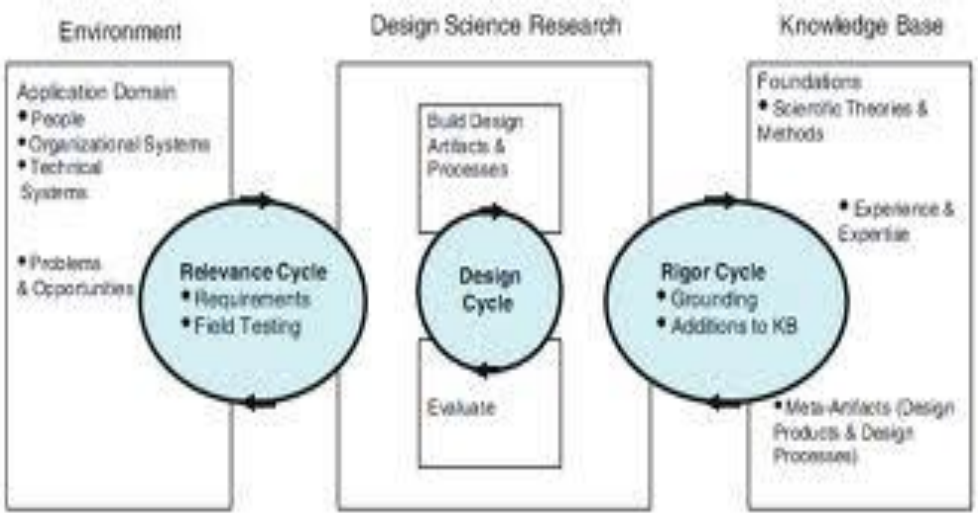


Fig. 2: 3 Cycles of the Design Science Research Framework (source: Hevner et al, 2004)

Though there are some critiques on the methodlogical contribution of the framework proposed by Hevener et al.(2004), it is important to note that Hevner et al (2004) did not propose a methodology as they did not focus on the philosophy of DSR in their essay article, instead their proposed framework has

the value of provinding a sort of roadmap for conducting and evaluating a valid DSR. The same proposed framework leaves eanough ground for other research approach (which would bring along an underpinning philosophical orientation) to be used in the process. Indulska & Recker (2008) are among the authors claimed that there is no methodological value of the Hevner et al(2004) framework, though they did recognize its wide acceptance by an increased publication of papers building on the framework.

There are other proposed DSR frameworks that exhibit characteristics quite similar with the one proposed by Hevner et al.(2004). For example, McKay & Marshall (2007) proposed a multi-paradigmatic framework that incorporates the social and organizational context of IT artifact. The framework impacts the range of topics that Design science can embrace and kind of methods that can be employed to correctly produce knowledge. This framework present similarities Hevner et al's one, in that the relevance cycle meets the needs of the social and organization context of IT artifact.

CONCLUSION

This article has attempted to review the current literature published on Design Science Research. First, we explored the relevance of Design Science Research within the IS-based research community. Design Science Research has proven to be the paradigm that successfully address practical and academic relevance in knowledge production. Secondly, we moved on the philosophical underpinnings of Design Science Research where we found that many publications are advocating the use of pluralistic approach based on traditional philosophical assumtions such as positivism, interpretivism, etc. Thirdly, we went deep into Design Science Research to understand its methodological base, where methodoligical pluralism has been suggested. Also, we looked into the frameworks that best capture the philosophical underpinnings, where the Hevner et al. (2004) has received wide adoption.

REFERENCES

1. **Andriessen**, D. 2007. *Combining Design-Based Research and Action Research to test Management Solutions*. Paper presented at the 7th World Congress Action Learning, Action Research and process Management, Groningen, 22-24 August, 2007.

2. **Avenier**, M.J. & **Bartunek**, J. 2010. *Bridging a Supposedly Unbridgeable Gap: Elaborating Scientific Knowledge from and for Practice*. Unité Mixte de Recherche CNRS / Université Pierre Mendès France Grenoble 2.

3. **Bartlett** & **Piggot-Irvine**, 2007, *Evaluating Action Research*, <http://www.nzcer.org.nz/nzcerpress/evaluating-action-research>

4. **Bartneck**, C. 2009. *Using the Metaphysics Of Quality To Define Design Science*.
5. Proceedings of the 4th International Conference onDesign Science Research in Information Systems and Technology, Malvern, Pennsylvania, Article No. 6. | DOI: 10.1145/1555619.1555627.

6. **Bartunek**, J.M. 2011. *What Has Happened to Mode 2?*. British Journal of Management, Vol. 22, 555–558 (2011).

7. **Carlsson**, S., 2005, *Developing Information Systems Design Knowledge: A Critical Realist Perspective*, The Electronic Journal of Business Research Methodology Volume 3 Issue 2, pp 93-102, available online at www.ejbrm.com

8. **Eriksson**, C.I., **Akesson**, M., & **Kautz**, K. 2011. *Authentic and Concurrent Evaluation –Refining an Evaluation Approach in Design Science Research*. Proceedings of PACIS 2011.

9. **Friedman**, K. 2003. *Theory Construction in Design Research: Criteria, Approaches, and Methods*". Design Studies (2003)
10. Volume: 24, Issue: 6, Pages: 507-522, Elsevier.

11. **Fuller**, R. B., 1992, *Cosmography, A Posthumous Scenario for the Future Of Humanity (with Kiyoshi Kuromiya),* New York, NY: Macmillan Publishing Company.

12. **Gero**, J.S. 2006. *Research Methods for Design Science Research:*
13. *Computational and Cognitive Approaches.* Key Centre of Design Computing and Cognition,
Department of Architectural and Design Science, University of Sydney
14. NSW 2006 Australia.

15. **Gregor**, S. 2009. *Building Theory in the Sciences of the Artificial*. Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2009.

16. **Gulati**, R. 2007. *Tent poles, tribalism, and boundary spanning: The rigor-relevance debate in management research*. Academy of Management Journal, 50(4): 775–782.

17. Hartmann, A. & **Dewulf**, G. 2011. *Challenges and Opportunities of Community-Engaged Research in Construction Management*. Proceedings – EPOC 2011 Conference (Engineering Project Organizations Conference).

18. **Harvey**, L & **Myers**, M.D., 1995, *Scholarship and practice: the contribution of*
19. *ethnographic research methods to bridging the gap*, Information Technology &
20. People, vol.8, no.3.

21. **Hevner**, A. R. 2007. *A Three Cycle View of Design Science Research*. Scandinavian Journal of Information Systems: Vol. 19: Iss. 2, Article 4.

22. **Hevner**, A.R., **March**, S.T., **Park**, J. & **Ram**, S. 2004. *Design Science in Information Systems Research*. MIS Quarterly Vol. 28 No. 1, pp. 75-105/March 2004.

23. **Hovork**, D.S., 2009, *Design Science Research: A call for a pragmatic perspective.*

24. **Indulska**, M. & **Recker**, J.C. 2008. *Design Science in IS Research: A*
25. *Literature Analysis*. In Gregor, Shirely and Ho, Susanna, Eds. Proceedings 4th
26. Biennial ANU Workshop on Information Systems Foundations, Canberra,
27. Australia.

28. **Jarvinen**, 2005, Action Research as an approach in Design Science.

29. **Kieser**, A. & **Leiner**, L. 2009. *Why the Rigour-Relevance Gap in Management Research is Unbridgeable*.Journal of Management Studies, Vol. 46, Issue 3, pp. 516-533, May 2009. Available at SSRN: http://ssrn.com/abstract=1394613 or doi:10.1111/j.1467-6486.2009.00831.x

30. **Kemmis**, S. & **McTaggart**, R., 1988, *The Action Research Planner* (3rd edn), Deakin University, Geelong. <http://www.aifs.gov.au/sf/pubs/bull1/tl2.html>

31. **King**, D. & **Kimble**, C. 2004. *Uncovering the Epistemological and*

32. *Ontological Assumptions of Software Designers*. Proceedings of the 9ème Colloque de l'AIM, (May 2004), Evry, France, 2004.

33. **Koponen**, E, 2008, *The development, implementation and use of e-learning: critical realism and design science perspectives.*
34. **Livari** & **Venable**, 2009, *Action Research and Design Science Research – Seemingly similar but decisively dissimilar*.

35. **McKay**, J. & **Marshall**, P. 2007. *Science, Design, and Design Science: Seeking Clarity to Move Design Science Research Forward in Information Systems*. Proceedings of the 18th Australasian Conference on Information Systems (2007), 5 – 7 December 2007, Toowoomba, Australia.

36. **McKay**, J. & **Marshall**, P. 2007. *Science, Design, and Design Science: Seeking Clarity to Move Design Science Research Forward in Information Systems*. Proceedings of the 18th Australasian Conference on Information Systems (2007), 5 – 7 December 2007, Toowoomba, Australia.

37. **McLaren**, T. & **Buijs**, P. 2011. *A Design Science Approach for developing Information Systems Research Instruments*: 6th International Conference on Design Science Research in Information Systems and Technology (DESRIST 2011), Milwaukee, USA.

38. **Mingers**, J. & **Brocklesby**, J. 1997. *Multimethodology: Towards A Framework for Mixing Methodologies*. International Journal of Management Sciences 25, 489-509.

39. **Niehaves**, B. 2007. *On Epistemological Diversity in Design Science – New Vistas for a Design-oriented IS Research*?. Twenty Eighth International Conference on Information Systems, Montreal 2007.

40. **Nwokah**, N.G., **Bariyima**, D.K. & **Anthonia** E. B., 2009, *Philosophical Foundations and Research Relevance: Issues for Marketing Information Research*, European Journal of Scientific Research, EuroJournals Publishing, Inc. 2009

41. **Peffers**, K., **Tuunanen**, T., **Rothenberger**, M.A. & **Chatterjee**, S. 2007. *A Design Science Research Methodology for Information Systems Research*. Journal of Management Information Systems / Winter 2007–8, Vol. 24, No. 3, pp. 45–77.

42. **Pries-Heje**, J.R., **Baskerville**, R. & **Venable**, J. 2008. *Strategies for Design Science Research Evaluation*. Paper presented at the In Proceedings of the 16th European Conference on Information Systems(ECIS), Galway, Ireland.

43. **Purao**, S. 2002. *Design Research in the Technology of Information Systems: Truth or Dare*.

44.**Ross** , S.M., **Morrison** , G.R., & **Lowther** , D.L., 2010, *Educational Technology Research Past and Present: Balancing Rigor and Relevance to Impact School Learning*, CONTEMPORARY EDUCATIONAL TECHNOLOGY.

45. **Saunders**, C., 1998, *The Role of Business in IS Research*, Information Resources Management Journal, Winter 1998, pp. 4-6.

46. **Schermann**, M., **Gehlert**, A., **Krcmar**, H. & **Pohl**, K. 2009. *Justifying Design Decisions with Theory-Based Design Principles*. Proceedings of the 17th European Conference on Information Systems. ECIS2009-0290.R1.

47. **Simon**, H.A. 1969. *The Sciences of the Artificial*. First edition. MIT~Press, Cambridge, Massachusetts.
48. **Straub**, D. & **Ang**, S. 2011. *Rigor and Relevance in IS Research: Redefining the Debate and a Call for Future Research.* MIS Quarterly (2011), Volume: 35, Issue: 1, Pages: iii-xi.

49. **Venable**, J. 2006. *The Role of Thoery and Thoerising in Design Science Research*. Proceedings of the DESRIST 2006, February 24-25, 2006. Claremont, CA, United States of America.

50. **Wadsworth**, Y., 1997(a), *Everyday Evaluation on the Run* (2nd edn), Allen and Unwin/Action Research Issues Association, Sydney. (http://www.aifs.gov.au/sf/pubs/bull1/tl2.html)

51. **Weber**, S. 2010. *Developing a Model for Theory-generating Design Science Research – Research in Progress* in: Doctoral Consortium of the DESRIST 2010: 5th International Conference on Design Science Research in Information Systems and Technology , St. Gallen, Switzerland , 2010.

52. **Worrall, L., Lubbe, S. & Klopper, R., 2007,** *Academic Research and*
53. Management Practice:Is the Relevance Gap Closing?

54. **Yoris**, A. 2001. *Design Science I: The role of Design Science in Electronic Commerce Research,* Communications of the Association for Information *Systems*: Vol. 7, Article 1.

55. **Zawedde**, A., **Lubega**, J.T., **Kidde**, S. & **Nakiyimba**, I. 2010. *Methodological Pluralism: An Emerging Paradigmatic Approach to Information Systems Research*. In Kizza, M. J., Lynch, K, Aisbett, J, Nath, R. and Vir, P.: *Strengthening the Role of ICT in Development*, Vol. VI pp. 99-128.

56. **Zmud**, R. "Editor's Comments," MIS Quarterly (20:2), June 1996a, pp. xxi-xxiii.

57. **Zmud**, R. "Editor's Comments," MIS Quarterly (20:3), September 1996b, pp.

Design research and research design - bringing the two together

Johannes C Cronjé & Ilse Oberholzer,
Faculty of Informatics and Design,
Cape Peninsula University of Technology
cronjej@cput.ac.za

Abstract

This paper will consider the phenomenon of Design Research as described by Van den Akker (2007). It will then consider Peter Rowe's (1987) four research positions, and then it will present a perspective of Design Research through the lens of Burrell and Morgan's (1979) model of research paradigms in social science research. The paper will show how Rowe's four design perspectives map directly onto Burrell and Morgan's research paradigms, and how by rotating through these paradigms, a design research cycle is formed. Finally, the paper will discuss four research questions that drive design and development research and illustrate this by way of a case study.

Introduction

In an academic environment where the production of creative outputs and academic research are often regarded as mutually exclusive, design research presents a useful tool for extracting publication value from the production process. The premise on which this article rests is that four of the perspectives of design thinking, as described by Peter Rowe (1978) can be mapped directly onto Burrell & Morgan's four paradigms of social research, and that by addressing these paradigms sequentially a design-research cycle is formed that follows the four stages described by van den Akker (2007).

Literature survey

Van den Akker (2007, p. 45-46) distinguishes four stages in design research: *Preliminary investigation, Theoretical embedding, Empirical testing;* and *Documentation, analysis and reflection on process and outcomes. Preliminary investigation* amounts to a systematic search of a particular context for elements and connections, through literature surveys, case studies, etc. to arrive at an overview of the needs and problems of the intended users. *Theoretical embedding* relates to coming to an understanding of the rationale of the potential solution. *Empirical testing* determines the practicality and effectiveness of the intervention, while *Systematic documentation, analysis and reflection on process and outcomes* amount to a reflection of what has been achieved in order to strengthen future development. Of course it is easy to see that van den Akker's framework can be cyclic. What is learnt from the *analysis* in the last phase feeds into the *primary investigation* of the second phase. Nevertheless it is absolutely possible to consider each of these phases in isolation.

Peter Rowe (1978) presents a framework of four design positions that architects take in their design of spaces. "First there is a *functionalist* position, distinguished by an emphasis on the accommodation of activities and the influence of building technology. Secondly there is a *populist* position, characterized by an acknowledgement and interpretation of contemporary commonplace building practices and user preferences. Third, there is a *conventionist* position, using a largely historical reference; and finally, a *formalist* position, using an architecture of formal possibilities for their own sake" (Rowe, 1978:124).
If one analyzes Rowe's four positions along two dimensions, they would fit onto on a 2 x 2 matrix, as is shown in Figure 9. The first dimension relates to the existence or absence of a "best solution". At the one extreme of the dimension is the conventional belief that there is one implied best solution to a problem and that regardless of whether or not that solution can be achieved, reaching it remains the ultimate functional goal. At the other extreme is the belief that there may be an infinite number of solutions and that these solutions are dependent on an infinite number of contexts. These contexts could relate to people (populist) or to form (formalist).

The second dimension relates to the abstract or concrete nature of the design problem or message. At the abstract extreme lies the formalist desire to follow the possibilities that the form presents, and the conventionist practice of using a set of abstractions that have developed over time. At the concrete extreme lies the practical reality of popular acceptance or functional use.

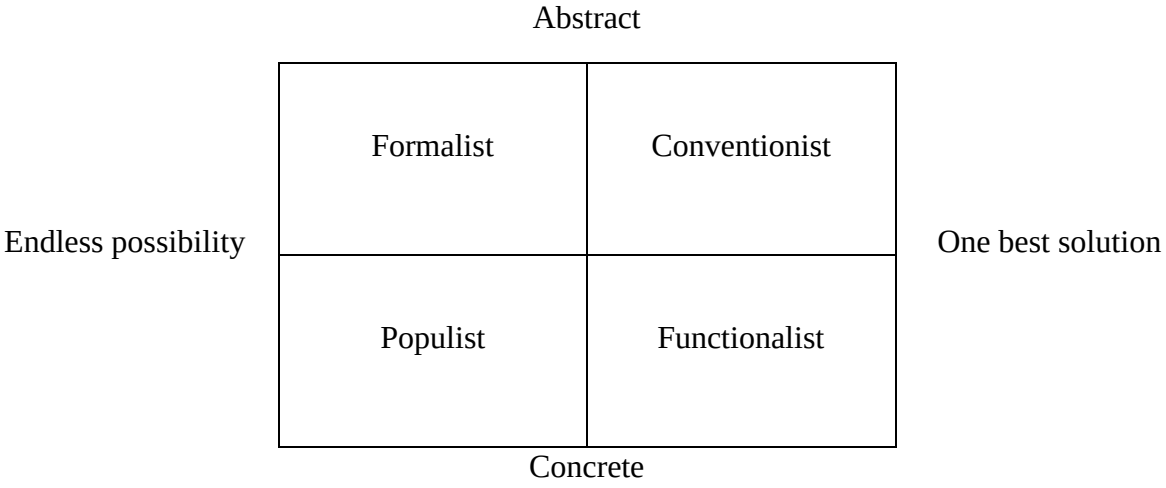


Figure 9 Four design positions – developed from Rowe, 1978

Burrel & Morgan (1979) propose four mutually exclusive paradigms of social science research, postulated on two orthogonal dimensions. The dimensions are the nature of social science research and the nature of society. The nature of social science research varies between positivist and anti-positivist. It is my contention that the positivist dimension might also be called the objective dimension. The nature of society ranges from a society of regulation to a society of radical change. One could argue that the society of radical change is concerned with abstract views of reality, while the society of regulation tends to be concerned with more concrete realities. The end-result is a two-by-two matrix as is shown in Figure 10. The following section will describe each of the paradigms in one sentence, and give my interpretation of the *aim* of each of the paradigms.

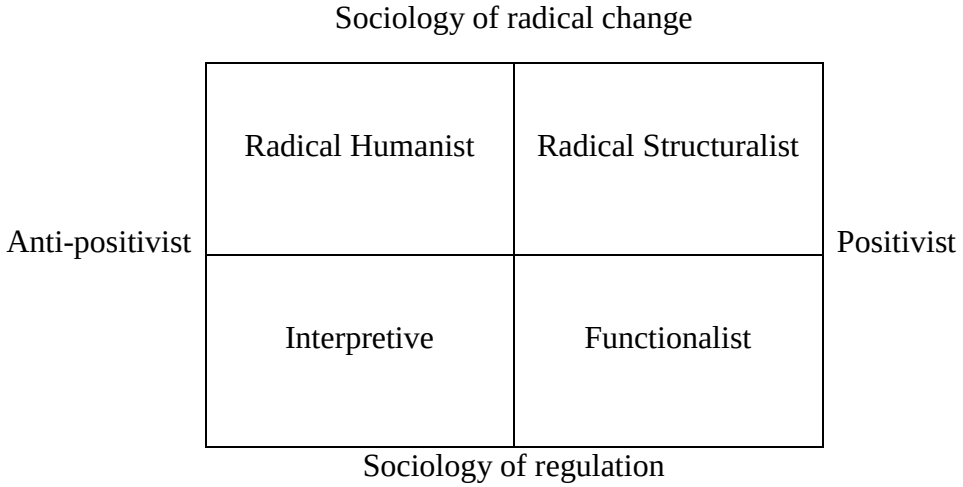


Figure 10 *Four paradigms for the analysis of social theory. Source: Burrell & Morgan (1979:22)*

Radical humanists aim to *explore* alternatives. They are interested in the subjective world, but feel the need to transcend or even overthrow current societal arrangements. Interpretivists aim to understand and *explain* alternatives. They believe that the human experience of the world is subjective, and they have a concern to understand it as it is. Functionalists aim to *develop* solutions. They believe that the world is objectively discoverable, and that things can be improved by "tightening up" the rules. Radical structuralists aim to *describe* the position as it is. They have an objective world view. They concentrate on structural relationships, believing that radical change is built into the very nature of society.

Roode (1993) uses Burrell & Morgan's model to argue that research questions and methods can be developed for each of the paradigms, and that such research could take place sequentially through each quadrant to form a framework for process-based research. He identifies four research questions that could be asked *What is; how does; why is; and how should*?

Roode's questions map directly onto Burrell & Morgan's model if one were to associate *How should?* with the positivist dimension, and *How does?* with the anti-positivist. *What is?* Relates to a society of radical change, because "In a society of radical change it is essential to know what the current situation is, so that it might be overthrown or transcended" (Cronje, 2011 p.4). *Why is*? goes with a society of regulation because "it is essential to know what the rules are meant to achieve" (Cronje, 2011, p.4).

It is now possible to generate one combined matrix of design thinking and design research in the social sciences, by combining all the positions discussed thus far (Figure 10).

Abstract

What are...?

Sociology of radical change

	Explore	**Describe**	
Anti-positivist	Radical Humanist	Radical Structuralist	Positivist
How does...?	Formalist	Conventionalist	**How should...?**
Subjective	Interpretive	Functionalist	***Objective***
Endless possibility	Populist	Functionalist	One best solution
	Explain	**Develop**	

Sociology of regulation

Why is...?

Concrete

Figure 11 Research aims and research questions

The model described in Figure 11 shows a related set of design positions, research aims, research paradigms, and research questions. Burrell & Morgan's assertion that these paradigms are mutually exclusive would imply that one can do only one research project at a time. Roode (1993) however, advocates that although one can only work in one paradigm at a time, it is certainly possible to work in each paradigm sequentially. In determining the sequence in which these paradigms could be addressed, Van den Akker's (2007, p. 45-46) stages of design research: *Preliminary investigation, Theoretical embedding, Empirical testing;* and *Documentation, analysis and reflection on process and outcomes,* become relevant. *Preliminary investigation* amounts to an exploration of terrain, and would therefore map onto the "Explore" quadrant of Cronje's (2011) combined model. Since a theory is meant to explain, the *Theoretical embedding* phase would map onto the "Explain" quadrant, while *Empirical testing* amounts to development. Finally the *Documentation, analysis and reflection on processes and outcome,* maps directly onto the "Describe" quadrant (Figure 12).

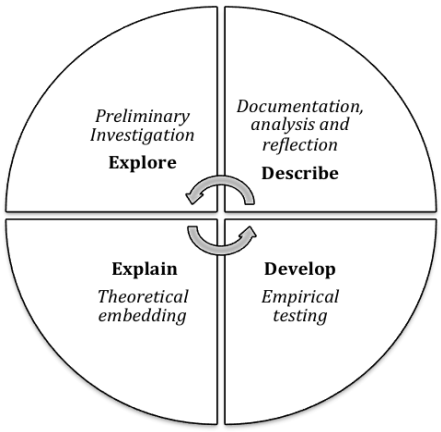


Figure 12 The design research cycle

If the wheel described in Figure 12 were turned in an anti clockwise direction it would generate a spiral pattern that cycles through the four design activities. Such a cycle would closely match the one described by McKenny (2001) shown in Figure 13.

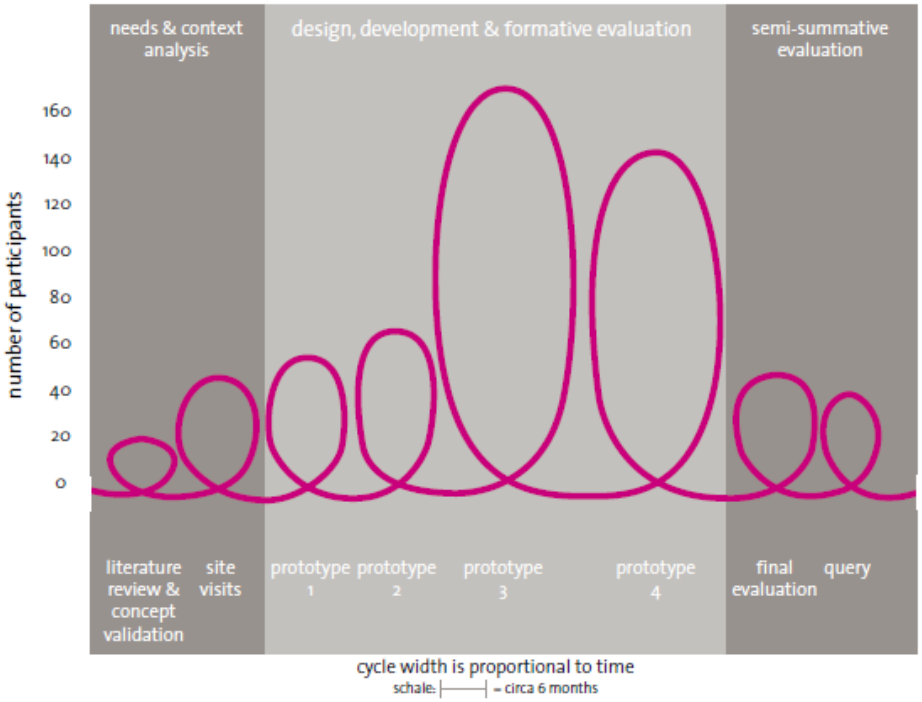


Figure 13 A typical design research cycle (McKenny, 2001)

The question now remains, "what happens in each of the cycles?"

The relationship between research and design in design research

As was stated in the introduction the central problem driving this study lies in the integration of design and research. The solution lies in separating out two streams a design stream and a research stream. What this means is that research will be the result of design, and design will be the result of research, as is illustrated by Figure 14

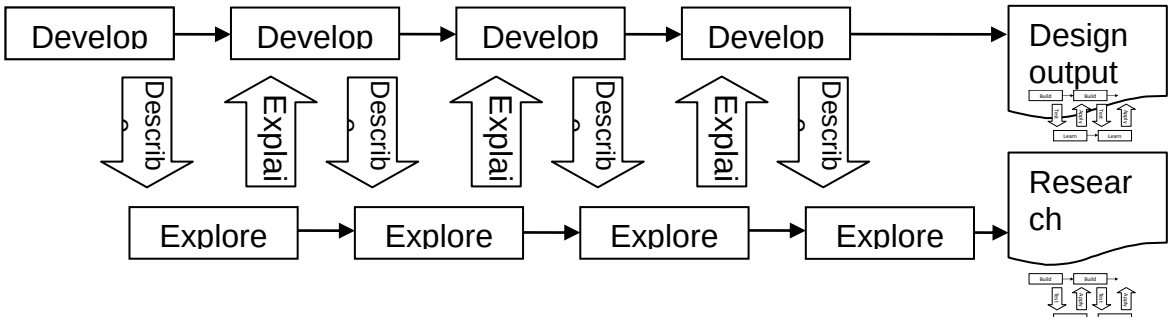


Figure 14: The Design-Research Cycle

velop" with "build". It could be argued that nothing can be described unless it has been tested. A graph or histogram, for instance, is the plotted result of some test or another – so "describe" might be replaced with "test". Similarly to explain really means to apply knowledge to a context. And by some stretch of the imagination it could be argued that the end product of any exploration is learning. We explore to learn what is there. Thus, by replacing the words *develop, describe, explore* and *explain* with *build, test, learn* and *apply* respectively, a very simple model can be developed of a process in which design and research are two parallel streams, connected by testing and application.

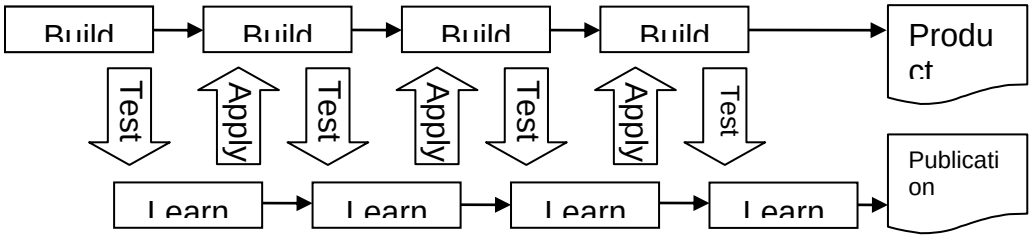


Figure 15 Build, Test, Learn, Apply...

The bigger picture

Figure 16 shows the cycle with the new verbs included. The aim of the preliminary investigation phase is to explore the terrain so that the researcher can learn (or get to know) the basic issues that come into play. Once those issues are on the table, the aim of the phase of Theoretical embedding is to apply those issues to theoretical situations in order to explain them. Once this is done the aim is to develop a prototype that will be built to perform an empirical test of the theory.

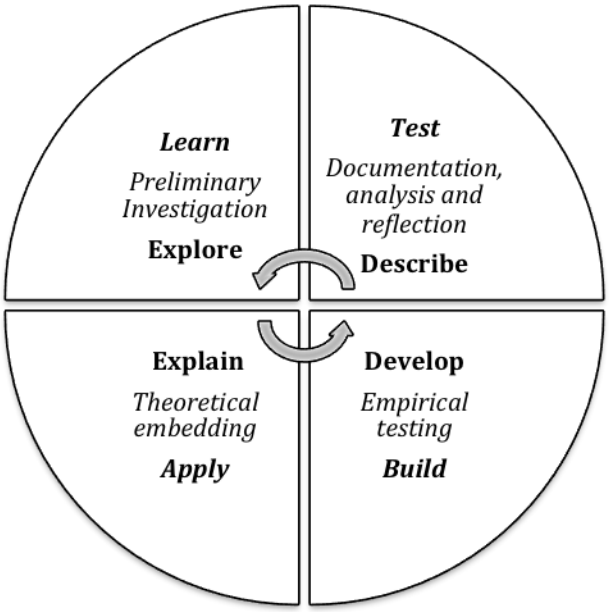


Figure 16 The revised design research cycle

The complete research design / design research model is shown in Figure 17.

What are...?

Abstract

Sociology of radical change

	Learn	***Test***	
	Explore	Describe	
How does...?	Formalist	Conventionalist	**How should...?**
Anti-positivist	Radical Humanist	Radical Structuralist	Positivist
Subjective	Interpretive	Functionalist	*Objective*
Endless possibility	Populist	Functionalist Develop	One best solution
	Explain		
	Apply	***Build***	

Sociology of regulation

Concrete

Why is...?

Figure 17 The research design / design research model

5Worked example

Say one wants to design a solution for disadvantaged single mothers in a fragile community. One could then start the cyle at "Learn". One could ask "What are the problems confronting single mothers in a fragile community?" and, "How do these mothers cope with those problems". This would lead to an exploration of the problem, from which the researcher would learn about those coping skills. The

question could then be modified slightly to "How do various mothers cope with different situations, and why do they do so differently?" This would allow the researcher to explain how the knowledge acquired can be applied. The next phase would be to develop a solution by asking "Why do the various solutions satisfy (or not satisfy) the needs of the users, and how can these be automated or scaled up? The answer to such a question would give rise to the design and development of a solution. Finally the question will be "How should the designed solution impact the lives of the users, and how does it, in fact do so?" The result of this subtraction sum will be some kind of description of the result of the investigation, and amount to an evaluation of the design. The first design research cycle will now have been completed, and the next question would be "What problems have not been solved by the solution (or what new problems have been caused)? And, how do these problems affect the users? And the story continues.

Case study

The domain of jewelry design is arguably one of the fields in which one is most likely to encounter the argument that the creative output stands on its own and that there is very little evidence of research. Moreover, when a specific piece is entered into a competition and wins such a competition, one could argue even further that such a piece constitutes a peer reviewed output and thus the outcome is equivalent to a research output. However as this article has pointed out thus far the production process and the research process run parallel. This brief case will explain.

The story begins when Author 2, in her final year of study was faced with the challenge of designing a unique, avant garde piece of jewelry. The piece had to explore the boundaries of gold as a medium, as well as explore contemporary issues in design and society.

In this instance the first step in the process was exploration. The two research questions were "What reference materials are out there that could act as inspiration for a unique jewelry design?" and, "How do these elements combine to form interesting patterns?" The first question is very wide, as is the case in the exploration phase. The second question therefore acts as a filter. The question was limited further by narrowing down the reference material to organic materials, and then to plant material. The research method was observation and experimentation. From the various plant materials selected the designer eventually settled on some blades of dried grass. These were spread out in various ways and the results were observed.

Once the exploration was over, the next phase was to understand the possibilities and constraints of the medium. Working in the *understand* quadrant. The second question remains the same, but now, a concrete question is added, which is "Why do some combinations work better than others?" The research method involved experimentation and observation, as well as sketching in pencil. Once the designer had reached an understanding of the combination of the elements from the sketches it was time to move to the *develop* quadrant. Here the next question was added: "How should these designs be translated into gold. The method was experimentation and observation by constructing a prototype as is illustrated in Figure 18

Figure 18 The prototype (Oberholzer, 2009)

Once the first prototype had been constructed it was analysed in the "describe" phase. The question that was added this time was "What are the visual possibilities of converting the prototype to a bangle?" The method was to sketch, and the output is shown in Figure 19.

Figure 19 The visual analysis (Oberholzer, 2009)

The visual analysis showed that, while it was possible to form the shape into a bangle of sorts resulted in a flat surface. Further exploration would be necessary, and thus the second phase in the design research cycle commenced with a number of sketches to answer the next question. This time it was decided to add a social dimension to the research. The two questions now were "What are the current social issues that could be explored to assist in finding a relevant shape" and "How do these shapes function when they are transformed into jewelry?" The social issue that was eventually selected was HIV and AIDS, and the visual image of the "Aids ribbon" was used as a guiding principle, as can be seen in Figure 20.

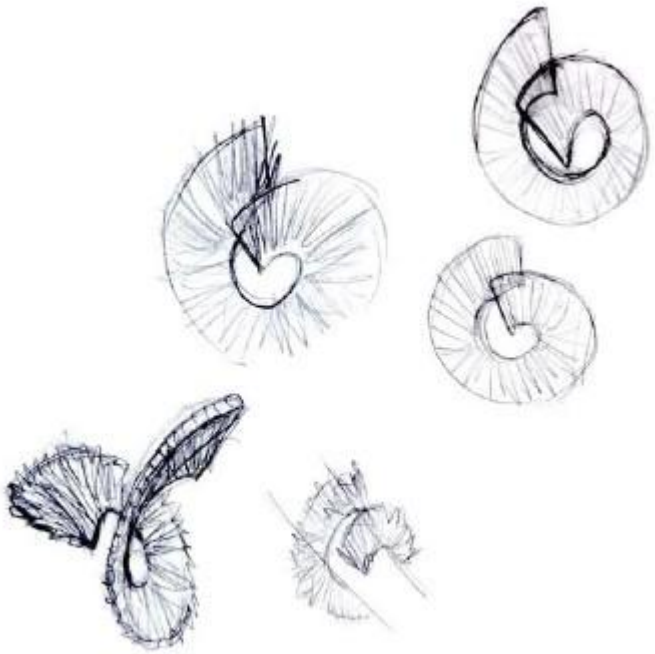


Figure 20 Further exploration (Oberholzer, 2009)

After the exploration there was a need to understand why the prototype was still not visually developed. The question was "Why does the prototype still seem unchallenging" The answer lay in the fact that it was a too obvious representation of the original leaves of grass. More development in followed with the question "How can the situation be reversed" and the answer lay in emphasizing the negative space. From this refinement, then, came the final brief to the manufacturer which resulted in the award-winning piece shown in Figure 21.

Figure 21 The award-winning piece (Oberholzer, 2009)

Conclusion and recommendations

The process as described by the case study is illustrated in Figure 22. From this it can be seen that the iterative design process does indeed allow research findings to be distilled from the development of the

product. It is recommended that students be encouraged to diarise their reflections during this process, and in doing so develop a culture of design research.

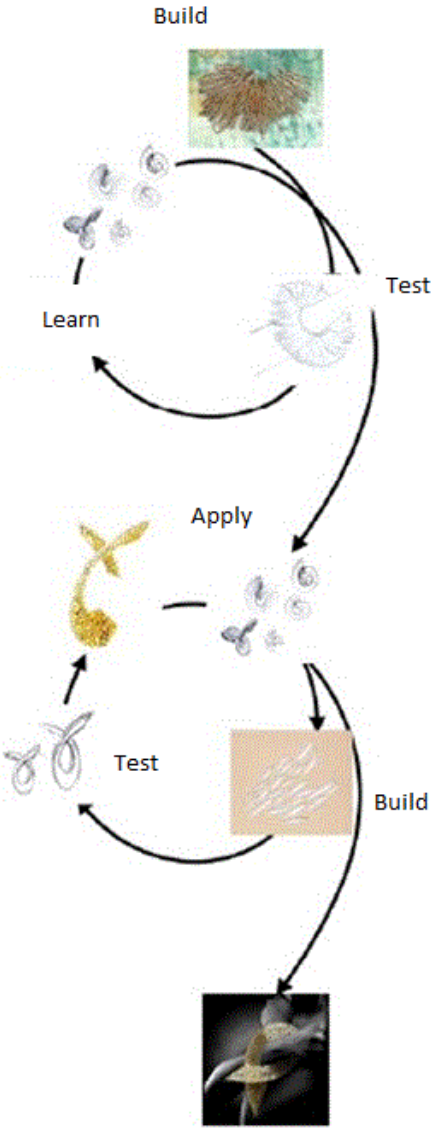


Figure 22 The Design Research Process in the case study (Oberholzer, 2009)

References

1. Burrell, G. & Morgan, G. (1979). *Sociological Paradigms and organisational analysis*. London: Heinemann.
2. Cronje, J.C. (2011) The ABC instant research question generator. Paper presented a the 4th *Building the scientific mind* colloquium, Stellenbosch, South Africa, March, 9. Accessed 10 July 2012 from http://www.learndev.org/dl/BtSM2011/Cronj%E9-The_ABC_Instant_research_question_generator.pdf
3. McKenny, S. (2001). *Computer-based support for science education materials developers in Africa: Exploring potentials.* Doctoral dissertation. Enchede: University of Twente.
4. Oberholzer, I. (2006) 'n Ontleding van die rol wat formatiewe evaluasie in die rol van kritiese denke het. Unpublished B.Tech essay. Cape Peninsula University of Technology.
5. Roode, J.D. (1993). Implications for Teaching of a Process Based Research Framework for Information Systems. Department of Informatics, University of Pretoria, 0002, Pretoria, South Africa.

6. Rowe, P. G. (1987). *Design thinking*. Cambridge, MA: MIT.
7. Van den Akker, J. (2007) Curriculum design research. In Tjeerd Plomp & Ninke Niveen (Eds) *An introduction to educational design research.* Amsterdam: SLO

The relevance of constructivism as an epistemological approach in design research: a case study

M Pretorius [1], HM van Zyl [2]
1 Department of Anatomy, School of Medicine, Faculty of Health Sciences
2 Department of Visual Arts, Faculty of Humanities,
University of Pretoria, Pretoria, South Africa
marinda.pretorius782@gmail.com
ria.vanzyl@gmail.com

Abstract

Developing an understanding of the epistemological approaches available in a discipline is part of the steep learning curve involved in post-graduate studies. It is especially challenging for novice designer-researchers who stand with one foot in real-life practice and the other in post graduate studies. This paper presents a case study and reflective overview of a study undertaken as part of a MA degree in communication design. The master research study investigates how design elements and principles applied in medical illustration influence the use, comprehension and preferences of students during learning. The research addresses the need of the medical illustrator to know more about the student as user when illustrations for learning purposes are created. A Repertory Grid technique was adapted for in-depth interviews, structured around specific formal design elements and principles. Findings were analysed and interpreted using an open-coding process.

The aim of this paper is to investigate the epistemological position in design research and the relationship between this position and the research process and methods. A theoretical overview of selected approaches is first presented. The student's MA study is then presented and discussed using the theoretical overview and frameworks as backdrop. The paper concludes with a personal reflection on the journey as researcher and medical illustrator.

Keywords: epistemology, design research, constructivism, subjectivism, objectivism, design elements and principles.

Introduction

One of the challenges of novice designer-researchers standing with one foot in the industry and the other in post-graduate studies is to understand the epistemological approaches of design research. An epistemological approach or paradigm[30] is necessary to address diversities within design research in order to create new knowledge, mutual understanding and to develop a foundation for theory.

Epistemology is described in Luke Feast and Gavin Melles (2010:1) as "the theory of knowledge that defines what kind of knowledge is possible and legitimate"[31]. Epistemology has to do with generating true or good knowledge valuable to a discipline such as design. Epistemology as a paradigm encompasses the theoretical framework, methodology and methods of research in any discipline but the literature shows varied opinions as to the nature of an epistemology for design research. Feast and Melles (2010:2) present three different epistemological positions for design research. Niehaves (2007:11) is of the opinion that design research encompasses more than one epistemological position for the generation of empirical and theoretical knowledge, although this is not fully recognised yet. Genevieve Johnson (2009:96) emphasises the fact that these positions cannot be viewed in isolation in order to generate new knowledge. It is apparent from reading various sources that the nature of the epistemological positions is

[30]Paradigm is understood as a distinct worldview based on certain epistemological and ontological assumptions (Bjoern Niehaves 2007:2).
[31]Michael Crotty as quoted by Feast and Melles (2010:1-2).

not that clear, especially in a new academic discipline such as design. Authors also use different terminology, often describing the same research approach. One of the challenges when planning research and writing research proposals, is the selection of an epistemological position and theoretical framework, before deciding on a research methodology.

This paper investigates the epistemological positions in design research and the relationship between these positions and research methods and processes. Firstly a theoretical overview of a selection of epistemological positions is firstly presented. A students MA study is then presented and discussed using the theoretical overview and frameworks as backdrop. The paper concludes with a personal reflection on the research journey of a medical illustrator illustrating showing possibilities and divergences.

Epistemological positions

Feast and Melles (2010) present an overview of a wide selection of literature in a quest to investigate epistemological positions in design research. Their quest specifically looks at the overlaps between scholarly research or theory and the practice of design, and three epistemological positions namely subjectivism, objectivism and constructivism are presented. Feast and Melles based their literature review on 300 journal articles, conferences papers and book chapters found in design research literature. In the next section these three positions are introduced from a design research perspective. A full exploration of these epistemological positions is outside the scope of this paper.

Subjectivism

Knowledge derived from a subjectivist epistemological position is based on personal experiences of individuals or tacit knowledge - what is learnt and known from personal experiences, feelings and opinions. Subjectivism within the spectrum of design research enables the designer and the user to assess artefacts that portray not only communicable qualities, but that may hold deeper meaning to provoke visual and imagistic thinking. Design research is indicated with a “small r” to demonstrate the search for personal development and deeper meaning, rather than just the formulation of communicable knowledge (Feast & Melles, 2010:2). The designer uses his or her personal framework of what is valuable to construct artefacts that are meaningful to others. The user on the other hand tries to understand and interpret the designed product within the reference of his/her own personal framework. With subjectivist knowledge reality do not have an absolute value, as reality is made up of personal relationships and beliefs on which others also rely (Johnson, 2009:90-91).

Objectivism

Positivism is a theoretical perspective associated with objectivism. Examples of such research methodologies are quantitative survey research and experimental laboratory research. Research methods or tools include measurements, statistical analysis, questionnaires and interviews (Feast & Melles 2010:2). Knowledge obtained from an objectivist position is the opposite of subjectivism, as it promotes factual and explicit rather than tacit knowledge. Knowledge generated from an objectivist point of view must be factual and concrete to form the foundation for theory formulation. Ken Friedman (in Feast & Melles 2010:3) states that knowledge within objectivism is articulated through systematic inquiry, organised in theory. Design research within the spectrum of objectivism includes the creation or study of artefacts based on factual references and reality to create space for theoretical formulation. Personal and individual interpretations surrounding the creation or assessment of these artefacts are done separately as they need to convey the essence of realism and professionalism. Meaning produced from thought is only determined by the structure of the real world and separate from the individual (Johnson, 2009:90). Theoretical perspectives associated with objectivism are postmodernism, structuralism and post-structuralism. Examples of research methodologies are discourse theory and deconstruction and research methods may include auto-ethnography, semiotics, pastiche and intertextuality (Crotty in Feast & Melles 2010:2).

Constructivism

Knowledge generated through a constructivist approach is derived from people, processes and objects (Cross in Feast & Melles, 2010:3). The characteristics of constructivism as research position in design research are as follows (based on Cross in Feast & Melles, 2010:3):

- Designed artefacts can encompass explicit as well as tacit knowledge.
- Meaning is constructed through engagement with the world and in terms of design, the designed artefacts.
- Different meanings are constructed in different ways to similar objects.
- Reflection plays an important role in design research.
- Design knowledge is obtained through reflection of the making of the artefacts as well as reflection on the way they are used.
- Design knowledge is derived from the way designers work which is referred to as "designerly ways".
- Through designerly ways of doing, explicit and implicit knowledge is generated.

Constructivism promotes an environment of collaboration, engagement and reflection of information to enhance the process of obtaining knowledge. One of the key characteristics or theoretical perspectives found in a constructivist position is that of interpretation without only objective truth involved. A constructivist approach in design research constitutes a sense of reciprocity between participant and researcher where new knowledge is co-constructed, providing the platform for theory formulation (Mills, Bonner & Francis 2006:9). Within the sphere of design research, constructivism provides opportunity for designers and users to subscribe different meanings to artefacts, based on professional and personal experiences valuable for interdisciplinary enquiry. Constructivism creates room for reflection by the designer him/herself to review their creations, offering opportunities for users to also provide feedback on the sufficiency and usability of their artefacts. Theoretical perspectives associated with constructivism are, for example interpretivism, hermeneutics, critical inquiry and phenomenology. Examples of research methodologies are ethnography, grounded theory, action research and discourse analysis. Research methods or tools include qualitative interviews, observation, case studies and use of narrative (Crotty in Feast & Melles 2010:2).

Case study

The following research project is presented as a case study and is part of a master's degree research project (part of a coursework masters). The study is titled: 'An exploration of students' perceptions regarding medical illustrations as a learning tool'. The student is a full-time medical illustrator at the School of Medicine at the University of Pretoria (SM at UP). The research questions are therefore practice related and driven by a need for specific and functional industry-related knowledge. The aim of the study is to explore how design characteristics[32] influence the use, comprehension and appeal of medical illustrations as part of the learning experience of students. The objectives of this study are to determine how design characteristics in medical illustrations influence the way students use illustrations as learning tool; the way students comprehend the content of illustrations during learning; and students' preferences for certain illustrations over others. Many anecdotal reports of how students approach anatomy are available, but little systematic research has been conducted on how students learn anatomy and the role of illustrations in this process. The study aims to obtain a deeper understanding of the user within a South African context - in this instance the undergraduate medical student. The importance of this study lies in developing of user-centred knowledge to improve the quality of work produced by medical illustrators.

Research methodology

A qualitative research approach was followed. This allowed for the inclusion of perceptions, experiences and behaviours of medical students, as well as the prior knowledge and experience of the researcher as

[32] Design characteristics is the term used to embrace design elements relevant to this study namely line, shape, colour, texture and depth and design principles namely unity, hierarchy, proximity and balance.

senior medical illustrator. The opinions were explored and the results interpreted. This study was in the form of exploratory qualitative research within an interpretive context. Because the study took an empiricist view of knowledge acquisition, data collection was used as research method. Qualitative research, as followed in this study, presents "a holistic perspective which preserves the complexities of human behaviour (Greenhalgh & Taylor, 1997:740). In-depth interviews (based on the repertory-grid technique) were used and the findings were interpreted by the researcher. These methods allowed for the perceptions, experiences and behaviours of medical students, as well as the prior knowledge and experience of the researcher as senior medical illustrator.

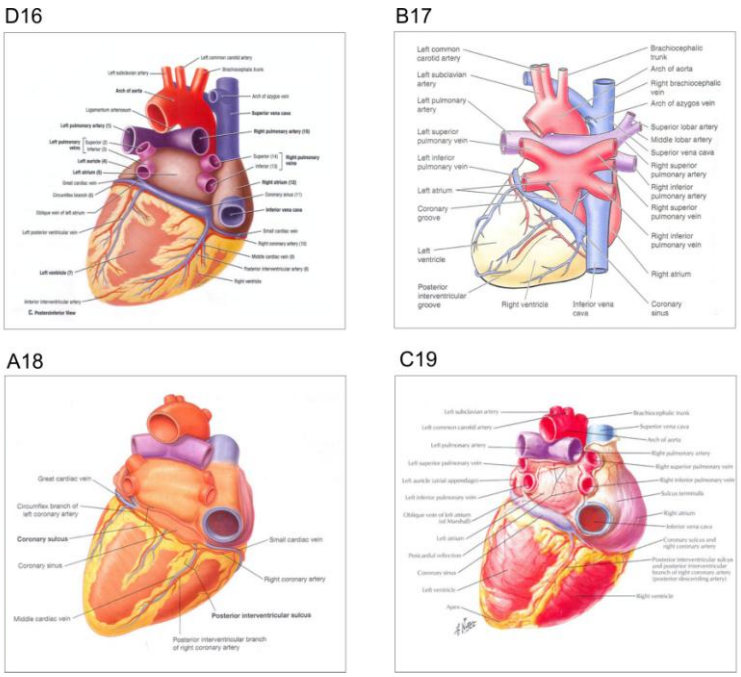
Data collection and sampling

Data was collected through semi-structured in-depth interviews with medical students. Semi-structured interviews are used to facilitate a focused exploration of a specific topic, using an interview guide (Fossey, Harvey, McDermott & Davidson, 2002:727). An interview guide was set up containing of a list of questions and illustrations designed to guide the interview process in a focused, albeit flexible manner. The illustration (Figure 1) shows an example of a set of illustrations used in the interview guide representing the four different views of the inferior base of the heart. The application of colour as design element and the way it could influence students' preferences for learning were investigated in this set. Open-ended questions were asked to each participant as set out in the interview guide.

Thirteen sets of medical illustrations formed part of the interview guide; with three or four illustrations per set. Each set of illustrations consisted of different applications of a specific design characteristic, but similar in content/message. The illustration (Figure 1) shows an example of a set of illustrations.

Examples of medical illustrations came from well-known sources, typically used by the students and lecturers, and some of the researcher's own illustrations were also included. Participants were asked to compare the different illustrations in each set, following the repertory grid technique of preference and comparison. Participants were also asked to elaborate on their selections in the form of an informal discussion. Laddering, a technique of delving deeper into participants' answers was applied allowing students to elaborate on the selections 'how' and 'why'. The repertory grid interview (RGI) is a method of collecting rich data during a structured, reflective process where the individual participants uncover their own 'personal constructs' or understanding of a given concept, attitude or perception (Alexander, van Loggerenberg, Lotriet & Phahlamohlaka, 2010:480).

Figure 1: The application of colour as a design element in illustrations of the inferior base of the heart as shown in the interview guide.



Purposive sampling was used as this enabled the researcher to select participants who meet both the inclusion and exclusion criteria. Six medical students in their second year and six in their fifth year of study at the School of Medicine, University of Pretoria were interviewed during the second semester of the medical curriculum. The reason for selecting junior and senior students was to also be able to compare how second-year students with limited medical knowledge experience illustrations as a learning tool, compared to fifth-year students with advanced medical and clinical knowledge. Interviews were audio taped and notes were made during the interviews.

Transcribing and analysis of data

Data was transcribed by the researcher and summarised on data sheets, using the principles of the RGI and the coding processes of grounded theory (Strauss & Corbin, 1990:61). The data sheets formed the foundation for analysis of participants' interpretations according to preferences, use and comprehension of medical illustrations during learning. An example of a data sheet (Figure 2) is provided showing the students' own personal constructs of the illustration. The categories represent the level of preference of each participant. (The example of the data sheet is shown in Appendix A).

An open coding technique based on grounded theory comprises the process of breaking down, examining, comparing, conceptualising, and categorising data. Relations and comparisons between each set of illustrations according to students' constructs were made and further refined through the process of axial coding. According to Strauss and Corbin (in Judy Kendall, 1999:747) axial coding is the process where data is broken down from open coding and put back together in new ways by making connections between categories.

The findings of the study offered confirmation of many requirements for medical illustration previously suspected, but also offered many unexpected surprises. The research resulted in in-depth understanding, even though only small samples of the population of medical students were interviewed. The pragmatic value of the study is that some guidelines can now be formulated, based on the research process, and these can be applied in a studio context and shared with others in the industry through publication.

Reflection on research the research journey

Training and education of illustrators or designers offer scant preparation for the research journey. This is especially the case for design practitioners who venture into the field of post-graduate research. Words such as 'epistemology' and 'ontology' are often totally unknown to novice designer-researchers.

One of the first decisions made in this study was to determine an epistemological position. It is debatable whether this decision was a strategic choice or one made on the designers' instinct. What became clear through the research journey is that knowing your epistemological position is a useful and guiding framework that can help you make very practical decisions about the research approach, methods and techniques. This study conducted with constructivism as an epistemological position because it promotes an interpretive framework of diverse opinions of participants.

The research process also forces the researcher/illustrator to critically reflect on the application of design elements and principles in her own work, as well as in the various samples chosen for the study. Critical reflection was part of the participants' experience during the interview process as they had to reflect on the illustrations based on pre-existing medical knowledge and personal experiences, before explaining what they understood to be functional. This demonstrates another characteristic of constructivism - co-construction of meaning - in this case between the researcher and student. Tacit and explicit knowledge are obtained through this interaction between participants and researcher. Participants not only provided factual medical knowledge when elaborating on their preference of illustrations for learning purposes, but they had to look at visual aspects of the illustrations as well. Their awareness of the application of design elements and principles in certain instances helped them to better understand the illustrations and supported their selection of preferences. Within a constructivist realm, responses of students regarding fields outside their scope are not deemed as correct or incorrect, but their interpretations are epistemologically valuable to the research.

For both the researcher and participants the study opened up new ways of interpreting and creating meaning in terms of medical illustrations as a learning tool. Participants were amazed when they were asked to choose between the illustrations as many of them could never before understand why they disliked learning from certain examples. Only when showed alternatives, did they understand the way in which drawings played a role in their preferences.

The interviews within a constructivist epistemology were created in a more non-hierarchical relationship in order to tap into greater depths of mutual meaning making (Jane Mills *et al*, 2006:10). In this framework the researcher is subordinate to the participant as he/she needs to obtain as much as possible information necessary to make the necessary interpretations. The researcher did not only prompt students to think and communicate more visually regarding the illustrations, but the researcher also obtained new knowledge with regard to their learning styles. The researcher obtained more information concerning participants' drawing abilities and how these are implemented during learning. The researcher gleaned a deeper understanding of participants' use of different media such as pen, pencil or ink when drawing illustrations in the course of memorising facts. Participants were motivated to elaborate on their preference for certain drawing styles of illustrations over others. The researcher also obtained a better understanding of students' use of multimedia such as the internet and a web-based education system as part of their learning methods.

This study did, however, also include components of the subjective and objective epistemological positions. From a subjectivist position the researcher had to determine her position in relation to the area of interest during the research process. Meaningful linkages between emotional and personal opinions on the one hand, and intellectual operations on the other, are important to consider (Mills *et al*, 2006:10). From a subjective position, the researcher had to accept and understand it when her illustrations were not

selected and why they would not serve as a better learning device. The researcher had to withdraw personal orientations from the research process and had to focus on new meanings generated.

According to Mills *et al* (2006:10) the researcher's passion for the research area of interest can blind him/her to certain aspects of the data. With this study, the researcher selected the illustrations based on the relevance of design elements and principles, while they may not be regarded as the most effective for learning purposes. Both groups of participants formed their own meanings of the illustrations for learning purposes based on personal experiences. Opinions of participants regarding illustrations were also grounded in cultural and socio-economic backgrounds, collaboration with fellow students, lecturers and how biology was studied during high school. Facial expressions and body language of students towards certain illustrations during the interviews were also an indication of certain feelings involved.

From an epistemologically objectivist perspective, students provided new scientific and medical knowledge based on what is learnt from anatomical textbooks, atlases, dissections, classroom discussions and clinical rounds in hospitals. The researcher used this information as reference to determine the usability and sufficiency of illustrations for learning purposes. New insights around the usability and efficiency of medical illustrations within the structure of the current curriculum at the SM at UP were obtained.

To conclude, this study followed a constructivist epistemological position within an interpretivist framework, using interviews as research method. Within this epistemological paradigm, deeper understanding regarding students' use, comprehension and preferences of medical illustrations as learning tool was obtained. However, integrating subjective and objective epistemological positions could possibly provide different, though essential perspectives concerning the user in the design process. Constructivism with an overlap of these epistemologies can possibly contribute to address diversities within design research and develop a theoretical foundation, although further research is necessary to this end.

List of references

1. Feast, L, & Melles, G. 2010. Epistemological Positions in Design Research: A Brief Review of the Literature. In: Proceedings of 2nd International Conference on Design Education, June 2010. Australia:University of New South Wales:1-4.

2. Greenhalgh, T & Taylor, R.1997. How to read a paper: Papers that go beyond number (qualitative research). Bio-medical Journal, 315:740-743.

3. Johnson, GM. 2009. Instructionism and constructivism: reconciling two very good ideas. International Journal of Special Education, 24(3):90-98.

4. Kendall, K. 1999. Axial coding and the grounded theory controversy. Western Journal of Nursing Research, 21(6):743-757.

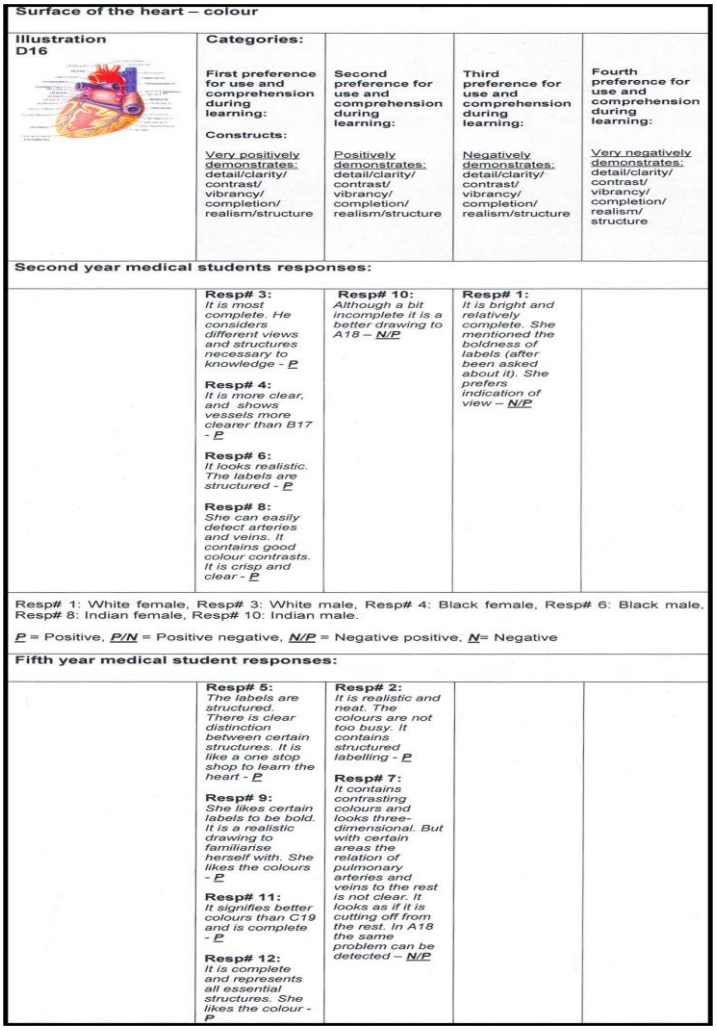
5. Mills, J, Bonner, A & Francis, K. 2006. Adopting a constructivist approach to grounded
6. theory: Implications for research design. International Journal of Nursing Practice,12:8-13.

7. Niehaves, B. 2007. On epistemological diversity in design science – new vistas for a design-orientated is research? In: Proceedings of the 28th International Conference on Information Systems, Canada: Montreal:1-13.

8. Strauss, A & Corbin, J. 1998. Basics of qualitative research.Techniques and procedures for developing grounded theory. London: Sage.

9. Van Loggerenberg, P, Lotriet, J, Phahlamohlaka, H. 2010. The Use of the Repertory Grid for Collaboration and Reflection in a Research Context.Group Decisions Negotiations, 19:479–504.

Figure 2: Example of data sheet showing preferences of second and fifth year students regarding an illustration of the heart.



Surface of the heart – colour				
Illustration D16	**Categories:** **First preference for use and comprehension during learning:** **Constructs:** Very positively demonstrates: detail/clarity/ contrast/ vibrancy/ completion/ realism/structure	**Second preference for use and comprehension during learning:** Positively demonstrates: detail/clarity/ contrast/ vibrancy/ completion/ realism/structure	**Third preference for use and comprehension during learning:** Negatively demonstrates: detail/clarity/ contrast/ vibrancy/ completion/ realism/structure	**Fourth preference for use and comprehension during learning:** Very negatively demonstrates: detail/clarity/ contrast/ vibrancy/ completion/ realism/ structure
Second year medical students responses:				
	Resp# 3: *It is most complete. He considers different views and structures necessary to knowledge - P* **Resp# 4:** *It is more clear, and shows vessels more clearer than B17 - P* **Resp# 6:** *It looks realistic. The labels are structured - P* **Resp# 8:** *She can easily detect arteries and veins. It contains good colour contrasts. It is crisp and clear - P*	**Resp# 10:** *Although a bit incomplete it is a better drawing to A18 – N/P*	**Resp# 1:** *It is bright and relatively complete. She mentioned the boldness of labels (after been asked about it). She prefers indication of view – N/P*	
Resp# 1: White female, Resp# 3: White male, Resp# 4: Black female, Resp# 6: Black male, Resp# 8: Indian female, Resp# 10: Indian male. P = Positive, P/N = Positive negative, N/P = Negative positive, N= Negative				
Fifth year medical student responses:				
	Resp# 5: *The labels are structured. There is clear distinction between certain structures. It is like a one stop shop to learn the heart - P* **Resp# 9:** *She likes certain labels to be bold. It is a realistic drawing to familiarise herself with. She likes the colours - P* **Resp# 11:** *It signifies better colours than C19 and is complete - P* **Resp# 12:** *It is complete and represents all essential structures. She likes the colour - P*	**Resp# 2:** *It is realistic and neat. The colours are not too busy. It contains structured labelling - P* **Resp# 7:** *It contains contrasting colours and looks three-dimensional. But with certain areas the relation of pulmonary arteries and veins to the rest is not clear. It looks as if it is cutting off from the rest. In A18 the same problem can be detected – N/P*		

Urbanity, design and inclusion: Mediating the physical and social bases ofurban planning through density and diversity lenses and sensibilities

Nagel Tapela
Faculty of Informatics and Design,
Cape Peninsula University of Technology
tapelan@cput.ac.za

Anzabeth Tonkin
Faculty of Informatics and Design,
Cape Peninsula University of Technology
tapelan@cput.ac.za

Abstract:

The academic discipline and profession of urban and regional planning has a tortured history as political project and social practice of physical management of increasingly urbanising regions and society in the rise of the industrial revolution. The links of urban planning to the modernist project of an emerging colonial economy in the building of new centres (cities) of facilitating accumulation in the south is an important starting point in exploring how modern planning is constituted and complicit in colonialism itself and a product of colonial relations. The paper initially contextualises and historicises modern planning as a practice of social ordering under the guise of design from both artistic and scientific standpoints. The paper then outlines how this metaphor was used to discipline space and people against the ills of migration arising from industrial-driven urbanisation where planning as design was depoliticised and sanitised as a value-neutral technocratic activity in the creation of colonial and apartheid cities.

The paper argues that current planning practices and theorising of urbanisation and urban development are not only ineffective in addressing urbanisation challenges, but in fact increasingly facilitate spatial inequality and inefficiencies, as well as consolidate and reinforce social exclusion and fragmentation. The authors assert that it is in fact the practices that remain trapped in modernist thinking and related normative value frameworks girding them that are out of synch with the more progressive policy and constitutional values and prescriptions developed over the last two decades. Finally, the paper suggests a textured and inclusive understanding of density sensibilities as a concept and strategic tool for achieving diversity in underpinning sustainability of largely dysfunctional urban processes, systems and spaces.

Introduction: 'urban planning is not design'...

The profession of modern town planning arose as a reaction to complex transformations that were occasioned by the unfolding political economies of industrial production and the resulting social formations and transitions that shaped urban regions in the West in the late nineteenth century. The impact of this industrial revolution on the social geography and spatial structure of production, circulation and consumption, and the emerging spatial economy and settlement, created physical, social and environmental problems that challenged conventional ways of city-building and management. Engineers, architects and environmental health professionals who were the technocratic professions, and the *de facto* urban managers, began to craft responses and practices to address the ills and dynamics of industrial-driven urban development – thus the birth of town planning as essentially a reactive practice; technocratic in its initial conception, and physical/spatial design focused in orientation.

The emergence of town planning as an academic discipline and profession did not mean that cities had not been consciously planned before. The balance between deliberative planning and the processes of

organic growth and management before the advent of industrial-led urban development and planning were then perhaps more synchronised and more understood (Mumford, 1961). The challenge of the new industrial urbanism was how this new science and/or art of urban management would be crafted, and derive its philosophical moorings, and therefore its theory base. Architecture, civil engineering and public health provided the initial professional home for planning, cast within a broader framework of public administrative practices that intersected with social utopian imaginaries of good city form, and euphoric recalls to countryside living – the varieties of the garden city concept. This physical design orientation and character of town planning would continue to inform the nature of interventions to address the social, environmental and economic consequences of industrial urbanism; and as the underlying theory bases for the new profession and practice, ushering the modernist paradigm in town planning.

Nigel Taylor (1999, p.327) was later to observe three major shifts in the purpose, and therefore normative theory, of Anglo-American planning in the post war (1945) period:
The history of town planning thought since 1945... suggest(s) that there have been three outstanding changes in planning thought over this period. These are, first, the shift in the 1960s from the view of town planning as an exercise in physical planning and urban design to the systems and rational process views of planning; second, the shift from the view of town planning as an activity requiring some technical expertise to the view of planning as a political process of making value-judgements about environmental change in which the planner acts as a manager and facilitator of that process; and third, the shift from 'modernist' to 'postmodernist' planning theory.

According to Taylor (1999), while these three shifts occurred in chronological sequence, there has often been an overlap or coexistence of these orientations in practice, with the physical planning/urban design, systems and rational process views emphasising technical and aesthetic competencies (spatial focus) remaining quite resilient in planning education programmes and professional practices. Planning theory based on physical planning and urban design has been criticised for its physical determinism of ‘master plans’ that were inflexible in coping with change; for social blindness, where the social fabric that underpinned urban change was ignored; and for planning and planners being value-neutral, technical experts and apolitical. Many of these debates that emerged since 1960, as reactions to these shortcomings, were intellectual attempts to deal with the criticisms and to put planning on a more appropriate road, remain relevant today (Harrison, *et al.* 2008).

Literature suggests that (colonial) planning approaches, cultures and practices, particularly in Africa (Frank, 2007) have taken longer to shift and remain trapped in planning as ‘an orderly development of space’ (Porter, 2010), despite being assaulted by new urbanisation processes associated with increased migration, informality, the thinning urban formal economy and the urbanisation of poverty. These challenges of a new urbanism are increasingly confronting planning practice that is trapped in outdated modes of thinking and intervening, and therefore insufficiently responsive to emerging developmental needs of urban environments. This apparent persistence of the view and practice of planning as an exercise in physical planning and urban design, as a rational process of decision-making and/or as a value-free activity requiring some technical expertise and solutions, attests to delays, and continuity of old and new paradigms of planning coexisting.

Alternative views tend to foreground planning as a political process of making value-judgements about environmental change in which the planner acts as a manager and facilitator of that process. Thus social theory and science began to ascend in influencing planning theory, in addition to physical design and aesthetics, assisting in mediating the physical and social bases of urban planning lenses and sensibilities. David Smith, a long-standing observer and researcher of the South African city, notes that:
[the]... conception of social justice manifest in group formation ...is important in that this kind of normative approach has been unusual in urban studies relating to city planning, the practice of which tends to be dominated by aesthetic and technical aspects of spatial form while taking underlying social relations as given (Smith, 2003:27).

These people-centred approaches to urban development and planning practices have gained sufficient momentum in local (Harrison, *et al*. 2003) and international discourses (Mattingly, 1998; United Nations Human Settlements Programme, 2009) to point to an emerging socially-girded ethic and paradigm in planning.

Historicising planning practices in the South African city

The South African city is a colonial city characterised by multi-layered exclusions, both in access to the city itself and to its resources, setting rigid lines of separation - socially, morphologically and economically. The apartheid city, to which the erstwhile colonial city was later surgically transformed, represents an extreme form of social engineering under the guise of modernist planning as a technocratic activity. It is also a colonial city having been created as part of a resource extraction network in the broader design of supplying resources to an incipient industrial capitalism and empire building. Despite the South African political transition and its underpinning constitutional mandate that attempted to reclaim a paradigm of social inclusivity and equity in envisioning a new urban planning framework, the practice has lagged behind, if not trapped, in the more intricate institutional knots that such transitions entail (Smith, 2003; Porter, 2010).

The nature and problems of the planning practice transition relate firstly to the broader difficulty of post-colonial planning cultures (Frank, 2007; Porter, 2010; Harrison, *et al*., 2008; Kamete, 2010) within the profession and state, as well as creation of institutional architectures to respond and drive the new practices. Second is the vastly changed nature and contexts for urbanisation in the South generally, and in South Africa in particular, where the collapse of arrested urbanisation, the so-called 'influx controls', coincided with increased informalisation of urban economies to usher a period of a hyper-urbanisation. Thirdly, and in the context of the two trends above, is the need to reassess old policy frameworks and instruments, draw new ones, and develop new competencies (knowledge, skills and values) and capacities to address the delayed paradigm shifts, informed by new perspectives, theory and practices. Education, training and reorientation of planners remain a challenge (Harrison, *et al.*, 2008; Tapela, 2010) in this connection. It has been noted that in the implementation of post-1994 policy frameworks, apartheid urban forms were consolidated, rather than transformed, largely because planning remained focussed on the unsustainable apartheid 'spatial fixes' that land and property markets had adapted to (Smith, 2003).

Urban fragmentation, low-density development and forms of exclusion

Harrison (2003, p.15) notes the centrality of urban fragmentation (and exclusion) as a key motif in the globalisation discourse he posits as a new meta-narrative in understanding new processes of urbanisation, "even though globalization as a concept is essentially about integration and increased connectivity". The increasingly 'fracturing social geometry' (and the resultant) in the form of multiple intersecting dimensions of identity and inequality, include race, class, gender ethnicity, sexuality, immigrant status and 'nationalisms' that suggest processes and outcomes of disintegration/fragmentation and integration/connectivity as parallel dialectical forces driving contemporary urbanisation (*ibid*, p.16). Some have argued that uncritical use of the 'rainbow nation' metaphor is a weak conceptual imagery for creating a multi-cultural society and city (Ndebele, 2009). Worby *et al.* (2008, p.16) suggest, in the wake of so-called 'xenophobic violence' in South African cities in 2008, that:

... in the view of many South Africans, it seems that the rainbow has been replaced by the onion: a way of imagining degrees of national belonging, layered around an authentic core.. In this view, the fragile outer skin is made up of black African immigrants... beneath that fragile exterior – so easily exfoliated and discarded, lie the Tsonga, Shangaan, Venda and Pedi, people with a firmer claim to inclusion, but on the political heartland and therefore a dubious loyalty to the national project... Yet this ethno-linguistic diagnostic was applied to blacks. White foreigners were safe from attack, insulated in the wealthier neighbourhoods of the city.

The onion imagery acknowledges the nature of conflict over resources and the often selective definition of fault-lines for *city*zenship and exclusions; but perhaps more powerfully, that after some time, the core of the onion begins to ferment and rot, just as the unfolding nature of primitive accumulation processes and practices of the elites (Black and White) are beginning to stink!

Importantly therefore, the social and physical intersecting dimensions of identity and inequality are at the centre of mediating density and social integration sensibilities in planning. At the physical level in the South African city, these involve low-density development and separation of land use and social identities, increased distance and costs of movement, and a coarse-grained texture of the urban morphological fabric. Socially this manifests in peripheralization of poverty and entrenchment of inequality. The apartheid city structure has tended to be reinforced by new policy frameworks and public investment patterns of the post-apartheid era (Bond, 2003) that have not sufficiently distinguished between fighting poverty and inequality in terms of intervention strategy and instruments (Gelb, 2008).

Cities arise, and are defined and distinguished by the physical agglomeration by which people and communities (migrants) are brought together and innovate around production, consumption and social reproduction and for shared destinies. While housing lies in the domain of social reproduction, it is the greatest user of land in urban areas. The history of low-income housing delivery in South Africa has been in the pre-eminence of the hostel and the so-called 'township house'. In the democratic era, the so-called RDP ('match box') house – an impossibly downscaled rural house typology (a farm house) or a miniature sub-urban (suburban) house under freehold title, has dominated housing delivery, often on the urban fringes. The predominance of the single-family detached dwelling house typology is unsustainable as it promotes urban sprawl and does not support viable operation of a public transport system (Cronin, 2012). Behrens and Wilkinson (2003) analyse the nature of this *un-sustainability* in terms of government expenditures on public transport subsidies *versus* housing budgets, location and type of new housing being developed, comparative average commuting time in South African cities and globally, and emerging market logics of the housing-transport nexus that planners struggle to motivate and provide justifications for location of housing further away from the city. Ironically, land and property markets that adapted to both the unsustainability of the political economy and urban spatial structure of apartheid have consolidated to rationalise the 'illogics' of an urban spatial economy that is economically inefficient and socially dysfunctional.

At the Planning Africa Conference held in Johannesburg in April 2008, a prominent academic and urbanist, Sir Peter Hall, suggested that the biggest planning challenge of the twentieth century (in the West) was urbanisation, and then predicted that the challenge for the new millennium would be sub-urbanisation (Hall, 2008). Reflecting on his statement and its relevance for the South African reality, the current authors suggest that the country's challenge will be a combination of both; and therefore responses will need to reflect more closely on the socio-political, economic and environmental repercussions of both processes. Poverty and inequality, the main social by-products of the emerging South African city, are however distinct issues and cannot be addressed by policy as if they are the same. Can the levels of poverty and inequality as they manifest in Cape Town today be sustained politically and socially? Posed differently: Are emerging levels of poverty and inequality sustainable? In this context 'sustainability' refers to issues of inter-generational equity and justice in resource utilisation in social, economic, environmental and political terms.

At the launch of the Development Action Group's Resource Book entitled *Sustainable medium-density housing: A resource book* (Tonkin, 2008) at Constitutional Hill, one of the present authors made the following observation regarding the book's possible contribution to an analysis of, and reflection on, the kind of responses needed to create sustainable cities:
Urbanity (or cities) is defined physically by relative density, economically by increased efficiencies in productivity, exchange, distribution and consumption of goods and ideas; socially by enhanced or higher

forms of human interaction; culturally by embracement of diversity and tolerance; and politically by inclusive and networked governance and innovation. The failure to balance these normative value frameworks, particularly in the context of globalization, often result in social and political crises, dysfunctional economies and ecological upheavals we have seen in many cities of the world, especially in the South (Tapela, in DAG, 2010 – *emphasis, the authors'*).

In demonstrating possibilities towards mediating the physical and social bases for a new urbanity and inclusive urban development praxis, the authors in the next section attempt a weaving of two concepts (density and diversity), common in urban planning discourses, to create textured understandings of the intersections between the social and the spatial.

The inclusion mandate in urban development practice

Several streams in international discourses have over the years consolidated an urban agenda towards socially just cities. Starting from Jane Jacobs' *The death and life of American cities* (1961) and *The economies of cities* (1969), several strands of arguments around rights-based approaches to development, the 'right to the city' movement, multi-cultural and inclusive cities, there is a growing consensus that points to strong linkages between urban sustainability and social justice and equity. Democratisation in South Africa, and particularly the progressive and activist aspects of South African Constitution, undergirds possibilities supporting responsive planning and development policy frameworks and practices.

4.1 The Right to the City

The World Charter on the Right to the City (2004) sets forth the duties and processes that guide civil society, governments, and organisations in order to assure the dignity of all people who live in cities, permanently or part-time. Article 1 of the Charter (2004, p.1) states that "(e)veryone has a right to the city without discrimination of gender, age, race, ethnicity, political and religious orientation and preserving cultural memory and identity, in accordance with the principles and norms established herein". According to the Charter (2004, p.1) "(p)otentially, the cities are areas of great riches and economic, environmental, political and cultural diversity. The urban lifestyle influences the manner by which we establish ties with our fellow human beings and with the territory". However, viewing post-1994 urban management approaches and practices through the lenses of the Right to the City model, South African cities fall short of the ideals of diversity, sustainability, equality and dignity for all, mainly as a result of a focus on "state-centric, housing-driven and (…) individual property rights over the social function of land and the city" (Görgens and Van Donk, 2011), despite widespread usage of 'Right to the City' rhetoric.

4.2 Sustainability and integration

Allen (2002, pp.16-17) re-articulates the primary arguments of sustainable urban development by emphasising the political underpinnings or quality of governance systems and frameworks that guide and link the relationship and actions of different actors and actions among the (previously popular) four dimensions (social, economic, ecological and physical). She draws attention to the importance of strong political support for processes formulating policies and programmes that advance sustainable development; as contextualised within global political economic factors and their local social and environmental manifestations as major determinants of policy decisions. This signifies a re-balancing of power where democracy, participation and discourse concerns of the poor and marginalised are considered in decision-making.

The approach to urban sustainability reflected in the Habitat Agenda that emerged from the Habitat II process in Istanbul in 1996, can be reworked to prise open spaces for a more politically informed approach to urban development, in general, and for integration, in particular. Significantly, the Habitat Agenda has provided the main reference point for governments (like South Africa) and civil society groups in finding policy ideas and strategies to address the myriad of urban problems stemming from

systemic fragmentation and inequality. Central to this agenda is the notion of integration spawned by the belief that sustainable urban development is only possible if economic, social and environmental agendas are aligned and mutually reinforcing. Typically, to sustain the fiction of this approach, a weak conception of urban politics and state-civil society engagements has been adopted for the reasons already explained. However, building on Allen's model it becomes possible to see that it is possible to inhabit and reformulate these mainstream discourses towards more transformative ends. In order to understand how to concretely achieve this, it is necessary to explore a number of inter-related dimensions of urban integration; in relation to the forms of people-, place- and sector-targeting that development interventions assume; including:
(a) sectoral and multi-sectoral development strategies;
(c) spatial frameworks and plans;
(d) institutional architectures and effectiveness;
(e) development and planning instruments;
(f) aggregate frameworks and places such as Integrated Development Plans; and
(g) political accountability systems.

Understanding and effecting appropriate inter-relationships between these domains or dimensions in relation to specific urban contexts, with unique geo-historical roots, is a vital step in advancing urban integration. It is critical to appreciate that urban integration is not some magical end-state that will be achieved in the foreseeable future. Instead, it must be regarded as a horizon to move towards (or away from), through deliberate actions which produce increasingly equitable and just outcomes.

Density lens/sensibilities: Concept and strategic tool for achieving sustainability…

Density is one of the most important indicators and design parameters in the field of human settlement planning and development. Density is a complex system in which various parts interact with each other and with parts of other systems in different ways, with influences on urban development and residential environments. It is impossible to establish all the components affected by or affecting density and the relationship between them. Moreover, the perception of density varies between countries, within countries among different social groups, and even within social groups, where factors such as gender, age, occupation, marital status and income affect people's perceptions of their environment (Tonkin, 2008, p.12). It is central to the technical and financial assessment of the distribution and consumption of land, infrastructure and public services in residential areas, albeit that there is no single definition of density. Density has far-reaching implications for practitioners, officials and civil society as it is often used as the basis of decision-making. The result is often highly dysfunctional environments that undermine sustainability and frustrate human activity (Tonkin, 2008).

Density should be used "sensitively" and "creatively", and be more than just a static control mechanism or standard for calculating the number of community facilities required in a residential area (Senior, 1984, p.16). The anti-planner and urban activist Jane Jacobs's manifesto *The Death and Life of Great American Cities* opens with the statement that her book is an attack on current (the 1960s) city planning and rebuilding (Jacobs, 1961). In outlining four qualities that any city neighbourhood must meet in order to be healthy and desirable to residents, namely mixed primary uses, short blocks, aged buildings and high density, she revisits the subject of a timeless way of building and planning, radically different from the approach to urban planning at the time. She posits answers the question of what the proper densities for city dwellings should be as follows (Jacobs, 1961, p.221):
The answer to this is something like the answer Lincoln gave to the question, 'How long should a man's leg be?' Long enough to reach the ground, Lincoln said. Just so, proper city dwelling densities are a matter of performance. They cannot be based on abstractions about the quantities of land that ideally should be allotted for so-and-so many people (living in some docile, imaginary society). Densities are too low, or too high, when they frustrate city diversity instead of abetting it. We ought to look at densities in

much the same way as we look at calories and vitamins. Right amounts are right amounts because of how they perform. And what is right differs in specific instances.

The demand for more efficient, sustainable and affordable urban environments where land is used more intensively, infrastructure and financial spending are applied more wisely, natural resources are used more sustainably and human resources are considered more carefully, especially resources available to the poorer inhabitants of the city, call for the importance of increased density to be recognised. Achieving sustainability in each sphere of performance is challenging and has rarely been achieved in the South African development context, where trade-offs are often made by decision-makers both consciously and unconsciously. Nonetheless, it is important to realise that in order for urban development to be sustainable in South Africa, it must address poverty, inequality, and the disparities in society. Without achieving sustainability in these spheres, urban development is ultimately unsustainable. Todes (in Jenks, Burton and Williams, 1996) contests that the prospects for 'compaction of cities' are shaped by forces such as old policies and institutional arrangements that need to be transformed to meet new challenges. She believes that the attitude of local planning authorities (and therefore political will in support of compaction), as well as market forces, the functioning of the urban land market and property markets, and government's *laissez-faire* way of dealing with them, NIMBY*ism* (Not-In-My-Back-Yard Syndrome) and lifestyle preferences all militate against an "integrative and urbanist version of compaction" (in Jenks, Burton and Williams, 1996, p.242).

Breaking New Ground (BNG), the South African government's sustainable human settlement plan, offers additional housing instruments to supplement existing ones and attempts greater levels of responsiveness to local circumstances. BNG promotes densification and integration as key objectives to "integrate previously excluded groups into the city and the benefits it offers, and to ensure the development of integrated, functional and environmentally sustainable human settlements, towns and cities" (Department of Housing, 2005, p.10). A move towards low-rise medium-density housing that makes efficient use of land and resources is necessary. The (social) medium-density housing programme covering rental housing options and alternative tenure housing options is one of the four main programme thrusts proposed in BNG. This programme focuses on the provision of social housing predominantly for households falling in the gap market (monthly incomes of R3500 to R7000 approximately, and not for low-income households) in so called 're-structuring zones' where "targeted and focused" investment is supported by provincial and local government (Department of Housing, 2005, p.10). Importantly and additionally, it is critical that sustainable medium-density public rental housing for low-income households is provided on well-located land. The current (largely untested) housing instrument to provide this type of housing is the Community Residential Unit Programme.

The social housing restructuring zones are intentioned as an instrument towards restructuring of South African cities, where its foremost concern is social, spatial, economic, and racial integration. According to the Social Housing Regulatory Authority, "(r)estructuring is thus intimately linked to interventions in the land market: either to protect lower income (and often Black) people from displacement or to bring lower income (often Black) into areas of economic and other forms of opportunity from which they would otherwise be excluded. This is perhaps the most important meaning of restructuring" (Social Housing Regulatory Authority. n.d., p.10). These zones are planned to correspond to Urban Development Zones and to link to planning processes such as the National Spatial Development Perspective, Provincial Growth and Development Strategies, Provincial Spatial Development Plans, and importantly municipal Integrated Development Plans.

Why density and densification should not be a swear-word

There is a tendency to associate poor environmental quality and low incomes with high-density development, and *vice versa.* User preferences based on experiences with medium-high density urban environments (for example, flats rented from city councils, especially during the apartheid years in South Africa or informal settlements with remarkably high densities) contribute to the negative light in which

this type of environment is seen. However, environmental quality varies independently of density, with good and bad environments occurring at both high and low densities. It is impossible to relate density to environmental quality, as urban environments are determined by more than just density controls. Jensen (in Senior, 1984, p.8) states that *"(d)ensity expressed as an intensity of occupation is not by itself the sole qualitative measure of housing development, which also depends greatly on planning and amenity standards, and the liveability of homes"*. Density cannot be used as an all-encompassing measure of the environment, but is one of many factors affecting environmental quality. Higher densities for new developments, and transforming existing low-density environments, are critical contributing factors towards better quality urban environments in South Africa. This is in line with the Social Housing Policy's specific objective promoting higher-density development in existing built areas (densification); development of large vacant sites within built urban areas (infill development); and restricting outward expansion (containment) (Department of Housing, 2005).

Certainly, government's commitment to restructuring, inclusivity, sustainability and access to opportunity, provides the normative basis and social (and political), spatial, environmental and economic rationale for a transformed approach to dealing with antediluvian suburban areas (such as garden city suburbs) based as they are on social utopian imaginaries of good city form, and euphoric recalls to countryside living. It seems that the negative effects of NIMBYism, resistance to diversity and change, and the fear of negative impact of property values is a selective amnesia, focussed on a perception of high densities implying 'low-income otherness' or the urban poor. In Cape Town for instance, Sea Point has the highest residential densities and land use mixes, and still remains one of the most desirable and sought-after residential choices internationally. Higher residential densities and use mixes have in fact been a driver for the property booms at the higher-end of the property market where town-house clusters and planned-unit development 'complexes' have facilitated the main significant addition to better-performing property developments, and therefore defining a new post-modern urban form to replace the now dysfunctional garden-city inspired traditional suburb. Performance-wise, the suburb and its rural origins in the 'farm-house' have not been out-passed on all fronts (economic, ecological, social and political). More recently, the security prerogative, where gating of sections of suburbs has become growing trend (Landman and Schönteich, 2002**),** the sustainability of the suburb (and its newer twin, the golf estates) is fast being called into question, equally as their social exclusion intensions are becoming clear.

Based on the aforementioned, the case for densification can be made on the basis of the following development and design tenets:

An integrated approach is rooted in a multi-sectoral approach where co-operation between a range of non-government role players, civil society, the private sector and government departments is crucial in the creation of a milieu that serves the widest possible range of household and community needs. Such an approach, if participatory and rights-based, is more likely to yield successful results relating to social, institutional, financial, economic, environmental and physical design issues. Sustainability, as defined by Allen (2000), is the ideal foundation on which to base densification approaches and embracing of diversity.

Linking to this is the nature of inequality and poverty of being multi-dimensional and complex. A multi-sectoral, holistic approach to development needs is required to improve the social, economic and physical conditions of poor households and to further the agenda of sustainable development. Effective integrated urban development is underpinned by good inter-governmental relations, collaboration between key role players, and active civil society participation in urban processes, such as the formulation of municipal Integrated Development Plans (IDPs) and local economic development strategies. The availability of sufficient resources to provide a wide range of social and economic programmes, including the delivery of housing, infrastructure and facilities to address community needs, are vital components of the integrated approach. Settlement policy should be expanded and the subsidy increased in all medium-

density environments to make provision for social objectives such as recreation, social amenities and the needs of children and youth. Co-operation between government departments is crucial in this regard, and spatial integration rooted in access to facilities, amenities and urban opportunities is paramount.

Compact settlements: Urban sprawl is the predominant form of urban development in South African cities, and manifests in the separation of activities and land uses, the suburban or township ethos, freestanding buildings surrounded by private space, inwardly-oriented neighbourhood units and the domination of the private motor car. Sprawl involves more than just low densities and is a complex and contested subject that ultimately deeply entrenches segregation. This form of urban development is irreconcilable with the notion of sustainability and is condemned due to its high social, economic and environmental costs, which are often hidden and are borne by the poor. The cost of providing adequate infrastructure, roads and services has become unaffordable and unsustainable for government. The time and financial implications are severe for the large number of people located on the periphery of urban areas. These are most often vulnerable groups such as the poor and women, who must travel long distances to access urban opportunities and employment. Urban sprawl is inappropriate in the face of growing environmental concerns, the shortage of land for development, changing household profiles and family composition and the shifting nature of employment environments.

Land and property markets**:** Growing concerns about the rapid formation of informal settlements, overcrowding in backyards and existing housing, segregation entrenched by suburbanisation and the inaccessibility of well-located land for the poor in general, make this shift towards more compact and dense settlements imperative. The struggle of access to land for the urban poor is a critical issue in post-apartheid South Africa, and resonates with the *raison d'etre* of the 'Right to the City' approach.

The operation of land and property markets excludes the poor and exacerbates existing inequalities and is in contravention of legislation that protects the right of the poor to adequate living environments. Government intervention in the land and property markets to ensure that they work for the poor is vital. A number of mechanisms could be used to support the efforts of poor communities to access urban land. Government could enter into new fiscal relationships with citizens, aimed at capturing unearned increases in land value and directing urban land development for the common good of all citizens. This could be achieved through land value taxes, land banking and land pooling/readjustment, and other mechanisms (Brown-Luthango, 2006). Appropriate use of these mechanisms could potentially increase the provision of medium-density housing in strategic locations. In this regard, the use of the land value tax (a tax on the value of the land excluding the value of the buildings or improvements on the land), or composite rating (value of the land to be taxed at a higher rate than the value of the buildings or improvements), would incentivise rate payers to erect additional dwellings on their properties, contributing to densification of lower-density suburbs. Currently, property owners are penalised for densifying on their properties as a result of a tax on buildings and improvements. Solomon (2007) points out the advantages of the land value tax as being adequate, fair, neutral and economical; intensifying land use; returning the value of government investment in local amenities to government; discouraging vacant possession for speculative purposes; discouraging urban sprawl by brining unused land into the market; encouraging access by bringing the price of land to more affordable levels; and dampening price escalation which activates the market.

In addition to ensuring that land, property and housing markets are functional, it is important to both apply existing instruments and devise innovative new instruments for effective spatial planning and land development, Spatial Development Frameworks (SDFs), restructuring zones, zoning regulations, urban edge instruments and Integrated Development Plans (IDPs) should be focused on achieving spatial and social equity in land and property markets. This could involve developing pro-poor mechanisms for value capture from surplus values accruing from 'boom conditions' in the upper end of the land and property market. These mechanisms will promote densification, integration and the generation of resources for low-income residential developments on well-located land, such as on smaller infill sites in

unsustainable, sprawling suburban areas. In this regard, government could explore both the 'carrot' of incentives and 'stick' of legislation in implementing inclusionary housing programmes (Brown-Luthango, 2006).

Good location: Good location is a complex concept to define, but access to employment, transport and urban opportunities and facilities are useful indicators. Through efficient use of state and other well-located land (including infill housing in lower-density suburbs), and the use of value capture and tax mechanisms, government could ensure the provision of affordable higher-density housing on well-located land for households earning below R3,500 per month, including security of tenure in the form of both rental and ownership housing. Appropriate well-located sites in close proximity to transport, economic activities and services should be identified and 'banked' for the development of affordable medium-density housing. For the poor, location is often more important than housing quality as it directly impacts on the accessibility of urban opportunities and underpins social networks and livelihood strategies critical for survival (Tonkin, 2008). Greater social integration may also result from the location of low-income households on well-located land.

Conclusions.

Cities are created by migrants and their role as centres of innovation rests largely from this heightened vortex of exchanges of human knowledge and cultures (Cohen, 2006). The paper attempted to explore two common concepts used in urban development and planning discourses and weave together the nature of physical and social underpinnings of planning as a social practice to develop more textured lenses and sensibilities to couch alternative understandings of the city and its management. The physical/design prerogative/inclinations of planning interventions in the city need to be wrapped around the lived reality and aspirations of all its citizenry - past, present and future. Since urban planning is defined by what it does (its substance as space and people) as well as how it does it (the processes of how intervention practices are conceived and implemented), the balance between modes of analysis and understanding substantive focus need to talk to the practices in a more informed manner.

This challenge often shows up in the policy-practice nexus. An example of this is in the refinement of post-apartheid human settlement policy as it is couched in *Breaking New Ground* (2004). While there is a more sophisticated understanding of the nature of urbanisation processes of informalisation of shelter, the policy still prescribes 'eradication of informal settlements' within impossible time frames and known resource constraints. While the language and imageries of more inclusive cities are written into policy frameworks that underscore the activist and progressive aspects of the Constitution that espouse rights-based approaches to development (Bill of Rights), several sets of tensions have hamstrung the realisation of inclusive cities. The first group of tensions relate to the silo-fashion of policy conception and interpretation of policy and strategy; the second to political will and institutional architecture and state capacity; and the third to unresponsive planning practices in assembly and use of development and planning instruments.

David Smith (2003, p.38) sounded a caution to built-environment practitioners to the need for moving beyond physical manifestations of what are essentially socio-economic and political processes and fore-grounded the necessity for using alternative lenses and sensibilities thus:
(t)he socio-economic limits of differentiation are to be found when material inequality among groups reaches unsustainable levels, in the sense of threatening moral order and social reproduction. The cultural limits of differentiation are likely to be when the values of mutual recognition and tolerance yield to active group chauvinism. Without some limits to spatial and social fragmentation, and some moral values against which actual practice of disparate groups can be called to account, we are left with the relativist (or postmodern) nightmare of anything goes. It is in trying to find these limits that urban studies and city planning are well advised to consort with ethics. Any form of successful transformation or development,

as intentional change for good requires understanding of what that good may be (– *emphasis, the authors')*.

The policy intents for densification get locked at the intersection of wavering political will, limited state capacity and unresponsive development management practices that together are unable to influence the land and property markets to be more equitable and redistributive.

References

1. Allen, A., 2002. "Urban sustainability under threat: the restructuring of the fishing industry in Mar del Plata, Argentina", *Development in Practice*, Volume 11, Numbers 2 and 3, May, pp. 152-73.
2. Behrens, R. and Wilkinson, P. 2003. *Housing and urban transport policy and planning in South African cities: A problematic relationship?* In Harrison, P., Huchzermeyer, M. and Mayekiso, M. Eds. Confronting Fragmentation: Housing and urban development in a democratising society.Cape Town: UCT Press, pp. 154-172.
3. Bond, P. 2008. *Degeneration of urban policy after apartheid*. In Harrison, P., Huchzermeyer, M. and Mayekiso, M. Eds. Confronting Fragmentation: Housing and urban development in a democratising society. Cape Town: UCT Press, pp. 40-54.
4. Brown-Luthango, M. 2006. *Capturing Unearned Value / Leakages to Assist Markets to Work for the Poor.* Prepared by Development Action Group for Urban Landmark.
5. Cohen, R 2006. *Migration and its Enemies: Global Capital, Migrant Labour and the Nation State*. Aldershot: Ashgate Publication.
6. Cronin, J. 2012. *How history haunts us...* The Sunday Times, Johannesburg, 29 April, 2012.
7. Department of Housing. 2004. *Breaking New Ground: A Comprehensive Plan for the Development of Sustainable Human Settlements*. Pretoria: Department of Housing.
8. Department of Housing. 2005. *A Social Housing Policy for South Africa: Towards an enabling environment for social housing development.* Approved in MINMEC June 2005. Pretoria: Department of Housing.
9. Development Action Group (DAG) 2010. Medium-density Housing as part of Sustainable Urban Development. *Urban Land Matters*. Issue 1, Volume 1, June, 2010.
10. <http://www.dag.org.za/underdev/docs/2010/Medium_Density_Issue_1.pdf> (accessed 27 June, 2012).
11. Frank, A. 2006. Three decades of thought on Planning Education. *Journal of Planning Literature*, 21(1) pp. 15-67.
12. Gelb, S. 2008. *Behind xenophobia in South Africa – Poverty or Inequality.* In Hassim, S, *et al* (eds.) *Go Home or Die Here: Violence, Xenophobia and the Reinvention of Difference in South Africa.* Johannesburg: Wits University Press, pp. 79-92.
13. Görgens, T., and Van Donk, M., 2011. *From basic needs towards socio-spatial transformation: coming to grips with the 'Right to the City' for the urban poor in South Africa*. Cape Town: Isandla Institute. <http://isandla.org.za/publications/152/> (accessed June 17, 2012).
14. Harrison, P. 2003. Fragmentation and globalisation as the new meta-narrative. In Harrison, P., Huchzermeyer, M. and Mayekiso, M. Eds. Confronting Fragmentation: Housing and urban development in a democratising society. Cape Town: UCT Press, pp. 13-25.
15. Harrison, P., Todes, A. and Watson, V. 2008. *Planning and Transformation: Learning from the post apartheid Experience*. New York: Routeledge.
16. Jacobs, J. 1961. *The Death and Life of Great American Cities*. London: Penguin Books.
17. Jacobs, J. 1969. *The economies of cities*. New York: Random House.
18. Jenks, M., Burton, E. and Williams, K. 1996. *Compact Cities and Sustainability: an introduction.* In Jenks M, Burton E and Williams K (eds). *The Compact City: a sustainable urban form?* London: E&FN Spon Press, pp. 11-12.
19. Jensen, R. 1966. *High Density Living*. London: Leonard Hill.

20. Kamete, A.Y. 2010 *Missing the point? Normalizing 'pathological spaces' in urban Africa.* Paper presented at the Planning Africa Conference, Durban 13-15 September, 2010.
21. Landman, K. and Schönteich, M. 2002. Urban fortresses: Gated communities as a reaction to crime. *African Security Review*, Vol. 11, No. 4.
22. Mattingly, M. 1998. *Changing urban planning practice*. Lecture delivered to professionals and government officers as part of Las Conferencias Sobre Planificacion Estrategica de Ciudades conducted by the Facultad de Arquitectura y Urbanismo, Universidad Nacional de Tucumán, San Miguel de Tucumán, Argentina, 15 April, 1998
23. Mumford, L. 1961. *The City in History: Its Origins, Its Transformations and Its Prospects*, New York: Harcourt, Brace and World.
24. Ndebele, N.S. 2009. *Of pretence and protest*. Mail and Guardian, 23 September, 2009.
25. Porter, L. 2010.*Unlearning the colonial cultures of planning*. Surrey: Ashgate Publishing.
26. Senior, B. 1984. *Factors affecting residential density: A search for the Zen of Density*. Unpublished Doctoral Thesis. Faculty of Architecture, University of the Witwatersrand, Johannesburg.
27. Smith, D. M. 2003. *Urban Fragmentation, inequality and Social justice: Ethical perspectives*. In Harrison, P., Huchzermeyer, M. and Mayekiso, M. Eds. Confronting Fragmentation: Housing and urban development in a democratising society.Cape Town: UCT Press, pp. 26-39.
28. Social Housing Regulatory Authority. n.d. Urban Development Zones: Restructuring Zones: Introduction <http://www.shra.org.za/resource-centre/shf-archives/90-urban-development-zones> (accessed June 17, 2012).
29. Solomon, D. 2007. *Issues and Alternatives in Implementing the Agricultural Land Value Tax in SA.* Paper presented at the Friends of DAG Seminar, 22 March 2007. Cape Town: Development Action Group.
30. Tonkin, A. 2008. *Sustainable medium-density housing: A resource book.* Cape Town: Development Action Group.
31. Tapela, N. 2008. Input at Constitutional Hill Launch of Development Action Group's Resource Book entitled *Sustainable medium-density housing: A resource book* (Tonkin, 2008) See excerpts in
32. Urban Land Matters, Issue 1. Volume, 1, p.3 (*Great thinkers explain densification...*) http://www.dag.org.za/underdev/docs/2010/Medium_Density_Issue_1.pdf
33. Tapela, N. 2010Planning and planning education in the Western Cape, *The Journal of Building and Land Development* (Special Issue, June 2010); Ardhi University: Dar-es-Salaam pp 100-114
34. Taylor, N. 1999. Anglo-American town planning theory since 1945: three significant developments but no paradigm shifts. *Planning Perspectives*, Volume 14, Issue 4, 1999, pp. 327-345.
35. Watson, V. 2003. Conflicting rationalities: Implications for planning theory and ethics. *Planning Theory and Practice*. Issue 4, Volume 4, pp. 395–407.
36. Worby, E, Hassim, S and Kupe, T. 2008. *Introduction*, in Hassim, S; Kupe, T and Worby, E (eds) 2008. Go Home or Die Here: Violence, Xenophobia and the Reinvention of Difference in South Africa; Johannesburg: Wits University Press. p. 1-26.
37. *World Charter on the Right to the City***.** 2004. Social Forum of the Americas – Quito – July 2004, World Urban Forum – Barcelona – September 2004. <http://www.planningnetwork.org/01_news/World_Charter_on_the_Right_to_the_City.pdf> (accessed June 17, 2012).
38. United Nations Human Settlements Programme, 2009. Planning sustainable cities: global report on human settlements. London: Earthscan.

A case for establishing an incubator as a catalyst to develop sustainable fashion SMMEs

Shamil Isaac
Faculty of Informatics and Design,
Cape Peninsula University of Technology
isaaci@cput.ac.za

ABSTRACT

The South African Clothing and Textile manufacturing industry has come under enormous pressure with a corresponding increase in job losses over the last few years due to imports from low wage rate areas. This decline largely corresponded with the World Trade Organisations ending the Agreement on Textiles and Clothing in 2005 which had previously assigned trade quotas in textiles and clothing to member countries. A revitalising of the industry is possible especially as there appears to be a steep rise in the cost of importing from the east viz. labour and transportation cost. One of the key factors constraining the success of the clothing and textiles industry is a well established design sector generating innovative designs.

The paper will focus on reviewing literature related to current international fashion incubators, fashion districts and fashion clusters as well as available data from SMME support organisations.

The findings will guide the development of a model for establishing a fashion design incubator in Cape Town to support graduate fashion designers. This approach would be to engage in a sustainable way with fashion entrepreneurs to support the acceleration of their continuous improvement in competitiveness, and be able to respond to the harsh realities faced by establishing a small business. Entrepreneurs are linked to relevant and available best practices or technology services, to respond to their specific needs. Stemming from this paper a more detailed engagement will have to be undertaken with the potential users and stake holders of such a facility to develop a potential funding proposal.

KEY WORDS
Fashion; clothing, entrepreneurship, SMMEs, incubators, sustainable fashion.

INTRODUCTION

The South African clothing sector has come under severe strain over the last few years especially due to low cost imports entering the country from low wage areas mainly. It was reported in the Business Day (Phakathi, 2012) that the clothing sector had been affected by cheap imports from China and that it had lost at least 50 000 jobs in the last 10 years. The South African clothing sector has since its early days been mainly production and not designed orientated i.e. companies sent their buyers and designers to the leading European fashion shows, exhibitions and store visits from which they would return to replicate what they saw and try to produce it cheaper. In 2009 the South African Minister of Economic Development, Mr. Ebrahim Patel in an address to the clothing industry employers and labour had emphasized that the industry had to develop a new survival strategy which he termed the "high-road of development" (Crotty, 2009). Mr. Patel a former General Secretary of the Southern African Clothing and Textile Workers Union(SACTWU) noted that the opportunities for South Africa was to develop a high value-add industry using one or more factors "that may include quality, design, innovation, new product

development, speed-to-market, or short-run production." The importance of the South African Fashion sector developing its design capacity was further emphasized when the Department of Trade and Industry (DTI) invited various stakeholders to a meeting to discuss the establishing of a National Fashion Council (DTI, 2011). One of the key proposals to emerge amongst others was to nurture young design talent through a phased process.

It is quite clear that the continued existence of the fashion sector cannot rely on low wage production, but the need to develop sustainable SMMEs through value added design. One good design can be multiplied many fold to create jobs in the fashion sector, however the challenges facing fashion designers coming from a creative base is enormous. Mills (Mills, 2011) uses a narrative sense making theory i.e. "creating order and making retrospective sense of experience" to capture the experiences faced by start-up fashion designers. Mills describes the tension between creative endeavour and business practice faced by fashion sector start-ups and uses the term the "creativity-business tension". It was noted in Mills capturing of the narratives in the research, that that although there were fashion designers who achieved a high sales turnover and high public profile, their profits were very low or non - existent. Mills, noted that those designers that emerged out of an enterprise development incubator saw "business design as an extension of the creative activity and adjusted from being a creative person to being a creative business person".

The paper therefore proposes the establishment of a Fashion Incubator or "Design Park" to develop and grow sustainable emerging fashion designers.

METHODOLOGY

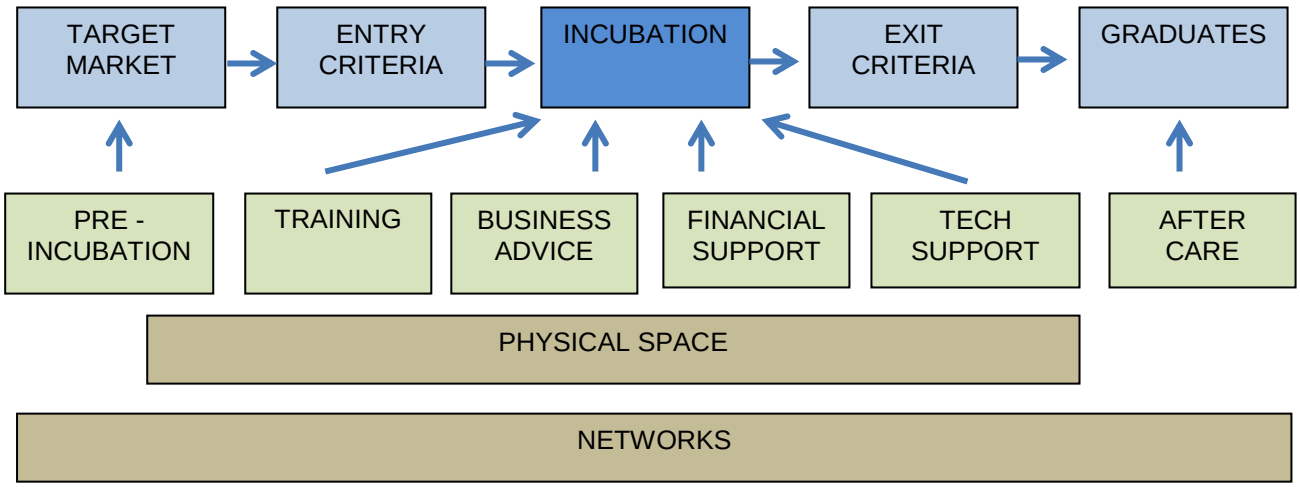
The paper reviewed literature and websites related to support for SMME fashion designers internationally as well as analysis of current data available from fashion SMME support organisations in Cape Town. A questionnaire containing 13 questions was also sent to the fashion incubators. With two responses, one promising to complete the questionnaire when they returned to office and the second one requesting a fee of $500 dollars to answer the questionnaire. Nevertheless general information contained in the questionnaire could be extracted from their websites.

INCUBATORS

Incubators have evolved over time and meant different things to different stakeholders. It was initially established to promote and develop high level innovation and therefore efforts were concentrated on science, engineering and information technology development. The Centre for Strategy and Evaluation Services in a report to the European Commission's Enterprise Directorate General (2002:9), defines an incubator as "an organisation that accelerates and systematises the process of creating successful enterprises by providing them with a comprehensive and integrated range of support, including: Incubator space, business support services, and clustering and networking opportunities".

The National Business Incubation Association (NBIA) a United States based organisation defines business incubation as "a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts" (National Business Incubation Association: nd)

In a World Bank initiative known as, Information for Development Programme (Infodev: 2010) a policy document describes a business incubator as focussing a range of services on clients that are designed to help them launch a well managed business. In this policy document it illustrates a very simple model for business incubators.



(Infodev, 2010)

In general therefore business incubators were established in identified sectors to provide support to SMMEs (Small Medium and Micro Enterprise) that would accelerate their success as sustainable businesses. The support could range from taking up residence in the incubator premises to providing business and technical support services and network opportunities to SMMEs outside of the incubator premises. Incubation is a fairly costly SMME development instrument especially if it accommodates residents. The focus is therefore concentrated on SMME development where the probability for success is highest.

INTERNATIONAL FASHION INCUBATORS

As described earlier, incubators play different roles in different environments and mean different things to different organisations. The emphasis in all the international examples found was on business support and networking. Incubators could be separated into two broad groups viz. residence based incubators or non-residence incubators. Another category of incubators also emerged which could be categorised as virtual incubators viz. providing on line advice.

Information was extracted from the Fashion Incubator websites listed in the table below.

	NAME	COUNTRY LOCATION	WEB ADDRESS
1	Boston Fashion Incubator	USA	http://bostonfashionincubator.com/
2	Council of Fashion Designers of America Fashion Incubator	USA	http://cfda.com/programs/cfda-fashion-incubator
3	Design Edge Fashion incubator	Australia	http://designedge.net.au/design-edge/Home.htm
4	Maisons de Mode - Lille	France	http://www.maisonsdemode.com/en/fashion-incubator.html
5	**Portanova Fashion incubator**	Croatia	http://www.fashion-incubator.hr/aboutus
6	San Francisco Fashion Incubator	USA	http://fashionincubatorsf.org/
7	Fashion Biz Inc (FBI)	USA, LA	http://fashionbizinc.org/
8	Garment Industry Development Corporation, New York	USA	http://www.gidc.org/Pages/default.aspx
9	Gold Coast Fashion	Australia	http://gcfashionincubator.vpweb.com.au/

	Incubator		
10	Hawaii Fashion Incubator	Hawaii	http://hawaiifashion.org/
11	DC Fashion Incubator	USA	http://www.dcfashionincubator.org/
12	Amsterdam Fashion Incubator	Netherlands	http://amsterdamfashionincubator.com/
13	Textile Clothing and Footwear Resource Centre of Western Australia	Australia	http://myfashionincubator.com/
14	**Philadelphia Fashion Incubator**	USA	http://www.philadelphiafashionincubator.com/
15	Seattle Fashion Incubator	USA	http://seattlefashionincubator.org/home
16	Toronto Fashion Incubator	Canada	http://www.fashionincubator.com
17	Winnipeg Fashion Incubator	USA	http://wpgfashionincubator.com/
18	Atlanta Fashion Incubator	USA	http://www.atlantafashionincubator.com/
19	Dallas Fashion Incubator	USA	http://www.dallasfashionincubator.com/

The services provided by the fashion incubators listed covers the following general support, some to a greater or lesser degree. This is a general compilation of the information and not specific to a particular incubator.

For residential and non-residential incubators:
General and business seminars
Seminars/workshops in range of areas i.e. business plan writing, basic accounting, finance, product costing, pricing, branding marketing, social media marketing, retail management, range presentations/ visual merchandising, cash-flow strategic programs, production and manufacturing, Importing/Exporting, human resources, etc.

Technical Workshops

Courses range from sewing, design, pattern making, product development, draping, styling and textiles.

Marketing
Showcase, Fashion shows, pop up boutiques (temporary retail space, normally in warehouse type environments), Media exposure

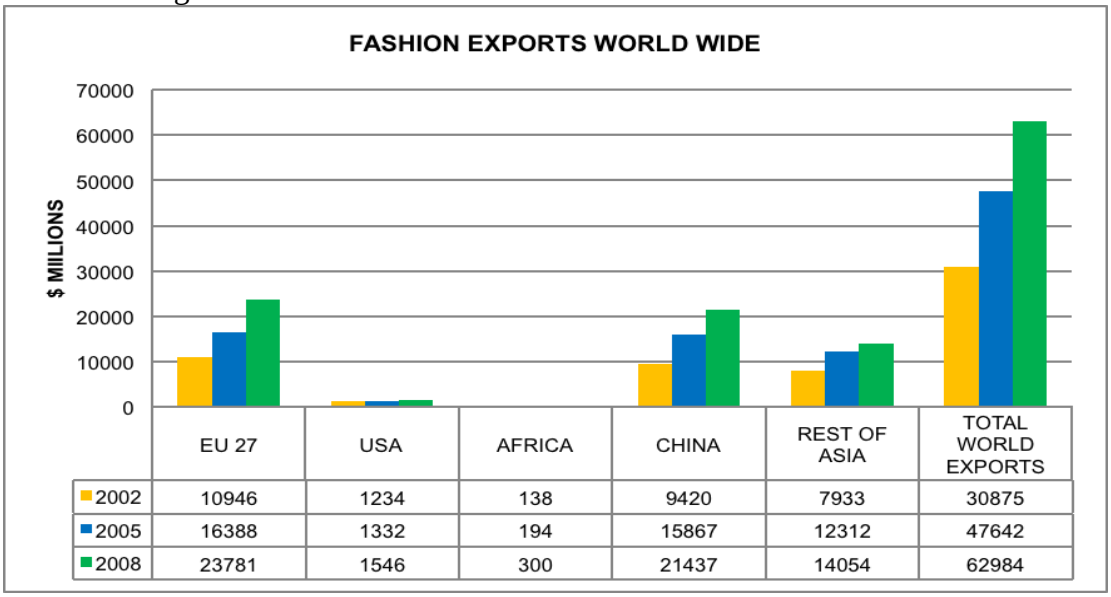
Other
Negotiated discounts, fashion trend websites, shipping costs, Networking opportunities, fabric suppliers, between designers, funding support, Advocacy, Mentorship, consultation

Residential Incubators
This is where the fashion physically takes up residence on the premises of the incubator as compared to just making use of the services of the incubator.

As listed for non-residence
Residence for a limited period (normally 1 year) on application, phased approach
Shared administration, office space and show rooms
Subsidised rental
Strict criteria with emphasis on potential for success.
Some have build-in partnership with retail outlets.

Fees charged
Courses fees range from free to between $500 and $1500 for technical courses.
Membership fees ranges from $150 to $250 per month for non-residence and $ 275 to $ 550 for residence. Cost would be lesser for shared work space increasing substantially for a private studio.

South Africa and particular Africa is lagging behind in fashion exports. The data extracted from the 2010 Creative Economy report illustrates this point clearly (UNCTAD, 2010). It is important to note that Europe still commands a significant share of exports even though its manufacturing base has been eroded. This illustrates that Europe's strength is in fashion brand and design as opposed to manufacturing.



	EU 27	USA	AFRICA	CHINA	REST OF ASIA	TOTAL WORLD EXPORTS
2002	10946	1234	138	9420	7933	30875
2005	16388	1332	194	15867	12312	47642
2008	23781	1546	300	21437	14054	62984

(UNCTAD, 2010)

SOUTH AFRICAN INCUBATION SUPPORT

An agency of the Department of Trade and Industries (DTI)viz. the Small Enterprise Development Agency (Small Enterprise Development Agency, n.d.) through its Technology Programmes supports incubators. The SEDA Technology Programme has 24 incubators across the country based on 3 different models of technology business centres (SEDA, 2012) i.e.
Technology Demonstration Centres (TDCs) for demonstration of value adding technology,
Technology Incubators (TIS), sheltered environment for technology based start-ups.
Hybrid Centres combination of the two. These centres cover a wide range of sectors viz. ICT, manufacturing, biotechnology, small scale mining, construction, bio-fuels, Chemicals Floriculture Automotive, Agriculture, Essential Oils, Aluminium Stainless Steel and Furniture. However no known incubator supports the fashion sector in South Africa.

Another independent advocacy and member organisation, SABTIA (South African Business and Technology Incubation Association. n.d) forms a linkage between incubators in South Africa and internationally. The role they see themselves playing amongst others is to develop networks, train organisations that support and assist SMMEs, lobby decision makers and stakeholders for the benefit of SMMEs,

SUPPORT FOR THE SMME FASHION SECTOR IN CAPE TOWN

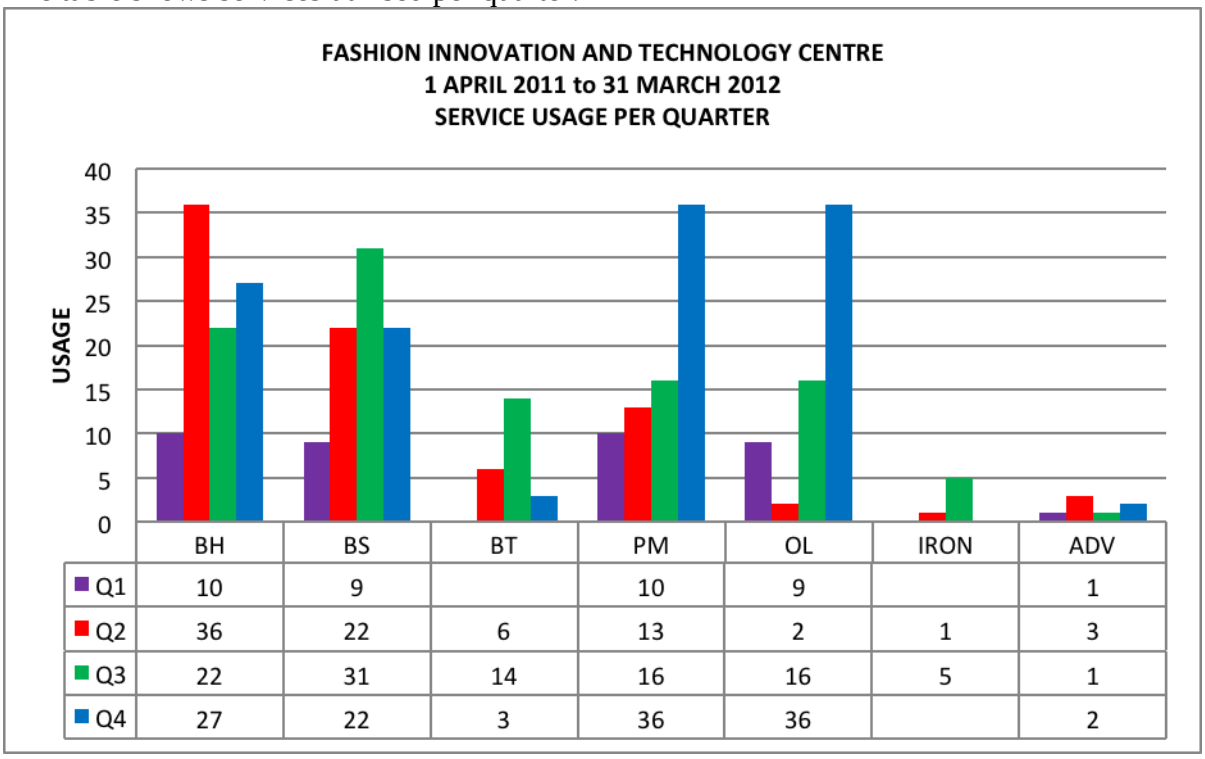
The Technology Station in Clothing and Textiles, based at the Cape Peninsula University of Technology, provide technology support to the clothing and textile sector especially SMMEs as part of its community engagement programme. The unit is supported by the Technology Innovation Agency to

assist SMMEs to prototype their innovations. The Technology Station in Clothing and Textiles joined up with the Cape Town Fashion Council and set up a satellite Station on the Cape Town Fashion Council premises which it named the Fashion Technology and Innovation Centre (FTIC). The pilot project provided 3 specialised machines and 2 basic machine viz. a plain machine and an overlocker as well as an iron supported by a technician.

The following data was recorded on a quarterly basis for a period of one year, 1 April 2011 to the 30 March 2012 (Isaacs, 2012).
The machines used were coded as follows

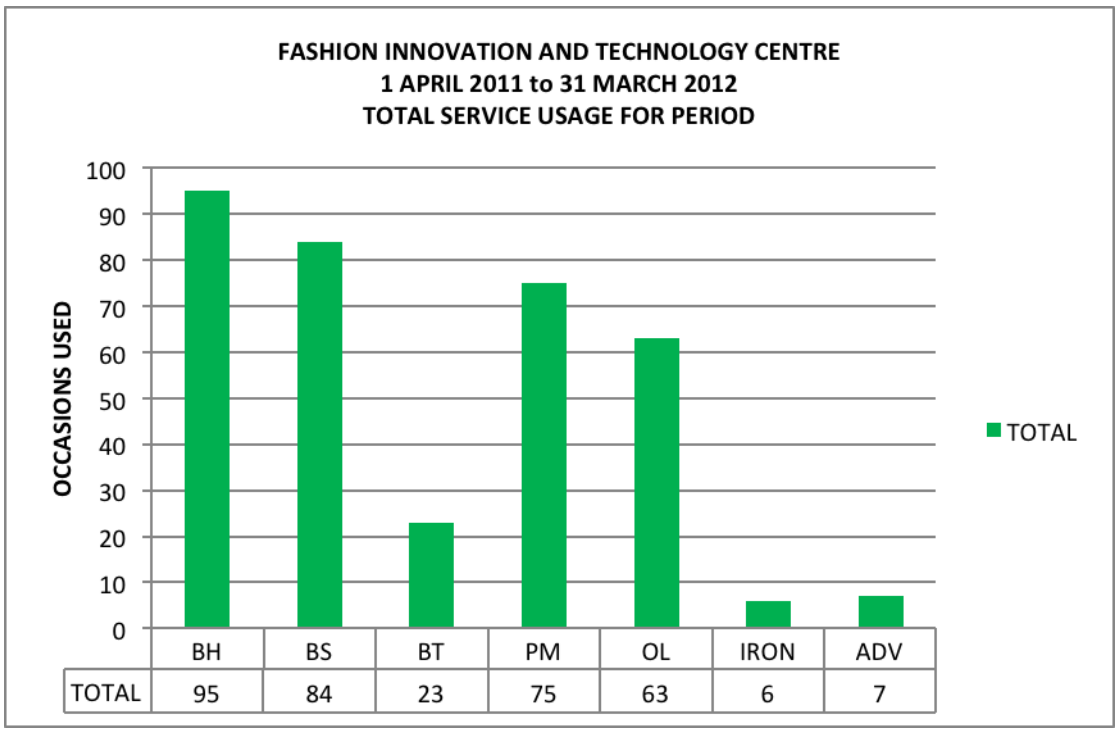
CODE	MACHINE
BH	Button hole machine
BS	Button sew on machine
BT	Bar Tack machine – strengthen corners on garments
PM	Plain machine
OL	Over locker machine
IRON	Iron
ADVICE	Advice was provided throughout but this was for specific advise only

The table shows services utilised per quarter.

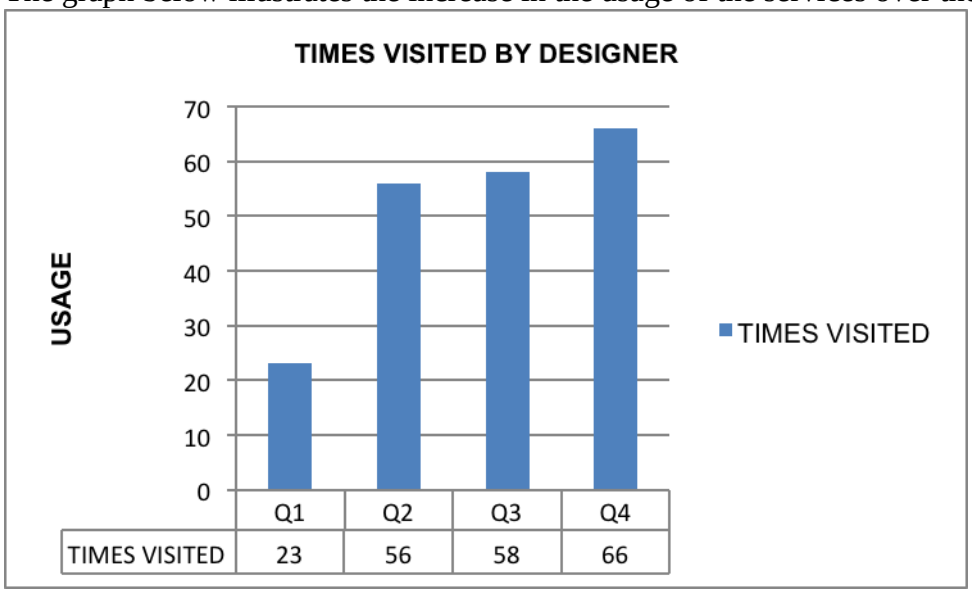


	BH	BS	BT	PM	OL	IRON	ADV
Q1	10	9		10	9		1
Q2	36	22	6	13	2	1	3
Q3	22	31	14	16	16	5	1
Q4	27	22	3	36	36		2

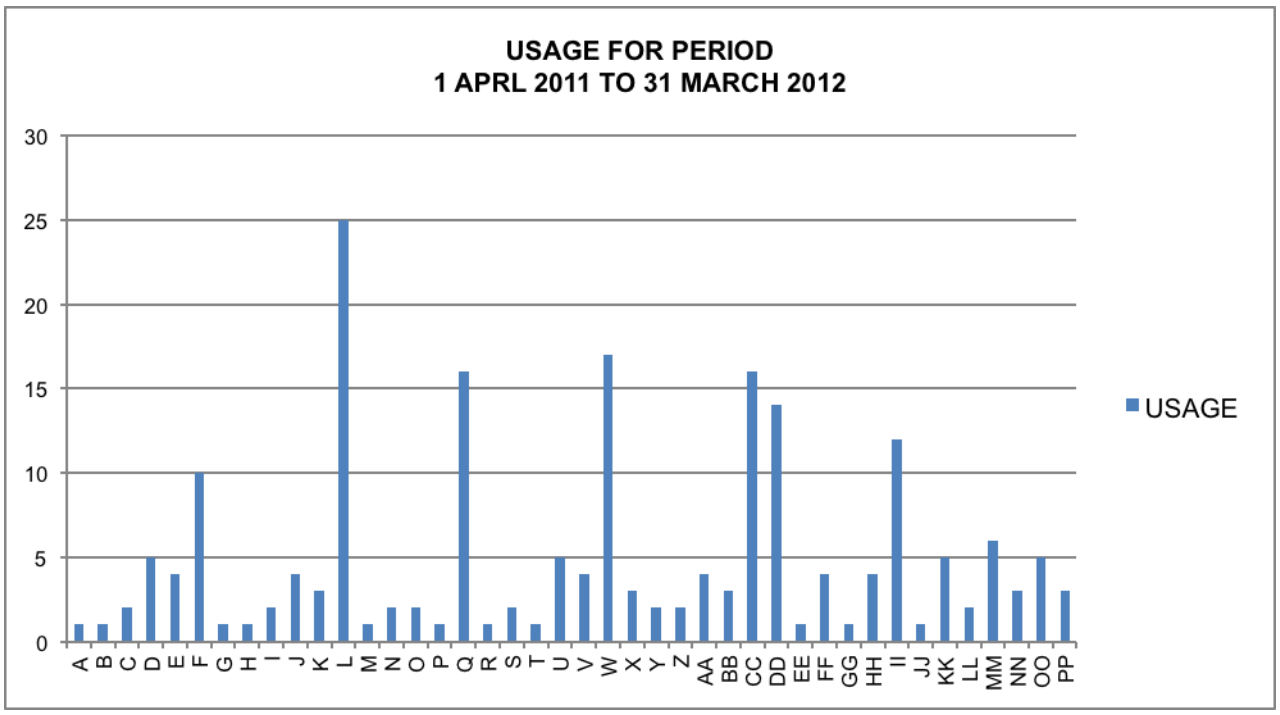
The table below shows the most popular services used by the designers during the period measured.



The graph below illustrates the increase in the usage of the services over the period recorded.



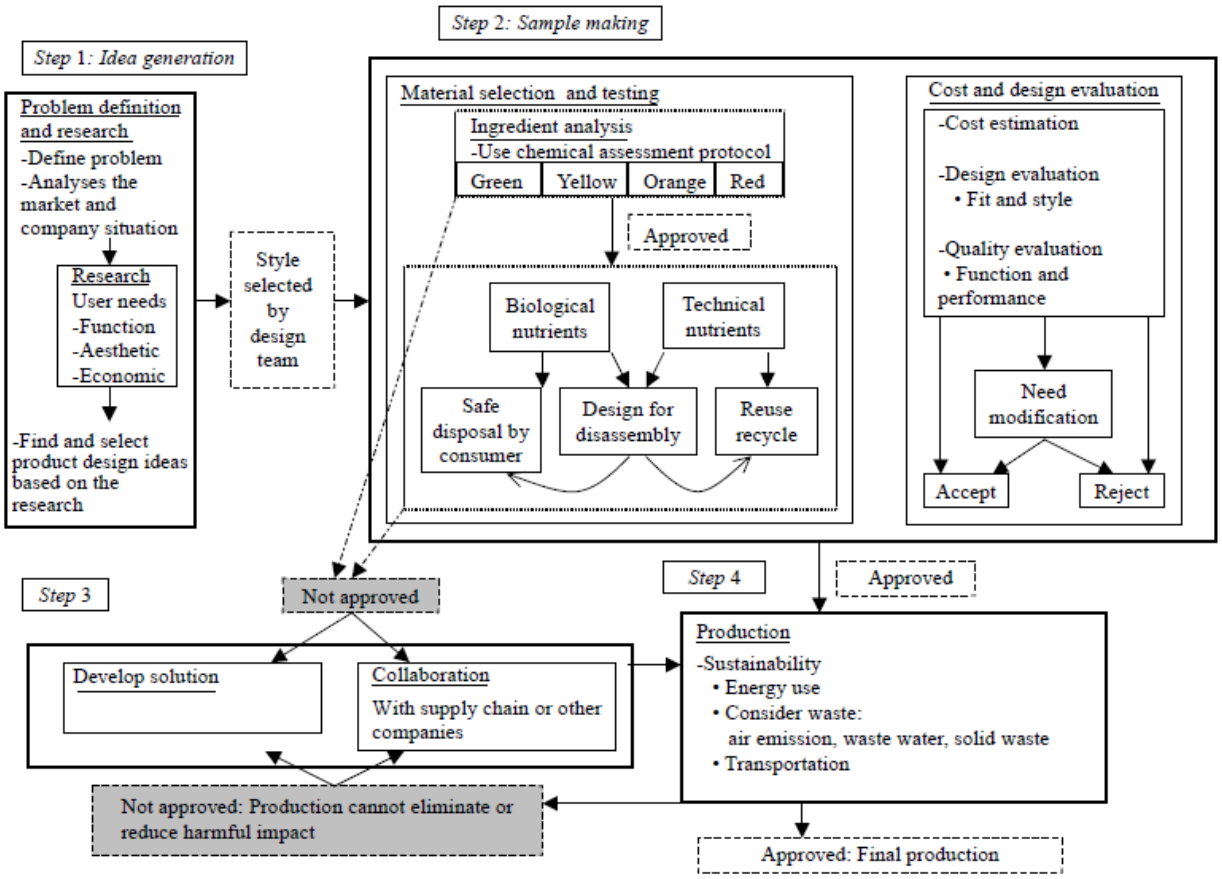
The graph below shows in coded form the frequency of the 42 designers who visited the FTIC during the period measured. Each letter represents a designer and how often they made use of the services.



The data collected for the period measured show a linear growth in usage of the services of the FTIC as designers become familiar with the support offered. The designers that use the service work at their own premises and use the FTIC for completing their products. Various designers especially those from disadvantaged backgrounds have informally indicated a need for residence space to help them grow their business. A detailed study will be done to establish the need for residential requirement.

SUSTAINABILITY

The fashion industry is known as one of the biggest polluters especially with regard to dyeing process of textiles. Designers from the position they occupy in the fashion value chain should be the first to influence the types of environmentally friendly materials and processes that fashion undertake in the journey to the consumer. In developing a product a designer should analyse the production process together with the product end use and care of the product (Soljaeie & Pusic, 2012:32). To be environmentally friendly the product should meet the requirements throughout its production cycle, during use and care and after its useful life has ended. An initiative by the Department of Trade and Industry (DTI) known as the National Cleaner Production Centre has been trying to influence environmental awareness amongst fashion designers by means of an environmentally friendly design competition called "No Kak" (National Cleaner Production Centre. n.d.). The intention of the competition was to use shock language (translated to mean "No Shit") to bring across a point about, no waste and no harmful products. A competition of this nature is quite an expensive exercise and therefor the last such event was held in 2009. This advocacy and awareness should be a continual process and should be introduced at the early stage of a fashion designers development and training. In an article on C2CAD (Cradle to Cradle Apparel Design) the researchers (Gam et al.,2009) developed a sustainable apparel design model. The model as shown below uses various steps whereby the fashion designer continuously remind themselves by means of checks and balances if they are using anything that will harm the environment during design and production.



(Gam et al.,2009)

CONCLUSION AND PROPOSAL

The Fashion Technology and Innovation Centre has all the characteristics to morph into a fully fledge Fashion Incubator. From the experience and information garnered within the FTIC could lay a foundation for the establishing of a fashion incubator

There is however still support required in terms of:

Access to fashion information that either requires them to either travel overseas, have access to syndicated trend information or subscription websites, the cost of which is extremely prohibitive to a start-up fashion designer.

Access to specialised equipment that is not necessarily required on a daily basis but is very expensive for a single entrepreneur to purchase

Product development and technical advice (mentoring).

Business advice

A Fashion Incubator Scenario

A centre would be available to fashion entrepreneurs against a set criteria viz.

Graduate of an accredited tertiary education institution in Fashion, Clothing or Textiles.

Registered business with a Business plan

Payment of subsidised service fee.

STAGE 1

Access to specialised technology to complete prototypes i.e.

Various specialised sewing machines

Sample embroidery machine and design facility

Linkages to subcontractors also known as CMT(Cut Make and Trim) factories

Technical advise

STAGE 2
Provide up to date information on future fashion trends through access to trend reports magazines journals web information.
CAD facilities
CAD pattern making and grading
Monthly network meetings
Mentoring for presentation to buyers
Show rooms
Business and accounting support.
Promote sustainable design

LONG TERM OBJECTIVES
Sustainable centre through membership fees and sponsors.
Organise group tour packages for young designers to attend international shows/exhibitions (access to DTI Export funds)
Develop the South African fashion tourist market
Retail outlets at strategic venues (e.g. Waterfront)
Link to trade house for export
Exhibition/ Fashion show
Sustainable Fashion awards

This facility would provide Fashion SMMEs technology support, provide opportunities to diversify, improve quality, improve productivity, improved sustainability through demonstration and use of new technologies and processes.

Why support fashion entrepreneurs? One fashion designers can stimulate the creation of many more jobs than one manufacturer. e.g. a leading design centre in Cape Town provides work to at least 30 subcontracting (CMT) firms employing on average 30 people per firm.

REFERENCES

1. Centre for Strategy and Evaluation Services. 2002. *Benchmarking of Business Incubators*. European Commission Enterprise Directorate General: Brussels.
2. Available WWW:
   http://www.bii.ge/eng/studies_&_Papers/%5B1%5D.benchmarking_bi_part_one_2002.pdf
3. (Accessed 18 June 2012)

4. Crotty, A. 2009 Clothing sector needs to contribute to strategy. *Cape Times, Business Report*. 15 October 2009.

5. DTI, 2011. *National Fashion Council meeting*, 11 August 2011. Lord Charles Hotel, Somerset West.

6. Gam, H.J., Cao, H., Farr, C. & Heine, L. 2009. C2CAD: a sustainable apparel design and production model. *Journal of Clothing Science and Technology*, 21(4):166-179.
7. Available WWW: http://dx.doi.org/10.1108/09556220910959954
8. (Accessed 30 May 2012)

9. Infodev. 2010. Global Good Practice in Incubation Policy Development and Implementation, The World Bank. Wash: Information for Development Program. Available WWW: http://www.infodev.org/en/Publication.834.html
10. (Accessed 18 June 2012)

11. Isaacs, S., 2012. Fashion Technology and Innovation Centre Usage Reports. 31 March.

12. Mills, C., 2011. Enterprise orientations: a framework for making sense of fashion sector start-up. *International Journal of Entrepreneurial Behaviour and Research*, 17 (3): 245-271
13. Available WWW: http://dx.doi.org/10.1108/13552551111130709
14. (Accessed 31 May 2012)

15. National Business Incubation Association. nd. What is an incubator?
16. Available WWW: http://nbia.org/resource_library/what_is/index.php
17. (Accessed 15 June 2012)

18. National Cleaner Production Centre. n.d.
19. Available WWW: http://www.ncpc.co.za/nokak/index.html
20. (Accessed: 14 June 2012)

21. Phakathi, B.2012 Wage deal in clothing sector fails to add jobs. *Business Day*: April 10.
22. Available WWW: http://www.businessday.co.za/Articles/Content.aspx?id=169219
23. (Accessed 10 April 2012)

24. Small Enterprise Development Agency. n.d. *Seda Technology Programme*.
25. Available WWW: http://www.seda.org.za/MyBusiness/STP/Pages/Incubation.aspx
26. (Accessed 15 June 2012)

27. Soljaeie, I., & Pusic, T. 2012. Textiles and ecology, *Colourage*. April 2012: 33-41
28. Available WWW: http://web.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=2def2c48-84f9-4e9f-a8bf-1fb4f4e48e7c%40sessionmgr15&vid=11&hid=8
29. (Accessed 15 June 2012)
30. South African Business and Technology Incubation Association. n.d.
31. Available WWW: http://www.sabtia.com/index.html
32. (Accessed: 16 May 2012)
33. UNCTAD. 2010. *Creative Economy Report 2010*, United Nations.
34. Available WWW: http://archive.unctad.org/en/docs/ditctab20103_en.pdf
35. (Accessed 15 June 2012)

DESIS-Africa: Design Thinking For Social Innovation and Development

L. A. Ambole
School of the Arts and Design,
University of Nairobi, Kenya
Lambole@uonbi.ac.ke

Prof. M.K. M'Rithaa
Department of Industrial Design,
Cape Peninsula University of Technology,
South Africa
MugendiM@cput.ac.za

Dr. R. Moalosi
Industrial Design and Technology
Department, university of Botswana, Botswana
MOALOSI@mopipi.ub.bw

S. Molokwane
Industrial Design and Technology
Department, university of Botswana, Botswana
molokwaneb@mopipi.ub.bw

Abstract

The discussion on sustainability has gained considerable ground over the recent past decade due to the apocalyptic predictions about the earth's dwindling resources. Though there is as yet no consensus on what it entails, the continuing dialogue on sustainability has led to a variety of approaches and initiatives geared towards sustainable change. One such initiative that seeks to promote social change and innovation through design thinking is the DESIS network. DESIS- Design for Social Innovation towards Sustainability- is a network of design labs, based in design schools and design-oriented universities, actively involved in promoting and supporting sustainable change. In Africa, three Design schools in Kenya, Botswana and South Africa as founding members of DESIS-Africa have committed to promoting social innovation in Africa. The three DESIS-Africa labs have each embarked on collaborative design activities that adopt a participatory action research framework geared towards supporting social change at the local level by co-opting local actors. On a larger scale, the DESIS-Africa labs seek to network with other DESIS labs in order to share successes and scale-up social innovation. The three Africa DESIS labs provide an excellent opportunity for a cross-sectional study. This paper therefore seeks, through an inductive approach, to engage in a qualitative content analysis of the labs' activities in order to generate concepts useful for building substantive and formal theories in the emerging discipline of sustainable design and development. A more immediate result of this study is the prospects for the scaling-up, replication and expansion of DESIS-Africa.

Key words: *Sustainability, sustainable development, social innovation, co-design, collaboration.*

Introduction

Fuad-Luke (2009:20) attests that "'sustainability' may be conceived as that meta-challenge – a concept that had its first tentative expressions more than 60 years ago, although it was then referred to in terms of man and his total environment". The discussion on sustainability has gained considerable ground over the recent past decade due to the apocalyptic predictions about the earth's dwindling resources. Today's Industrial society has been singled out as the main culprit in this alarmingly fast depletion of natural resources (Vezzoli & Manzini, 2008:7). The prevailing production-consumption system of this industrial society over exploits non-renewable resources to produce for the affluent few while emitting non-biodegradable waste into the environment, affecting mostly the poor majority (ibid). Some of this poor

majority who make up a sixth of the world's population have little or no access to clean water (Birkeland, 2002:13). Acid rain, ozone depletion, global warming and soil erosion are some of the other ills that our environment bears due to reckless and wasteful industrial processes (ibid). The USA alone which has less than 6% of the world's population consumes a third of the world's energy and a third of its natural resources. (Birkeland, 2002:14).

Consumerism in the USA is synonymous with the 'American dream' that epitomizes a faith in absolute abundance (Wood, 2007:108). If the rest of the world was to live this dream then severe estimates allege that the earth as we know it would come to a catastrophic end in the next few decades (Glyphis, 2001). Materialism we are told is embedded in our human behavior that instinctively yearns to create, produce and consume (Chapman & Gant, 2007:5). Designers have thus found their calling in answering to this insatiable need for things. Thackara (2007:xvi) bemoans the fact that design today forces people to waste astounding quantities of matter and energy in their daily activities. He further terms design projects as 'egregious' commissions by clients (ibid).

Fuad-Luke (2009:xx) furthers the discussion by suggesting that the status quo should be interrogated against prevailing realities. Sustainable Development, due to its myopic view of economic growth as part of human progress, has not been able to avert negative social and environmental trends. The author challenges sustainable development with a new vision of 'positive development', that is a holistic approach to restore ecosystem services (ibid). Fuad-Luke's (2009) is particularly germane when one considers the fact that the notion of development is a contested one as there exist underlying assumptions and implicit power differentials between those who prescribe it, and potential 'beneficiaries' of it. Though an acceptable and inclusive definition of 'development' is beyond the purview of this paper, we are of the view that this matter warrants robust interrogation within the scholarly community.

Vezzoli & Manzini (2008:4) argues that though sustainable development is now accorded prime importance in official communication of all international organizations, little progress has been made in achieving environmental sustainability. Large multinational companies have for instance shown interest in sustainability issues and some like Philips have gone further and developed an array of eco-efficient products to reduce their carbon footprint. Sadly though most of this interest is in the form of rhetoric and active efforts towards eco-efficiency such as those made by Phillips are negated by the increased sales of green products (Chapman & Gant, 2007:21-22). Vezzoli & Manzini (2008:16) also avers that green-products, though each having less 'ecological' weight, have not helped to reduce the overall consumption of natural resources.

If the existing technological innovations that seek to create more ecological products prove to be futile, how then are we to achieve sustainability? The UN tells us that almost all modern human endeavours produce carbon dioxide (http://unfccc.int). Are there alternatives that can reduce our carbon footprint while at the same time satisfying our inherent urge for personal fulfillment? Answers to these questions are vital to sustain the future of mankind.

1.1 Designing for Sustainability

Earlier it was pointed out that designers have been blamed for being partly responsible for the deterioration of the planet through their continued promotion of conspicuous consumption. In an attempt to preserve the earth for current and future generations, a strong case has been made for *Design for Sustainability* (DfS). Proponents of DfS envisage a sustainable world, where everyone can have their basic needs met while the earth's resources are used responsibly and equitably (Dawe et al., 2005). The United Nation's definition of sustainable development that has been widely adopted advocates that the needs of the present should not compromise the ability of future generations to meet their own needs (www.un.org).

Sustainable development presents a challenge for designers who Wood (2007:103) says are able to meet this challenge because they are imaginative and creative. Vezzoli & Manzini (2008:16) urge that designers should reconstruct the prevailing ideas of well-being that are presently associated with having more material goods. Materialism they continue is premised on the technocratic culture that disregards the socio-cultural and environmental implications of consumption (Vezzoli & Manzini, 2008:18). Chapman and Gant (2007:3) in the same vain posit that sustainable design is the anti-thesis of design. In this regard sustainable design seeks to redirect behavior by steering consumers towards sustainable alternatives (Chapman & Gant, 2007:5). Alternatives that can be achieved if designers take into consideration ecological sustainability and social equity (Birkeland, 2002:6).

Research and practice on sustainability issues has given rise to several approaches: ecological or green design that advocate for designing with nature rather than against it (Birkeland, 2002:3), biomimicry, a branch of material science that redesigns industrial systems according to biological lines to eliminate waste and toxicity, (Birkeland, 2002:9; Vallero & Braiser, 2008:25), Design for Environment (DfE), Environmentally Responsible Manufacture (ERM) or dematerialisation that aims to lessen the environmental impact of a product or service over its entire life-cycle (Life-Cycle Analysis or LCA) (Birkeland, 2002:7; Calantone et al., 2001; Hargroves et al., 2008) and whole system design or cyclical design that is an integration of the steps in the design process to allow for synthesis and innovation throughout the process (Hargroves et al., 2008; Vallero & Braiser, 2008:8).

Vezzoli & Manzini (2008:10) advance the meaning of some of these approaches towards sustainability: 'Dematerialisation' is not only decreasing material and energy flows but also reducing the overall need for products and services. The perception of wellbeing in a sustainable world is also redefined as being more context-based as it depends less on accumulation of new artifacts and more on the appreciation of the existing environment (Vezzoli & Manzini, 2008:24). The authors therefore steer the debate on sustainability away from technological innovations, as is the case with approaches such as ERM, DfE and LCA, and more towards social innovations.

1.2 Social innovation

Dunne (2010) describes the quest for sustainable value as a 'wicked problem' because issues of sustainable value evade clear formulation and often involve multiple perspectives. Sustainability issues being wicked or complex problems can therefore not be solved using only technological measures. This is because the processes in technology tend to be linear and narrow in context (Howaldt & Schwarz, 2010). Social innovation thus offers an alternative method of solving the sustainability quandary as it seeks to re-configure social practices to better answer needs that cannot be satisfied using established practices (ibid). Drewe et al. (2008:9) point out that the persistent social problems we face today ask for new ideas that cannot be found in existing market driven regimes. The authors insist that such problems require creative strategies that foster inclusion and integration. (Drewe et al., 2008:22).

Social innovation, understood in its most general sense, happens everywhere. Mulgan (2006) affirms that for as long as there are problems in the society, societal actors will seek innovative solutions. The lack of rigorous research into social innovation in comparison to technological or commercial innovation however hampers the growth and scaling-up of these innovative solutions. As a result social problems remain acute and underfunded (ibid). Despite these draw-backs, it is asserted that much of the most important innovations of the near future will follow the patterns of social innovation (Mulgan et al., 2007). The reason being that the, Industrialized Western world is moving away from manufacturing economies to services economies in the areas of health, education and care (ibid). We as researchers in the African context also lay claim to this supposition albeit for a different reason. We agree with M'Rithaa (2008) that the developing economies of Africa can overcome the many social ills that impede their growth only through integrating 'participatory grassroots ideals' in their quest for development.

These inferences confirm the importance of social innovation in solving the world's most intractable challenges.

Just like 'sustainability', social innovation has multiple definitions. (Drew et al., 2008:22; Mulgan et al., 2007, www.berkana.org, csi.gsb.stanford.edu/social-innovation). Some common characteristics can however be gleaned from the various literature to arrive at a shared understanding. It is clear for example, that social change is the aim and the necessary ingredients for this change to happen are the social actors who form networks that morph into networks of networks or 'communities of practice' (www.berkana.org). Manzini, (2007) refers to these groups of people that cooperatively invent as 'collaborative networks' and 'creative communities'. The power of such networks strengthens around shared values that can be harnessed for sustainable development (Vezzoli & Manzini, 2008:24).

The power of important social innovations is further sustained by the continued interaction within the networks and diffused through formation of new relationships (Mulgan et al., 2007). The seemingly sudden fall of the Berlin wall was a demonstration the power of connected local action (Mulgan et al., 2007). The more recent Arab Spring of 2011(edition.cnn.com) offers a clearer expression of how local actors connect to form powerful forces that distabilise existing regimes. Networks can also grow out of economic concerns such as the small voluntary investment groups in Kenya some of which have matured into Small and Medium enterprises (edition.cnn.com). It is estimated that well over half of Kenyans are members of such groups locally referred to as 'chamas' and banks are rushing to tap their potential through microcredit services (ibid).

Organisations can also turn socially robust ideas into profitable business. Safaricom, Kenya's largest mobile operator is one such organisation that has successfully rolled out a money transfer service known as M-pesa to the benefit of 23% of Kenyans, some of whom cannot access formal banking services. 11% of Kenya's Gross Domestic Product is transferred in this manner yearly and it comes as no wonder that 60 similar schemes across the world have sprung up (www.economist.com). These and other exemplars such as Fair Trade or the work of Muhammad Yunus (csi.gsb.stanford.edu) affirm the veracity of the claim that there is an urgent need to critically investigate social innovation as an important theory and practice. This paper aims to boost this claim by analysing the strides made by DESIS-Africa (Design for Social Innovation towards Sustainability-Africa).

1.3 DESIS

In a paper titled 'Design research for sustainable social innovation' Manzini (2007) proposes an "articulated research programme… that is a worldwide collaborative research programme into design for sustainability, targeted to catalyse and focus all the available design energies." Manzini (2007) decries the current situation where no search programme exists as the few designers and design researchers engaging in sustainability issues move in different directions and therefore bring no real contribution to the creation of common knowledge.

Perhaps to respond to this need DESIS (Design for Social Innovation towards Sustainability) was formed. With Ezio Manzini as its international coordinator, DESIS exists today as a network of design labs, based in design schools and design-oriented universities, actively involved in promoting and supporting sustainable change. (www.desis-network.org). The organization is thus a collaborative network of designers promoting sustainable change and social innovation. This network has expanded organically to include the professional and pedagogical aspirations of member nodes and presently "comprises several DESIS-Local sub-networks within specified regions. DESIS-International is therefore the framework within which the different DESIS-Local networks coordinate themselves and undertake certain global initiatives" (Manzini et al., 2010:14).

DESIS Network originated from three main international activities in the 2006-2008 period: the European research EMUDE, 2005; the UNEP Program CCSL, 2008 and the international conference Changing the Change, within the framework of Torino World Design Capital, 2008 (www.desis-network.org).

DESIS Network further collaborates with other networks whose focus (such as social innovation, quality of everyday life, design for sustainability, and design school coordination) is complementary to its own. In this spirit, to date, formal agreements have been established with: Social Innovation Exchange (SIX), Sustainable Everyday Project (SEP), Learning Network on Sustainability (LeNS), Partnership for Education and Research about Responsible Living (PERL) and International Association of Universities and Colleges of Design, Art and Media (CUMULUS). DESIS also establishes special partnerships with private companies, non-profit organizations, foundations and government agencies that share similar views and are willing to co-develop open projects on topics and areas of common interest. (www.desis-network.org).

The Study: DESIS-Africa labs

In Africa, three Design schools in Kenya, Botswana and South Africa as founding members of DESIS-Africa have committed to promoting social innovation and sustainable change in Africa. Two of these schools (University of Botswana and University of Nairobi) were the first to formally set up DESIS labs in 2011, whilst the Cape Peninsula University of Technology established a lab in mid-2012. The said Labs have each embarked on collaborative design activities that adopt a participatory action research framework geared towards supporting social change at the local level by co-opting local actors. On a larger scale, the DESIS-Africa labs seek to network with other DESIS labs worldwide in order to share success stories and scale-up social innovation.

As part of the regional coordinating team of DESIS-Africa, the authors carried out a cross-sectional study of the three Africa DESIS labs. The research sought, through an inductive approach, to engage in a qualitative content analysis of the labs' activities in order to generate concepts useful for building theory in the emerging disciplines of sustainable design and social innovation while also offering prospects for the scaling-up, replication and expansion of DESIS-Africa. Maintaining an interpretivist epistemological stance, the researchers analysed data from the three labs with the aim of establishing patterns of association.

2.1 Findings

A content analysis of the three labs activities revealed that there exist several similarities between the labs in their approaches, target groups, goals and challenges. All three place emphasis on working with local communities which is in line with the objectives of DESIS. The local communities targeted by the DESIS lab in Botswana is that of poor people living in peri-urban areas; the StAD DESIS lab in Nairobi is targeting the university community that is made up of staff and students; whilst the initiatives at CPUT are a combination of the two. Working with these different groups presents varying challenges given that none of the labs has any consistent source of funding for its activities. Linking design students and poor communities outside of the university campus requires at the very minimum, transportation and time on site. Working on campus does not present this challenge though it offers fewer opportunities for interacting with more diverse groups.

Based in design schools, the three labs actively involve students in the projects through participatory design. In Botswana students were involved in the branding and packaging for organic sweets from the *marula* fruit made by the Dibapalwa Nageng Trust. Dibapalwa Nageng which means 'things collected from the veldt' is a Trust made up of five women and it is based at Gabane, on the outskirts of Gaborone. Using a participatory design model the project required students to co-design with the trust and thus empower the women economically while also encouraging them to use natural resources sustainably.

The StAD DESIS lab initiated an interdisciplinary project that saw students work on a single design brief that incorporated four design specializations, namely: interiors, fashion, graphics and product design. The students worked in groups to conceptualise an 'open space' that would serve as an open and interactive space for the design community at the University of Nairobi. The project entailed joint critiques by several lecturers throughout the semester where students were encouraged to maintain a multi-faceted approach to the design process while incorporating sustainability approaches such as recycling and re-use into their designs. The initiative was a rewarding learning experience for both students and lecturers as it allowed for an enriching discussion and exchange of divergent ideas while also introducing students to DfS approaches.

At CPUT DESIS lab staff and students collaborated with BioWise, the NGO managing the Naturally Knysna and Biomimicry Discovery Park projects, as well as in the co-design of a destination branding strategy in collaboration with students from VEGA The Brand School – this project was also supported by professional designers of the Cape Town Design Network who acted as mentors and judges for the project. Additionally, CPUT (which is contributing a parcel of land for the project) is a key partner in The Fringe – a design and innovation district being developed adjacent to the Cape Town Campus of CPUT. The DESIS-inspired community-based tourism project was co-sponsored by …XYZ Design Pty (a leading industrial design consultancy in Cape Town) with community members of Genadendal, a historic town in the Western Cape Province. Other projects required students to familiarize themselves with the lives of people living in the peri-urban townships around Cape Town and involve them in designing practical and relevant solutions that appreciates the opportunities and challenges of these areas so as to provide a sustainable source of income for the communities. Housing and sanitation are pressing challenges faced by such communities – the proposed approaches such as 'incremental housing' invite communities to finish their own houses based on their needs, income and indigenous knowledge of building materials. Table 1 summarises the analysis and findings of the study.

Table 1: Summary of DESIS-Africa lab projects

	University of Botswana DESIS lab	StAD DESIS lab University of Nairobi	Cape Peninsula University of Technology DESIS lab
Activities & Approaches	Design for Environment: add value to local natural resources Participatory Design: Involving students and communities	Inter-discplinarity: involving different design disciplines Participatory design: involving students	Co-design with communities: Co-designing sustainable housing/ community-based tourism Biomimetic inspired participatory design projects Strategic alignment with Cape Town's World Design Capital (WDC) 2014 agenda
Target groups	Local communities: women group Design students	Local communities: university staff and students Design students	Local communities: townships Neighbouring communities Design students
Goals	Sustainable employment Women empowerment Sustainable use of natural resources	Integrated design projects Collaborative design community	Promoting Indigenous knowledge Sustainable livelihoods/housing for local communities Exploring synergies between DfS and biomimicry
Challenges	Lack of expertise Lack of financial support	Lack of financial support Low buy-in from faculty	Lack of dedicated funding for projects Lack of appreciation of the value of DfS in addressing socio-economic challenges
Collaborations	UNPD: grants for the Dibapalwa Nageng Trust University of Botswana Business Clinic: Enterprenuership for the Trust Africa-Brasil Dialogs: visualization and	School of the Built Environment University of Nairobi	Africa-Brasil Dialogs: visualisation and representation of social innovation cases The Fringe Biomimicry South Africa WDC 2014 and the City of Cape Town VEGA The Brand School, Cape Town Community members in the town of Knysna Community members in the town of Genadendal

	representation of social innovation cases		BioWise …XYZ Design Pty Creative Cape Town/ Cape Town Partnership Cape Craft and Design Institute

The approaches and activities of the three labs confirm that co-opting local communities is considered an imperative component in the sustainable design process. The study also shows that it is important to collaborate with other like-minded organisations in order to pool resources for greater impact. In particular the University of Botswana DESIS lab and the Cape Peninsula University of Technology DESIS lab have established strong links with other organisations and thus increased their visibility and cogency.

Conclusions

It is hoped that the results of this study can provide opportunities for the scaling-up, replication and expansion of DESIS-Africa. Through closer collaboration and co-opting different stakeholders, the three labs can increase the visibility of DESIS-Africa and thus rope in more design schools and universities into the increasingly important discussion on sustainability. The three labs however need to identify sustainable sources of funding and support for projects in order to ensure the continued dialogue on sustainable design and social innovation in Africa.

As the carrying capacity of the earth decreases the onus is on everyone especially universities to advocate for a paradigm shift that encourages sustainable behaviour and sensitivity towards the environment. DESIS is a global initiative that explores the possibilities and opportunities of a shift towards social innovation and sustainability. DESIS-Africa, which is very much in its infancy and facing several challenges, seeks innovative solutions for the African continent taking into account valuable lessons from other labs in the network. Africa with its rich source of indigenous knowledge and social capital presents DESIS-Africa with the promise of success in its quest for sustainable solution.

References

1. Birkeland, J. 2002. Design for sustainability, a sourcebook of integrated eco-logical solutions. London: Earthscan Publications Ltd.

2. Calantone, R., Curkovic. S., Handfield, R., Melnyk, S. 2001. Integrating Environmental Concerns into the Design Process: The Gap between Theory and Practice. IEEE Transactions in Engineering Management, 48(2). Available at: http://www.bus.msu.edu/erm/assets/images/gap-t_p.pdf (accessed 17 March 2011)

3. Chapman J., Gant N. (Eds) 2007. Designers, Visionaries and other Stories, A collection of Sustainable Design Essays. London: Earthscan. (Also Thackara J. Forward i-xviii)

4. CNN. 2011. Twitter #occupy wallstreet movement aims to mimic Iran. Available at edition.cnn.com/2011/09/16/tech/social-media/twitter-occupy-wall-street/index.html (Accessed 14th August 2012)

5. CNN. 2011. Women lead the way in Kenya's thriving investment groups. Available at edition.cnn.com/2011/BUSINESS/03/29/women.investors.kenya/index.html (Accessed 14th August 2012)

6. Dawe, G., Jucker, R., Martin S. 2005. Sustainable development in higher education: current practice and future developments, a report for the higher education academy,

November 2005. Available at http://www.heacademy.ac.uk (accessed 30 September 2009)

7. DESIS Network 2012. Available at www.desis-network.org (accessed 5 June 2012)

8. Drewe, P., Klein, J., Hulsbergen, E. (eds) 2008. The Challenge of Social Innovation in Urban Revitalization. Amsterdam: Techne Press.

9. Dunne, D. 2010. Two inquiry-based approaches to sustainable value: Positive design and integrative thinking. Source: Advances in Appreciative Inquiry, Volume: 3, 2010
10. Available at www.emeraldinsight.com/search.htm?st1=design education&ct=bks&nolog=634193&displayno=20 (accessed 2 June 2011)

11. Economist 2012. Banking on mobile phones: Out of thin air. Available at www.economist.com/node/16319635 (Accessed 14th August 2012)

12. Glyphis, J., (ed) 2001. How can the architect contribute to a sustainable world? Proceedings of the Wingspread Conference, 24–26 August, Racine.
13. Available at www.secondnature.org (accessed 13 May 2009)

14. Howaldt, J., Schwarz, M. 2012. Social innovations, Concepts, research fields and international trends. Available at www.internationalmonitoring.com/fileadmin/Downloads/Trendstudien/IMO%20Trendstudie_Howaldt_englisch_Final%20ds.pdf. (accessed on 6 June 2012)

15. Fuad-Luke, A. 2009. Design activism: beautiful strangeness for a sustainable world. London: Earthscan.

16. Graduate School for Stanford Business – Center for Social Innovation (2012). Available at csi.gsb.stanford.edu/social-innovation (Accessed 14th August 2012)

17. Hargroves, C., Smith, H., Stasinopoulos, P. 2008. Whole System Design: an integrated approach to sustainable engineering. London, GBR: Earthscan.
18. Available WWW: http://site.ebrary.com (accessed 10 January 2011)

19. Manzini, E. 2007. Design research for sustainable social innovation. Available at: www.sustainable-everyday.net/manzini/ (accessed 20 April 2011)

20. Manzini, E., Penin, L., Gong, M., Cipolla, C., M'Rithaa, M.K. & Mendoza, A. 2010. The DESIS Network: Design and Social Innovation for Sustainability. The Journal of Design Strategies, 4(1): 14-21.

21. Mulgan, G. 2006. The Process of Social Innovation. Available WWW: www.mitpress.mit.edu/innovations/ (accessed 12 August 2012)

22. Mulgan, G. Tucker, S. Ali, R. (2007). Sanders, B. Social Innovation. What it is, why it matters and how it can be accelerated. Available at: http://www.youngfoundation.org/files/images/03_07_What_it_is__SAID_.pdf (accessed 12 August 2012)

23. Thackara, J. (2007). Forward. In Chapman J., Grant N. (Eds), Designers, Visionaries and other Stories, A collection of Sustainable Design Essays (i-xviii). London: Earthscan

24. Wood, J. (2007).Relative abundance: Fuller's discovery that the glass is always half full. In Chapman J., Gant N. (Eds), Designers, Visionaries and other Stories, A collection of Sustainable Design Essays (i-xviii). London: Earthscan

25. Vallero, D., Braiser, C. 2008. Sustainable design, the science of sustainability and green engineering. New Jersey: John Wiley & Sons.

Linking classroom and community: an exploration of the similarities between service learning and a human-centered design methodology in contemporary design education

Fatima Cassim & Anneli Bowle
University of Pretoria
Pretoria, South Africa
Fatima.Cassim@up.ac.za

Abstract

The current emphasis on social responsibility and community collaboration within higher education has led to an increased drive to include service learning in the curriculum. With its emphasis on mutually beneficial collaborations for both students and the community, service learning is particularly meaningful for both parties, but also extremely challenging to manage successfully. When considering service learning from a design education perspective, it is interesting to note that contemporary design practice emphasises a similar approach known as a human-centered design, where users are considered and included throughout the design process. Human-centered design thus indicates a shift in focus, from products to people, and emphasises greater relevance, sustainability and accountability in all design products and processes. In considering both service learning and human-centered design as foundations for design pedagogy, various similarities in terms of philosophy and methodology are evident. This paper thus explores the relationship between a service learning community engagement approach and a human-centered approach. Each approach is considered individually after which a more in-depth comparison between the two approaches are considered. Butin's (2003) typology of service learning, namely the four Rs – respect, reciprocity, relevance and reflection – serves as a point of departure from which the two respective approaches, service learning and human-centered design, are compared. Lastly, the potential value and relevance of a combined understanding of service learning and human-centered design is considered, specifically within the context of higher education in South Africa.

Design education, human-centered design, service learning, community engagement, experiential learning, practice-based research

Introduction

From a global perspective, there is an increased emphasis on social responsibility as well as the role of community engagement within higher education today. Within South African institutions, such as the University of Pretoria[33] for example, this focus is also evident. More specifically, the focus is placed on curricular and research related community engagement where community engagement activities are formally integrated into the curricula of undergraduate and postgraduate programmes. The aim of these activities is to establish a mutually beneficial and respectful collaboration in the teaching, learning and scholarship of staff, students and external partners such as schools, community service agencies and organisations to name a few.

When mutually beneficial collaborations take place, such activities are referred to as service learning. Bringle and Hatcher (1996:222) define the activity of service learning "as a course-based, credit bearing

[33] "The University of Pretoria sees Community Engagement as a key priority" and community engagement is therefore positioned as a strategic objective in both the vision and mission statements of the University (Community Engagement 2011). In addition, community engagement "is not treated as a separate function, but is considered integral in all aspects of learning and teaching. It is therefore incorporated widely in academic programmes, projects and research efforts" (Community Engagement 2011).

educational experience in which students participate in an organised service activity that meets identified community goals and reflect on the service activity in such a way as to gain further understanding of the course content, broader appreciation of the discipline, and an enhanced sense of civic responsibility." Furthermore, according to Colby *et al* (2000:xxix), service learning considers the development of the participant (student) as an accountable and engaged participant in society and community, both nationally and internationally.

Owing to the pedagogic foundation of service learning, it needs to be discipline specific and is therefore applicable within a communication design context. Drawing on the abovementioned focus of service learning, it is interesting to note that contemporary communication design practice shares a similar viewpoint about collaboration and social responsibility. In order to deliver more responsible and sustainable design products, contemporary design practice is increasingly focused on human-centered design approaches, where the user is considered and included throughout the design process. A greater understanding of users and their context is reached through an iterative design and research process, which includes user research, prototyping, continuous reflection and critical evaluation of outcomes.

The idea of human-centered design is not a new concept but has evolved over time to indicate a shifting emphasis from a focus merely on products to the people who use those products. A human-centered approach emphasises relevance, sustainability and accountability throughout the process and aims to create products that "make life better" (Frascara, 2002:39).

Students need to be made aware of their roles and responsibilities within the design industry and broader society, not only in terms of commercial enterprise, but also social enterprise. In order to prepare communication design students to realise their potential and play a more significant role in social innovation, educators need to include experiential learning approaches in the curriculum.

Considering higher education in general and more specifically design education outlined above, the aim of the paper is to explore the relationship between a service learning community engagement approach and a human-centered design approach. Each approach is considered individually by means of a literature review before a more in-depth comparison between the two approaches can be considered. This comparison is done in order to explore the value of new methodologies for experiential learning within the context of design education.

Service learning

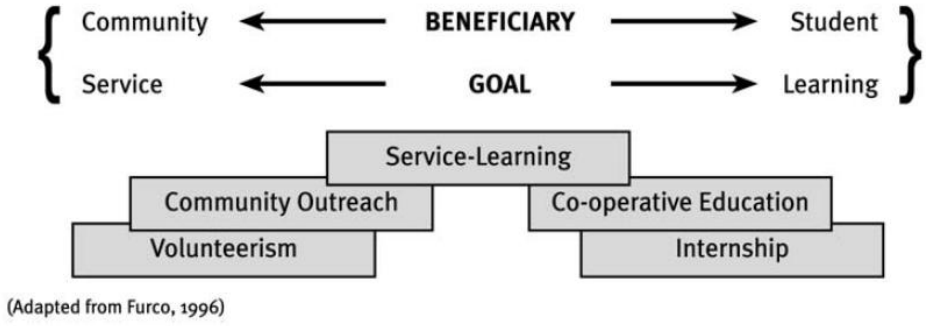
As noted in the introduction, community engagement is increasingly found on the agenda of higher education institutions as a core value, both nationally and internationally, and is a practice that draws on the knowledge base of the scholarship of engagement. O'Brien (2009:30) acknowledges that the scholarship of engagement is a concept that was advocated by Ernest Boyer, "who expanded the (Western) traditional notion of scholarship as purely research – the discovery of knowledge – to include the teaching, integration and application of knowledge." More specifically, Boyer (1996:20) positions the scholarship of engagement as an activity that connects the resources of a University with pressing social, civic and ethical problems with a larger purpose and a mission in order to create "a special climate in which the academic and civic cultures communicate more continuously and more creatively with each other."

Within this context of engagement there are various forms of service programs that are adopted by teachers and students. Drawing on Furco's continuum (Figure 1), the South African Higher Education Quality Committee (HEQC) differentiates between these forms of service programs by considering their position on the continuum in terms of two variables: "the primary *beneficiaries* of the service (i.e. community or student); and the primary *goal* of the service (i.e. community service or student learning)" (HEQC, 2006:21).

As one type of community engagement, service learning sits in the centre of Furco's continuum. What this implies is that there is a balance between the intended beneficiary of the service and the goal of learning. A number of authors, including Furco (2011) and Giles and Eyler (1994), attribute the definition of service learning to Robert Sigmon, who claimed that it is service-learning when both those who are providing the service and the recipients of the service learn from the engagement with each other. Hence, service learning can be defined as "an experiential education approach that is premised on 'reciprocal learning'" (Sigmon, in Furco, 2011:71).

It should be noted however that since service learning is a relatively new phenomenon, there isn't one definitive description of service learning and Butin (2003:1676) recognises this by referring to the following descriptions that are often used when trying to define service learning and what activities can be regarded as such: "academic service learning, community-based service learning, [and] field-based community service." From a South African perspective, Le Grange (2007:3) also supports this view by stating that service learning "continues to be the subject of debate and deliberation." It is interesting to note however, that Butin (2003) sees merit in this deliberation of definitions because he believes that the different conceptions allow for flexibility in the enactment of service learning across different disciplines.

Figure 1: Distinctions among Community Engaged Learning (HEQC 2006:21).

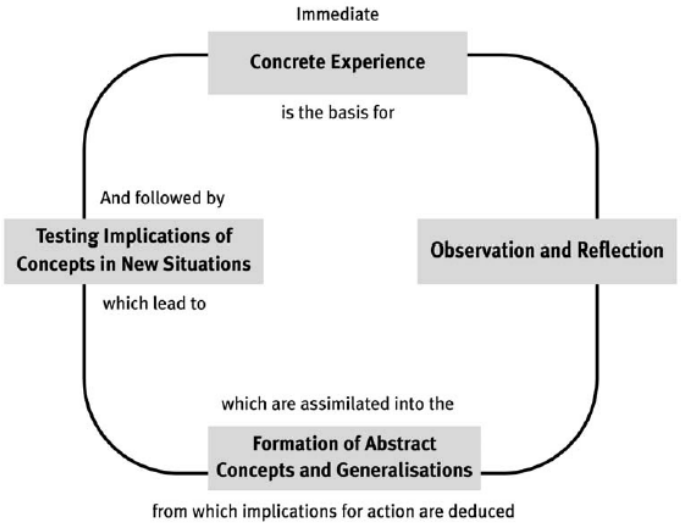


Despite the lack of a single definition, experiential education as a theoretical and pedagogical foundation for service learning is a recurring premise in service learning literature (Giles & Eyler, 1994; Saltmarsh, 1996; HEQC, 2006; Le Grange, 2007). Furthermore, there is also the recognition that service learning has its roots in the educational pedagogy of constructivism which is consistent with experiential education's stance that knowledge is gained through personal experience (HEQC, 2006:14). John Dewey, a pragmatic philosopher and one of the key 20th century thinkers, emphasised the importance of hands-on learning and he has been a seminal author whose work has informed the pedagogy of service learning to date. David Kolb, also influenced by the work of Dewey, explored the learning styles and processes of experiential learning and developed his own model, namely the experiential learning cycle (Figure 2).

This cycle "explores the cyclical patterns of all learning" (HEQC, 2006:17) and comprises four stages, including experience, reflection, conceptualisation and action. These four stages are closely linked to the following criteria for service learning programs at an institutional level (HEQC, 2006:25):

Relevant and meaningful service with the community
Enhanced academic learning
Purposeful civic learning
Structured opportunities for reflection

Figure 2: A depiction of Kolb's (1984) Experiential Learning Cycle (HEQC 2006:18).



The abovementioned criteria for service learning form a particular conceptual framework for service learning but for purposes of this paper, it is also necessary to consider the theoretical underpinnings of service learning to better understand service learning as a form of inquiry and also as pedagogy. Giles and Eyler (1994)[34] as well as Saltmarsh (1996) acknowledge Dewey's contribution to service learning and review Dewey's writings and philosophy of education. This research is carried out by the respective authors as a means of "advancing a body of knowledge and as a guide for pedagogical practice" of service learning (Giles & Eyler, 1994:77). More specifically, Giles and Eyler (1994) argue that theory drives the research agenda for service learning. Criticism exists for focusing on the theoretical foundations of service learning (Le Grange, 2007) as well as service learning in practice within the context of higher education (Butin, 2006) but it should be reiterated here that the aim of this paper is not to critique the theory and practice of service learning *per se* but rather to present the underpinning tenets of service learning in order to facilitate the subsequent comparison with a human-centered design methodology. To this end, the five areas of Dewey's contribution to service learning[35], as identified by Saltmarsh (1996)[36], are unpacked briefly below as a working framework.

Linking education to experience

Dewey believed that learning is an active process. His educational philosophy saw a connection between mind and action, that is linking theory with practice, and it is this principle which underpins service learning. Furthermore, the link between education and experience inextricably links the school and the community because the community is the context in which education and experience play out. Hence, service learning calls for "the institutional reorientation of the school/college/university in its relation to the community" (Saltmarsh, 1996:15).

Democratic community

Saltmarsh (1996:16) acknowledges that Dewey was of the belief that education, by its very nature, is a social process and that "education involves socially interconnected action for a particular social end." The interconnected action comprises "face-to-face" association with the community and this in turn lends

[34] Giles and Eyler (1994) draw primarily on two works of Dewey: *How we think* (1933) and *Experience and Education* (1938).

[35] It should be noted that Dewey did not use the term service learning, however his insight and his philosophy of education has subsequently informed and contributed extensively to the pedagogy of service-learning (HEQC 2006:15).

[36] For purposes of this paper, Saltmarsh's (1996) writing has been consulted in consideration of Dewey's five areas since he has extensively considered a number of Dewey's publications, including *Democracy and Education* (1916), *Ethics* (1932) and *Education and Social Change* (1937*)* to name a few.

itself to an education and practice of cultural democracy. According to Dewey, the development of one's sense of self is dependent on engagement with other people. Saltmarsh (1996:16) also notes that Dewey spoke of a "community of interests" where the common good is given priority over self interest. Within an African context, it is worth mentioning that this position is in keeping with the humanist philosophy of *Ubuntu*. This philosophy is summed up well by the familiar idiom relating to *Ubuntu*: I am because we are.

Service
In this context, service relates not only to the choice of "face-to-face" association activities but, more importantly, to the attitude with which the engagement is carried out. Dewey maintained that for a service to be most beneficial, it needs to be a mutually beneficial and reciprocal relationship with the identified community. Therefore, the attitude with which the service should be approached should be one of justice and not of charity. In addition, a service relationship is one "defined by opportunity, choice, social responsibility, and social need" (Saltmarsh, 1996:17). It is essential for the association actions to address pressing social needs and to instil a sense of responsibility in the participants.

Reflective enquiry
Ultimately, the purpose of the link between education and experience is to learn from action. Reflective enquiry is necessary to move learning "beyond conditioning, [and] beyond the classroom" (Saltmarsh, 1996:18) and to maintain the link between thought and action. One of the core characteristics of reflection is the generation of own knowledge (insight) directly tuned to practice. Another important characteristic of reflective enquiry is "to make the connection between intent and result of conduct" (Saltmarsh, 1996:18). Reflection is therefore a core component of service learning in that it has the potential to influence the application of knowledge in further action and thereby have a longer-lasting and sustainable impact in the creation of a "just democratic community" (Saltmarsh, 1996:18).

Education for social transformation
Initially, Dewey considered education as the primary means of social transformation but he later acknowledged that education needs to be coupled with political activity for social transformation. Nonetheless, he advocated that both education and service play a mediating role in society, whereby the intention is to break down the barriers between different sets of people (distinguished by different circumstances and privileges) and to ensure that each person is "occupied in something which makes the lives of others better worth living" (Dewey, in Saltmarsh, 1996:19).

Human centered design

Design is inherently connected to human concerns and can be defined as the "human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes" (Buchanan, 2001b:9). Frascara (2002:37) also provides a definition for design, as a "problem-oriented, interdisciplinary activity" that deals with complex interrelationships between people and their products. However, this holistic vision for design practice has developed fairly recently, and has been advocated by seminal design theorists such as Richard Buchanan and Jorge Frascara.

According to Buchanan (2001b:14) an increased awareness of how products influence human experience, as well how products mediate interactions between people and their social and natural environments has led to a shift towards what is known as human-centered design. Frascara (2002:33) also calls for a greater understanding of the complexities of "people-centered design", where the focus of the design activity is on people instead of products. This view is further supported by Klaus Krippendorff (2005:13) who explains how design in the post-industrial society has shifted from being product-or production-centered[37] to being a human-centered activity.[38] Sabine Junginger (2012:171) provides a comprehensive

[37] Krippendorff (2006:13) also refers to the previous product-centered approach as "technology-centered".

summary of the principles of human-centered design, which can serve as a working definition for purposes of this paper:

A human-centered design approach fully embraces the social, political, ecological and economical context in which individual interactions take place. Furthermore, human-centered design pays attention to the ways in which any product or service enables, encourages or discourages, even disables, a person to engage with other people, objects, services and environments. A focus of human-centered design is therefore on the human relationships people and groups of people have or may have.

Human-centered design is commonly associated with disciplines such industrial design, interaction design and experience design (Junginger, 2012:170), and more recently also with graphic or communication design (Hanington, 2010:21). In these contexts, the terms "human-centered design" and "user-centered design" are often used interchangeably. However, various theorists such as Buchanan, Hanington, Junginger and Krippendorff have distinguished between the two terms and have commented on the differences between these two approaches.

Krippendorff (2005:59), for instance, finds the phrase "user-centered design" problematic since it oversimplifies the user as a "statistical artifact" that needs to be targeted, often at the expense of others who may also be influenced by the production or use of the design product. Junginger (2012:172) also argues that human-centered design relates to a broader responsibility related not only to the individual but also to relationships and collective experiences, acknowledging for example that certain products may be meaningful to some while being detrimental to society or the environment. Both individual and collective experiences are thus considered in human-centered approaches.

Furthermore, the term "human-centered design" clarifies and humanises the understanding of the practice, beyond that of usability and user testing (Hanington, 2003:10) to include a vast range of "softer" human concerns that need to be addressed such as "product desirability, pleasurable interactions, and emotional resonance" (Hanington, 2003:10). Frascara (2002:39) also considers the broader range of human needs that moves beyond mere product efficiency and recognises three areas of design practice: "design that works to make life possible, design that works to make life easier, and design that works to make life better." This last objective, "to make life better" is particularly complex as it focuses on promoting sensual and intellectual enjoyment, mature feelings, higher consciousness as well as cultural sensitivity (Frascara 2002:39). Design activities from this perspective are thus aimed at improving the overall quality of life. Similarly, Buchanan (2001a:37) provides a holistic understanding of human-centered design practice as that which aims to "support and strengthen the dignity of human beings as they act out their lives in varied social, economic, political and cultural circumstances".

In order to produce products that are highly usable as well as meaningful, designers need to acquire an in-depth understanding of users and communities. The research process thus becomes incredibly important throughout the human-centered design approach. According to Hanington (2010:18) human-centered design indicates an "integrated process that includes active consultation with people (users) through various means of primary research during all phases of design development" (Hanington, 2010:18). Newer approaches to human-centered design research specifically encourage the active participation of users and communities throughout the design process. Elizabeth Sanders (2002:6) describes a shift towards participatory design approaches, also referred to as post-design since the designer becomes a facilitator who focuses on overall user experience instead of merely the artifact. Furthermore, this shift indicates a blurring of boundaries between designer and researcher and the user becomes an integral member in the design team (Sanders, 2002:2).

[38] According to Krippendorff (2005:212) human-centered design is "concerned with how stakeholders attribute meanings" to artifacts and aims to assist in the creation of "reliable interfaces, while discouraging those that cause disruptions, disappointments, breakdowns, and harm".

Human-centered design thus indicates a shift away from the designer as "lone genius or authority", towards a practice where the designer collaborates with users and other stakeholders (Krippendorff, 2005:36). This realisation that designers cannot simply impose their solutions onto others indicates an increased level of respect and sensitivity towards those who will be affected by design products. The main aim of human-centered design is thus to create more relevant and sustainable products through socially, politically and environmentally responsible practices. This changing emphasis in design practice has implications for design education as well in that the new generation of designers need to be educated in a way in which values such as responsibility and sustainability become integral to their ways of design thinking and practice.

At the Design Education Forum of Southern Africa (DEFSA) conference in 2000, Buchanan (2000) argued that principles of human-centered design need to be built into a new framework for design practice, design education, and design research in South Africa. The vast amount of social, political and environmental problems faced in contemporary South African society needs to be addressed by upcoming young designers and in order for them to do so, they will need to acquire a "broader humanistic point of view" that will help them understand the complexities surrounding these problems (Buchanan, 2001b:38).

A joint frame of reference

From the respective explorations of service learning and human-centered design above, it is evident that an emphasis on community engagement and collaboration is a shared attitude in both methodologies. Furthermore, similar philosophies, regarding responsibility and accountability in practice, are also found in both approaches. These similarities therefore provide a point of departure to compare the two approaches in more depth. However, before a comparison can be drawn, it is necessary to recognise that both service learning and human-centered design are relatively recent developments and as a result, lack a well-articulated theoretical and/or conceptual framework. In light of this, Butin's (2003) simple, yet inclusive, typology of service learning, namely the four Rs - respect, reciprocity, relevance and reflection - is adopted as a joint frame of reference for the subsequent discussion. This choice is not to impose a limit on the objective of this study but rather to serve as a means for further consideration of the similarities between service learning and human-centered design methodologies. Each of the four Rs is first briefly defined and then related to service learning and human-centered design respectively.

Respect

Respect relates to actions and conduct in accordance with good morals and ethics. It is a characteristic that is articulated consistently in writing about service learning as well as human-centered design in terms of the need for respect of circumstances, views and way of life of the various project participants. The previously mentioned "face-to-face" association that is required in service learning involves student participation in a community. Such active civic participation calls for social responsibility in the identification of pressing needs as well as an attitude of justice in the provision of a service to address those needs (Saltmarsh, 1996:17). As a result, students are challenged to pay careful attention to cultural diversity as well as to respect differences in power, privilege and prejudice when working with a community (Academic Service-Learning 2009). As a result, respect can be regarded as a cornerstone of service learning as it relates to an increased value of community and also promotes the creation of a democratic community.

As mentioned previously, human-centered design is rooted in principles of human dignity and human rights (Buchanan, 2001a:37), which relates directly to the idea of respect. If approached correctly, research activities within community settings can be incredibly valuable since immersion and direct

engagement "forges a sense of empathy between designer and user" (Hanington, 2003:17).This empathy in turn potentially leads to an increased sense of civic responsibility and an increased understanding and urgency in assisting communities through the production of truly meaningful products. Open communication and dialogue are thus not only necessary in developing more effective products, but also important in building mutual trust and respect. Frascara (2002:34) argues that "unidirectional communication is unethical and inefficient" and that ethical communication design should incorporate dialogue, partnership and negotiation with communities of use. Krippendorff (2005:60) describes that respect in a human-centered design process is "granted by attentive listening and acknowledging what people say, not necessarily complying with what they want, but giving fair consideration to their views and interests." Designers thus need to employ sensitive and ethical methods throughout the design process and aim to reinforce human dignity and rights at all times.

Both service learning and human-centered design focus on collaborative or participatory approaches (working with others) as this shows a greater level of respect in allowing communities/users to express their own needs and desires, instead of making assumptions about them (working for others). This view is substantiated by Percy, Zimpher and Brukardt (2006:x) who believe that "successful partnerships should be: of the people...by the people...and for the people."

Reciprocity

The identification of respectful collaboration and engagement above naturally leads to the characteristic of reciprocity. The word reciprocity refers to the mutual benefit of all those who are participating in an engagement or activity (Butin, 2003:1677). Reciprocity in a service learning context means that mutual benefit is gained by both the students and the selected community. It should be noted here that within service learning, the term communities refers specifically to "those specific, local, collective interest groups that participate in the service-learning activities of the institution. Such communities are regarded as partners" and not as recipients (HEQC, 2006:24). Both parties are thus seen as active participants in the process.

In the same vein, in any design endeavour, there are multiple stakeholders and participants. For example, both the designer and client usually receive benefit through financial gain or other worthwhile incentive from design work. However, Krippendorff (2005:29) explains that there isn't always reciprocity in technology-centered design since it often focuses only on factors important to the designer and client, even though products are usually consumed and used by larger communities. In contrast, human-centered design considers the benefit to the user or community in greater depth. This becomes extremely relevant in contemporary design education settings where students need to not only develop their design, research and problem solving skills but also to increase their accountability and to contribute meaningfully to the communities they engage with.

The acceptance of communities as partners is a condition that allows for reciprocity in both service learning and human-centered design approaches. Nonetheless, it should be noted that reciprocity in both contexts is ideal and a fair exchange is one of the biggest challenges in practice (Butin, 2006; Drentell & Lasky, 2010).

Relevance

Relevance can be regarded as the pertinence of engagement (Butin, 2003:1677). This highlights the fact that for service learning to be successful, the engagement or service provision needs to be relevant and meaningful to all the participants, including the students, the learning institution and also the community. When service learning is implemented correctly, the aims of the engagement are usually developed within the context of the community and this helps to ensure relevance (Butin, 2003:1677). This view is supported by Saltmarsh (1996:15), when he refers to the central idea of Dewey's pragmatic philosophy of an individual engaging in the world and in so doing, creates meaning. According to the HEQC (2006:25), the service rendered needs to be "relevant in improving the quality of life for the community, as well as

achieving module outcomes" since service learning is a "credit bearing educational experience" (Bringle & Hatcher, 1996:222).

In Frascara's (2002:35) view, human-centered design is relevant in that it rises above fads and fashions to "penetrate all dimensions of life with a view to improving it." Thus, Frascara (2002:34) calls for greater accountability, relevance and sustainability in contemporary design practice. The idea of design for the sake of self-expression is thus no longer considered relevant, as it does not look towards the user's needs and desires. Buchanan (2000) also asserts that from a human-centered design perspective, it is essential for designs to be appropriate to the situation of use. Buchanan (2001b:14) defines propriety as "the proper mixture of emphasis on what is useful, usable, and desirable in a product." To this end, Buchanan encourages the practice of rigorous research throughout the design process in order to ensure that design outcomes are relevant and meaningful.

Following from this, it is evident that service learning and human-centered design value appropriateness as a measure of relevance. They are both inclined towards human and environmental needs created by and/or resulting from human action.

Reflection

The word reflection denotes a form of mental processing (Moon, 1999:4) and goes beyond mere experience to provide context, meaning and ultimately results in the creation of new knowledge (Butin, 2003:1677). Since learning is essentially about transformation within the context of education, reflection is a valuable tool for students who are involved in service learning. As a result, educators ensure that in order for students to relate their community experiences to the aims of the academic module, there are structured opportunities to reflect. Such opportunities are central to experiential learning as a means of transforming experience into knowledge about the module content, a more holistic understanding and appreciation of the respective field of study as well as improved personal values and social responsibility (Bringle and Hatcher, 1996; Giles & Eyler, 1994). According to Lawson (2006:299), there are essentially two interpretations of reflection: reflection-in-action and reflection-on-action. It can therefore be understood that reflection-in-action is carried out during the teaching/learning process and reflection-on-action is done after the engagement has been completed.

Human-centered design draws on Donald Schön's (1983) concept of the reflective practitioner and advocates that the design process is iterative in nature, with continual evaluation and reflection that feeds back into the design cycle in order to ensure the creation of more effective products. For example, Hanington (2010:21) explains how research in human-centered design is conducted throughout the design process, in the exploratory, generative and evaluative phases. Prototype testing, as a form of reflection-in-action, is a valuable method of generating feedback which can be incorporated into another iteration of the design process, providing continuous improvement and higher levels of assurance that solutions will be appropriate and effective. It is owing to this iterative design process that Frascara and Winkler (2008:11) prefer to use the term 'response' instead of 'solution', since they believe that design problems can be reduced but never fully solved. This more modest approach acknowledges that better responses may be achieved "when more information becomes available, or when a more intelligent designer meets the problem" (Frascara, 2008:11). This belief therefore substantiates the need for reflection-on-action in order to advance design knowledge.

Consequently, in order for any service learning or human-centered design experiences to be meaningful and have value, embedded knowledge needs to be arrived at and this is facilitated through the practice of reflection.

Conclusion

The above discussion of the similarities between service learning and human-centered design indicates that the two methodologies share common ground (especially in bridging theory and practice) and that Butin's (2003) four Rs may serve as an interface between the two. This paper therefore suggests that, where relevant, the two methodologies need to inform a new pedagogic approach of linking classroom and community in contemporary design education. The call for new ways of teaching and learning are substantiated by a number of reasons which are discussed briefly in conclusion to the paper.

Dickson[39] (2003:60) recognises the need for new teaching methodologies by stating that an increasing number of educators are moving away from "traditional teacher centric teaching methodologies that have focused on passive learning activities, and move toward skills that foster greater student centered inquiries in a more interactive setting." In addition, his affirmation that the simulation of real world problems is central in design-based education substantiates the important role that experiential learning plays in educating designers.

Another advantage of taking learning outside the traditional classroom is that design students have a better opportunity of engaging in research. This view is supported by Buchanan (2004:37) who argues that "design schools that prepare students for stylistic and formal expression address only a small part of the discipline of design." Instead, he believes that the design curriculum should "strive to integrate stylistic and formal expression with the ability to conduct user research, task analysis, and a variety of other technical activities suited to different branches of design." Despite research being an important part of the designer's problem-solving skills set, Hanington (2010:20) has more recently argued that design students are rarely formally educated on research methodology. Hence, institutionalising community engagement may facilitate a better understanding and application of research skills by design students.

Drenttel and Lasky (2010) also support the need for students to learn the necessary "tools and training to explore and address social-design problems" and they note that it "has been a growing mission of educators." This observation was made following the *Winterhouse Symposium on Design Education and Social Change*[40] held in 2010. The central topic for discussion at the Symposium was the objectives and the challenges of social-change projects. A pertinent challenge that was identified was aligning pedagogy with practice. For example, one of the participants, Jamer Hunt, questioned which participants were being served foremost, the students or the target community (Drenttel & Lasky, 2010). He expressed his frustration "at the superficiality of a lot of projects that often end up making students feel better about themselves with no impact" (Hunt, in Drenttel & Lasky, 2010). It is in addressing this challenge that service learning may have a significant role to play in terms of promoting and moving towards mutually beneficial engagements.

Considering that "[e]ngagement between higher education and other societal sectors is a key theme in higher education discourse in South Africa, as it is in other countries" (O'Brien, 2009:29), it is unlikely that design educators will be met with resistance for looking towards service learning as a means of implementing more formalised and successful community engagements in their design curricula. Ultimately, the aim is for the scholarship of engagement to "direct the work of the academy toward more humane ends" (Cox, 2006:123-124) and for "humane life" to be the maximum aspiration of design practice as well as any other intellectual effort (Frascara, 2002:39).

[39] Despite speaking from an architectural design position, Dickson's (2003) sentiments about service learning are applicable to other design disciplines as well. This is owing to the general practice-based nature of design education.

[40] The first *Winterhouse Symposium*, initiated by the Winterhouse Institute (the organisation co-founded by William Drenttel), was convened with "participants from a variety of design and business programs" with the intention of creating a collaborative network (Drenttel & Lasky 2010). The Symposium was held in Connecticut, from 17-19 October, 2010.

References

1. Boyer, EL. 1996. The scholarship of engagement. Journal of Public Service and Outreach, 1(1):11-20.

2. Bringle, RG & Hatcher, JA. 1996. Implementing service learning in higher education. The Journal of Higher Education, 67(2):221-239.

3. Buchanan, R. 2000. Human dignity and human rights: toward a human-centered framework for design. In: DEFSA Conference Proceedings, June 2000. Available WWW: http://www.defsa.org.za/request.php?95 (accessed 24 May 2012)

4. Buchanan, R. 2001a. Human dignity and human rights: thoughts on the principles of human-centered design. Design Issues, 17(3):35-39.

5. Buchanan, R. 2001b. Design research and the new learning. Design Issues, 17(4):3-23.

6. Buchanan, R. 2004. Human-centered design: changing perspectives on design education in the East and West. Design Issues, 20(1):30-39.

7. Butin, DW. 2003. Of what use is it? Multiple conceptualizations of service learning within education.Teachers College Record, 105(9): 1674-1692.

8. Butin, DW. 2006. The Limits of Service-Learning in Higher Education. The Review of Higher Education, 29(4):473-498.

9. Colby, A, Ehrlich, T, Beaumont, E, Rosner, J, & Stephens, J. 2000. Higher education and the development of civic responsibility, in Civic Responsibility and Higher Education, edited by Ehrlich, T. Phoenix, Arizona: Oryx:xxi-xliii.

10. Academic Service-Learning. General information. [Brochure]. 2009. University of Pretoria.

11. Community Engagement. University of Pretoria. 2011. Available WWW: http://web.up.ac.za/default.asp?ipkCategoryID=85 (accessed 8 June 2012)

12. Cox, DN. 2006. The How and Why of the Scholarship of Engagement, in Creating a new kind of University. Institutionalising Community-University Engagement, edited by Percy, SL, Zimpher, NL & Brukardt, MJ. Bolton, Massachusetts:Anker:122-135.

13. Dickson, KA. 2003. Interdisciplinary Design Education Through Service Learning. The California State Polytechnic University, Pomona Journal of Interdisciplinary Studies. Available WWW: http://www.csupomona.edu/~jis/2003/Dickson.pdf (accessed 8 June 2012).

14. Drentell, W & Lasky, J. In: Winterhouse First Symposium on Design Education and Social Change: Final Report. Available WWW: http://changeobserver.designobserver.com/feature/winterhouse-first-symposium-on-designeducation-and-social-change-final-report/22578/ (accessed 8 June 2012).

15. Frascara, J. 2002. People-centered design: complexities and uncertainties, in Design and the social sciences: making connections, edited by Frascara, J. London: Taylor & Francis:33-39.

16. Frascara, J. & Winkler, D. 2008. Jorge Frascara and Dietmar Winkler on design research. Design Research Quarterly, 3(3):1-13.

17. Furco, A. 2011. Service-learning: A balanced approach to experiential education. Available WWW: http://educacionglobalresearch.net/wp-content/uploads/03-Furco-1-English1.pdf (accessed 8 June 2012).

18. Giles, DE & Eyler, J. 1994. The theoretical roots of service-learning in John Dewey: toward a theory of service learning. Michigan Journal of Community Service Learning, 1(1):77-85.

19. Hanington, B. 2003. Methods in the making: a perspective on the state of human research in design. Design Issues, 19(4):9-18.

20. Hanington, BM. 2010. Relevant and rigorous: human-centered research and design education. Design Issues, 26(3):18-26.

21. Higher Education Quality Committee (HEQC). 2006. Service-learning in the curriculum. a resource for higher education institutions. Pretoria: The Council on Higher Education.

22. Junginger, S. 2012. The Chile miner rescue: a human-centered design reflection. The Design Journal, 15(2):169-184.

23. Krippendorff, K. 2000. Propositions of human-centeredness: a philosophy for design. Available WWW: http://repository.upenn.edu/asc_papers/210. (accessed 8 June 2012).

24. Krippendorff, K. 2004. Intrinsic motivation and human-centered design. Available WWW: http://repository.upenn.edu/asc_papers/47. (accessed 17 May 2012)

25. Krippendorff, K. 2005. The semantic turn: new foundations for design. Boca Raton: CRC Press.

26. Lawson, B. 2006. How designers think. The design process demystified. Fourth Edition. Burlington: Architectural Press.

27. Le Grange, L. 2007. The 'theoretical foundations' of community service-learning: from taproots to rhizomes. Education as Change, 11(3):3-13.

28. Moon, J. 1999. Reflection in learning and professional development. London: RoutledgeFalmer.

29. O'Brien, F. 2009. In pursuit of African scholarship: unpacking engagement. Higher Education, 58:29-39.

30. Percy, SL, Zimpher, NL & Brukardt, MJ (eds). 2006. Creating a new kind of university. Institutionalising community-university engagement. Bolton, Massachusetts: Anker.

31. Saltmarsh, J. 1996. Education for critical citizenship: John Dewey's contribution to the pedagogy of community service learning. Michigan Journal of Community Service Learning, 3(1):13-21.

32. Sanders, E. 2002. From user-centered to participatory design approaches, in Design and the social sciences: making connections, edited by Frascara, J. London: Taylor & Francis:1-8.

33. Schön, D. 1983. The reflective practitioner: how professionals think in action. New York: Basic Books.

Encouraging engagement.

V. du Preez
Department of Research, Theory and History of Art & Design
| CPUT | Cape Town | SA
dupreezv@cput.ac.za

V. Barnes
Department of Industrial Design
| CPUT | Cape Town | SA
barnesv@cput.ac.za

Abstract:

A student's experience in a tertiary programme should develop the professional skills needed after graduation as well as equip students with necessary skills to navigate real world situations. In the design field students work and learn in an educational design studio which mirrors the working model of professional design industries. Design students' learning experiences can be investigated from both an external point of view, by establishing the level of student involvement, as well as from an internal point of view through the level of engagement encouraged by the method of teaching and learning.

Student involvement, as explored in this paper, relates to the framework developed by Astin (1984) in which he states: "Quite simply, student involvement refers to the amount of physical and psychological energy that the student devotes to the academic experience." If a student is involved they stand to gain more from the educational experience. This experience could further be enhanced by developing an engaging learning situation. The term 'engagement theory', as explored by Kearsley and Shneiderman (1999), is grounded in technology based education but can be applied to most learning environments: "The fundamental idea underpinning engagement theory is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks". The Schlechty Centre (2009) describes students who are engaged by their learning environment as able to learn at high levels with a clear and comprehensive understanding of what is being learnt, as well as being able to retain what they have learnt and that they are able to apply this new knowledge to different contexts. The three characteristics of an engaged learning experience are collaboration, project orientated assessment and authentic (real-world) learning. These characteristics are similar to practical studio based education practices which focus on problem based projects, grounded in real world contexts.

This paper investigates the level of student involvement of Industrial Design 3 students as well as whether engagement is encouraged within the theoretical subjects associated with this programme. To establish the level of student involvement students completed the 2012 National Survey of Student Engagement (NSSE) and findings are compared to corresponding data from America and Australia. The level of engagement experienced by third year Industrial Design students in the theoretical subject was documented using a design ethnography methodology. The aim of the research is to establish whether design students, with varying levels of student involvement, would have a more engaged learning experience in theoretical subjects if the learning experience was collaborative, project orientated and based in a real world context.

Keywords: Student involvement, student engagement, design ethnography

Introduction

One of the most important aspects of professional design is commitment to the design process and the needs of the client or user. In the educational design studio the working practices of professional studios are mirrored to encourage a real world learning environment. However, as with any learning situation, the level of involvement the student experiences and the level to which the student engages in the classroom or studio is reflective of their success.

In a world filled with so many distractions and responsibilities, students often have to juggle a multitude of activities such as their studies, work, personal interest, family and many more. These activities contribute to the holistic development of a person but could impact on the focus and involvement they demonstrate within the learning environment. To establish the level of involvement of senior Industrial Design students, they completed the 2012 National Survey of Student Engagement (NSSE). The NSSE establishes the factors that impact on the time of a student and their participation in various activities. The NSSE, the survey used in this project, was developed in the United States of America. The term 'engagement' as used in the survey refers to the level of involvement. Astin (1984: 297) described an involved student as one who: "...for example, devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students." The results from the survey, as completed by Industrial Design students, are discussed in this paper along with a comparison between results from this project and results from America and Australia.

The level of student involvement highlights the time students spend on learning activities, their willingness to create relationships with peers and faculty, as well as their enthusiasm towards activities offered by the department and institution. However, does a high level of involvement neccessarily translate into academic success? Does the amount of time spent in the educational design studio reflect the marks students achieve? The changing nature of student and staff profiles in design programmes may impact on the level of involvement, as stated in the survey, but it does not reflect an unwillingness to engage meaningfully with staff and coursework, but rather a change in practice.

Students, particularly in the upper years, are increasingly responding to shifting teaching patterns by only coming into the studio on the days that teaching staff are available; the studio becomes little more than a temporary meeting place, where students can catch up with their tutors and fellow students. We suggest that this is leading towards a concept of studio identity being primarily defined, not by space, but by events. (Duggan, 2004:72)

With the changing nature of student profiles and studio participation, the level of student involvement may not be a clear indication of academic success. This paper thus aims to establish both the level of student involvement, as well as the level to which students engage when they participate in class. An engaged learning experience was designed (in which the learning experience is collaborative, project orientated and based in a real-world setting), after which students discussed and completed a qualitative questionnaire relating to their experience. The aim was to identify whether students could retain and apply knowledge generated during the sessions to new contexts. Student activities and participation were observed (using a design ethnographic methodology) and supported with a qualitative questionnaire and feedback session.

Contemporary Literature Review

Astin was one of the first to suggest that student involvement (here called "engagement") was a key indicator for success in learning, arguing that "a particular curriculum, to achieve the results intended, must elicit sufficient student effort and investment of energy to bring about the desired learning and development. Simply exposing the student to a particular set of courses may or may not work" (Astin 1984: 522). His view was that engagement was more concerned with behavioral mechanisms, facilitating

student development. It was imperitive to see a change in focus from content to what the student was *actually doing* – in terms of how much time and energy was devoted to the learning process (Astin, 1984: 526). In his article on student life, McInnes discusses that findings of student studies, including the NSSE (used in *this* paper). While emphasising the importance of out of the classroom activities, the findings suggested that a pattern of declining engagement could be seen in many areas (McInnes, 2004: 391). While the impact of technology on student learning can be seen as "dramatic", the need for students to *engage* with knowledge must be seen as central, as part of their academic and social integration. (McInnes, 2004: 388). Carini, Kuh and Klein describe their 2002 research project – in which they studied over 1000 students in 14 institutions in the USA. They state that "very act of being engaged" plays a critical role in life after college – suggesting that engagement plays a foundational role in developing necessary skills (Carini *et al*, 2006: 2). The results of their study confirm that "student engagement is linked positively to desirable learning outcomes such as critical thinking and grades" (Carini *et al*, 2006:19).

Kearsley and Schneiderman discuss engagement theory from a technology-based education background (1999). "The modern workplace demands proficiency in these skills (communication, planning, management and social skills), yet historically students have been taught to work and learn on their own" (Kearsley and Schneiderman, 1999). Consequently, they place great emphasis on meaningful learning, and highlight collaborative teams and project –based activities as essential for student development. They suggest that these activities increase student motivation to learn, as well as facilitating the understanding of diversity and multiple perspectives. This is clearly important in today's increasingly diverse and international student populations. The 2005 study by Ahlfeldt, Mehta and Sellnow measured the level of engagement of students involved with problem-based learning. They make a strong argument for collaborative work on problems as part of the learning environment, "Through the process of working together, learning takes place. The group members interact to solve the problem and this discourse eventually leads to a solution" (Ahlfeldt *et al*, 2005: 9). This is clearly a more student-centred approach, and the result of the study "establishes credibility for engaged teaching practices" (Ahlfeldt *et al*, 2005: 16), as well as showing the effectiveness of these methods, including problem-based learning. In his 2008 paper, *Strengthening Student Engagement*, Jones describes an engagement-based teaching and learning approach, to cultivate and support student engagment. Peer behaviors that support student engagement include active listening, and encouraging students to express opinions. Other strategies to promote student engagement include students as teachers and peer mediation (Jones, 2008: 9). Co-operative learning, structured discussion, problem analysis and seeking solutions were also described as strategies that contribute to better student engagment (Jones, 2008: 5)

Methodology: Design ethnography

Ethnography as a qualitative research methodology has its origin in various social sciences including sociology and anthropology. The early uses of the methodology focused on the study of human culture, behaviour, communication and relationships through observation. The early ethnographic studies did however not encourage immersed participation on behalf of the researcher. In response to this Malinowski and Redfield wrote:

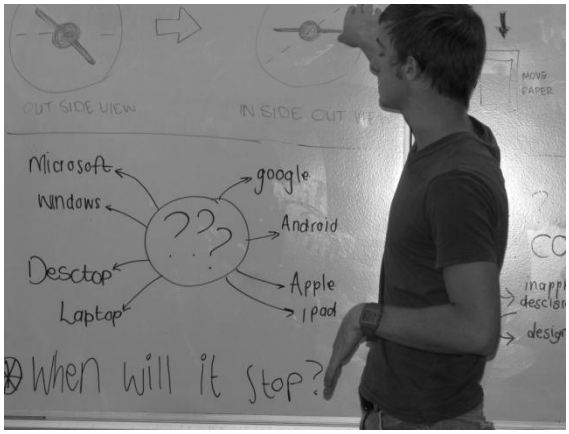
...Anthropological science, he [Malinowski] is telling us, is also an art. It is the art of seeing perceptively a human and social situation. It is the art of taking a warm interest in the particular while seeing in it the universal. For equally he is telling us that the art of ethnographic insight, fully to perform its task, must become a science (1948:ix)

This approach required anthropologists and other researchers to gain a deeper understanding based on actual observation and not to base findings on personal interpretations and views (Segelstrom, Holmlid and Alm, 2009: 1952). The use of ethnography in design research benefits from this view, as research is often required to investigate and observe the user; not in a manner which imposes the beliefs and views

of the researcher on the user, but an honest expression of the user's perspective. This is explained by Dr. Van Dijk (2010:1): "Design ethnography is ethnographic qualitative research set within a design context. It delivers results that inform and inspire design processes, for instance service design processes. It offers reference material about people's everyday life; their practices, motivations, dreams and concerns." The suitability of ethnography to the design paradigm is reflected in the number of design fields which now implement ethnography as an almost standard methodology including service design, user-centred design, universal design, emphatic design, and inclusive design.

In this project ethnographic methods were used to observe the level of engagement students displayed within the subject Theory of Industrial Design 3. Observation was completed in a reflective cycle; firstly students were observed through photo-ethnography during a traditional class lesson and discussion. The dynamic in the classroom was then reversed – leaving the students in control of a discussion session. During this session the activities were video recorded, in order to observe the participation in peer facilitated classes, as well as the level to which students engaged. An interesting unexpected observation from the session relates to the distribution of 'power' through shared leadership throughout the session. General observations were noted throughout both sessions. Reference is made to student actions and group interaction, but not to individual students, so as to provide anonymity.

Figure 1: Students facilitating a theoretical discussion on the work of Donald Norman



To support and facilitate the interpretation of observations and to ensure that the participants had a voice in the research process, all students within the group completed a qualitative questionnaire.

Student involvement: an investigation and comparison[i]

Institutions of higher learning face an unprecedented number of challenges today. Kuh, Kinzie, Schuh and Whitt (2011) describe the dilemma of institutions faced with pressure to deliver high quality education in the face of economic woes, to students who are increasingly diverse and academically underprepared. It seems more important than ever for students to achieve success in their studies. Hardy, in her 2009 paper *Student engagement: paradigm change or political expediency?* discusses the importance of testing for student engagement to all stakeholders:

Students need to be sufficiently engaged with higher education and learning to achieve their potential and gain from participation. Therefore student engagement is one of the most important concepts to emerge in the latter half of the twentieth century. (Hardy 2009)

Students' intrinsic involvement with their learning can be measured using engagement tests. It is also beneficial for institutions to know to what extent the students make use of their educational opportunities (Radloff & Coates, 2009:4). Educators also need to adapt to meet the needs of their students in order to engage them in learning - students that have shorter attention spans, products of their digital generation (Ahlfeldt, Mehta & Sellnow, 2005:5).

4.1 The Student Engagement Test

The Industrial Design senior students completed the paper-based version of the National Survey of Student Engagement –the NSSE. This test was developed in the United States in 1998 by a panel of experts, and became available nationwide and in Canada in 2000. The test now has a participation rate of around 750 American and Canadian colleges and universities (National Survey of Student Engagement, 2011:5).

The NSSE documents dimensions of quality in undergraduate education and provides information and assistance to colleges, universities and other organizations to improve student learning. Its primary activity is anually surveying college students to assess the extent to which they engage in educational practices associated with a high level of learning and development. (NSSE, 2011)

This data, collected annually, covers a broad range of questions, including questions related to study behaviour inside and outside the institution, relationships with peers and staff, career plans, learning experiences and living arrangements. The data is considered of great importance to the institutions, whose aim is to improve student engagement. The questions of the NSSE fall into 5 dimensions that reflect student engagement:
Active and collaborative learning
Enriching educational experiences
Supportive campus environment
Level of academic challenge
Student – Faculty interaction (Hardy, 2009)

Administered to 2.1 million students from the USA and Canada, the comparative figures used in this paper are from the 2011 survey (NSSE, 2011:5). These figures are used as indicators only, primarily because the survey is offered to students from all faculties. There is currently no equivalent test designed for the South African context. The question types are, however, structured in an open manner, requesting students to comment on their activities and interactions. The main contextual factor[ii] which needed to be considered was that of language, as the test is formulated in American English. The participating group of students were all proficient in English, as a first or second language, and the Industrial Design programme is presented in English, using a problem based learning approach. Ahlfeldt *et al* (2005:17) in their study of the link between student engagement and problem based learning (PBL), describe the college of Arts, Humanities and Social Sciences as "a naturally 'expressive' area of study, which is highly conducive to this type of learning [PBL]", and consequently indicates the highest levels of student engagement. The Industrial Design programme is based in PBL

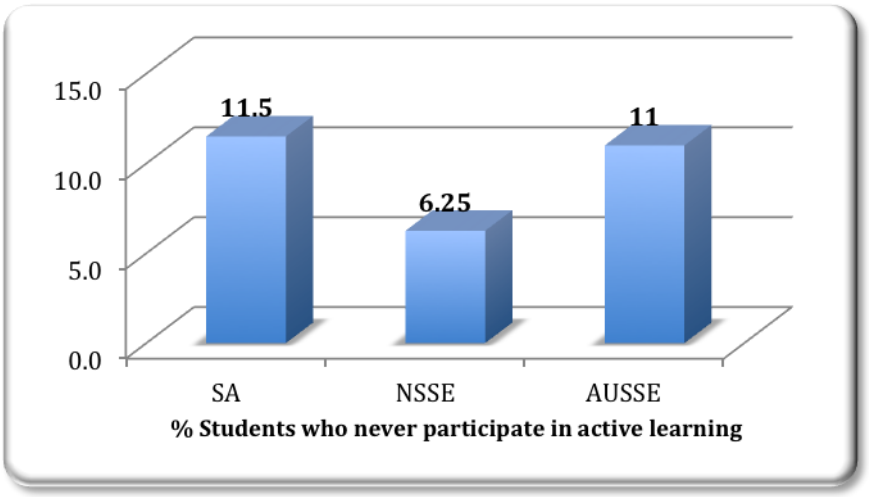
4.2 Student Engagement Comparison

There is no repository of data describing South African students' level of engagement with their studies, nor is there an independent body generating statistical data within the South African context. The student engagement data from the Industrial Design senior students were compared with results from the senior students' responses to the NSSE (USA) and the Australasian Survey of Student Engagement (AUSSE). AUSSE was first developed in 2005 by the Australian Council for Educational Research, and is based on the NSSE. The comparison between findings of this project and data from the America and Australia was merely to examine findings against an established benchmark. The contextual differences between the countries were considered, and all culturally or regionally specific questions were isolated and disregarded. The NSSE and the AUSSE results both use the Active and Collaborative Learning focus areas. The AUSSE defines active learning as the "extent to which students are involved in experiences that involve actively constructing new knowledge and understanding" (Radloff & Coates, 2009:17). Data related to questions about learning experiences included class participation, time spent working with other students inside and outside the class setting, and discussing work outside the class (Radloff & Coates, 2009:17, NSSE, 2011:36). Questions relating to these areas are not based in a specific cultural or regional context. The scores are indicated as percentages. While answers of "very often" and "often" can

be considered definitely positive for engagement, "sometimes" could be either positive or negative, while "never" is a definite negative response.

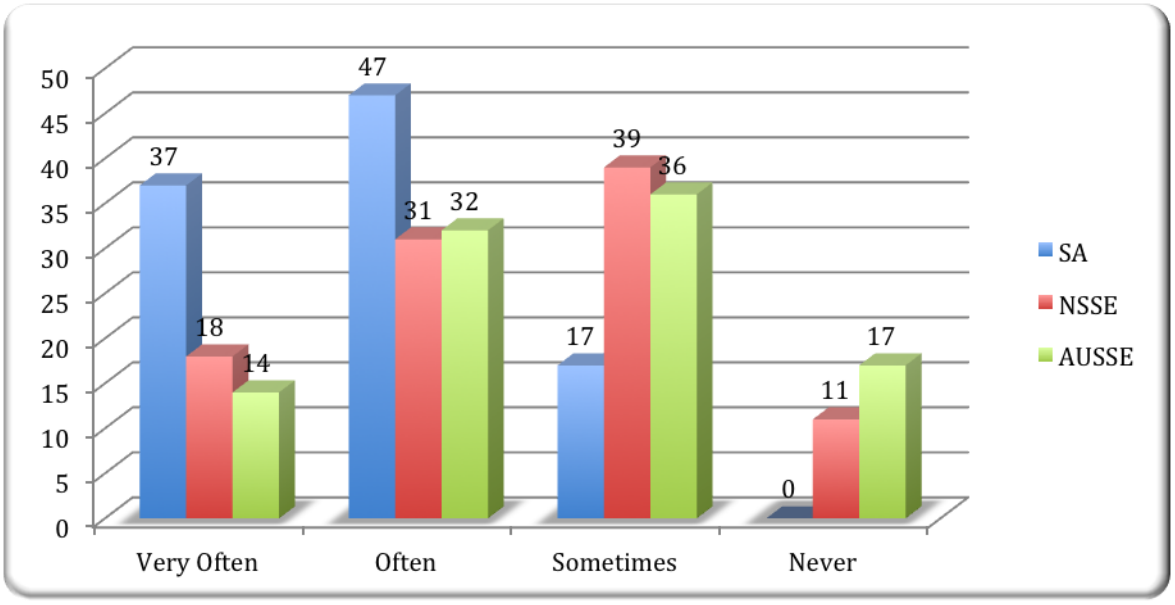
Overall, a large gap remains between the USA students and the AUS and SA students who responded to "never" participating in active learning activities. While USA scored an average of 6.25%, the AUS scored 11% and SA 11.5% (Figure 2). The more shocking score is the SA score of 37% of students *never* discussing readings/ ideas with staff outside the class. The class participation scores show the highest score of 71% for US students asking questions in class/ contributing to class discussions "very often" or "often". The AUS score of 54% for "very often" and "often" is balanced with a 40% "sometimes". The SA score of 34% ("very often" and "often" participate in class) indicates a lack of interest in class participation, backed up with a 60% for "sometimes". This would need to be interrogated with staff, with a view to improving the class participation.

Figure 2: Engagement scores: Students who never participate in active learning



The SA students, however, score by far the highest for collaboration with their peers. They scored highly positive "very often" or "often" for "working inside the class with others", an enormous 84% - nearly 40% more than the USA (49%) and AUS (46%) scores (Figure 3). The SA score for working outside class with peers is also surprising high, 76%, still considerably more than the 61% for US and mere 50% AUS score. The level of collaboration within the programme is affected by the project types and the nature of design itself. This is explained by Stacey (1996:138): "In this sense . . . creativity is not simply an attribute of an individual mind, but a characteristic of a wider system: a group. In the end individuals can be said to be creative only if they can engage with the creative activity of others, in both some kind of competition and some kind of cooperation". This idea is supported by Wenger, McDermott and Snyder (2002) who links this process of collective evaluation and meaning making to communities of practice which facilitate creativity and higher levels of engagement in environments such as educational design studios.

Figure 3: Engagement scores: working in class with other students



Assessing Industrial Design students' engagement within a theoretical subject

The level to which design students are involved in their education is not necessarily reflected in their studio activities, or the teaching and learning environment created by the lecturer or facilitator. In order to assess whether students were actively involved in learning activities, the level of student engagement within the theoretical subject History of Industrial Design 3 was reviewed. One can characterise an engaged learning experience as a learning environment which encourages students to use active cognitive process and which encourages student participation. An engaged learner is personally involved in the learning experience, understands the benefit of the learning experience, gains new knowledge through processing of information and is able to relate the gained knowledge to different spheres of understanding (Kearsley & Shneiderman, 1999). The engaged learning space benefits from humans' natural information-seeking nature:

Humans are viewed as goal-directed agents who actively seek information. They come to formal education with a range of prior knowledge, skills, beliefs, and concepts that significantly influence what they notice about the environment and how they organize and interpret it. This, in turn, affects their abilities to remember, reason, solve problems, and acquire new knowledge. (Bransford, Brown and Rodney, 2000:10)

Engagement theory can be broken down into three main principles as developed by Kearsley & Shneiderman (1999): *Relate*, *Create* and *Donate*. The first principle, *relate*, requires that there is collaboration and group activities to engage learners. The importance of collaboration in *design* education goes beyond the facilitation of an engaged experience, because communication and the ability to successfully work in a group are essential professional design skills. The second principle, *create*, requires project types and assessment to focus on a student's chosen area of focus or profession. The generation of projects thus creates knowledge regarding real world scenarios. The final principle, *donate*, refers to the importance of professional and community input during learning experiences and projects. The main considerations in developing an engaged learning activity is that students must find the generated knowledge and context relevant. Focusing on the three principles of an engaged learning experience, a module within the subject Theory of Industrial Design 3 was redesigned to encourage participation and engagement. Aspects of the module which related to the principles are included as Table 1.

Table 1: Engagement principles and teaching and learning implications.

Engagement Principle	Teaching and Learning Activity
Relate	Small group research activities Small group discussions Class discussion Formative peer evaluation and feedback
Create	Industry related project theme Project topic selected by student
Donate	Research required collaboration with industry and/or relevant communities of practice

During the module students were observed in 4 sessions, in order to investigate whether they were engaged in the learning experience. The first session observed was a traditional lecture (two 45 minute sessions with a 15 minute break in between) with lecturer guided discussion at the end. The second session focused on small group discussion followed by a lecturer led group discussion. In the third session students were given a reading task for the following week, followed by an optional lecturer led group discussion. The final session was completely student led – individuals were randomly selected to lead discussion with no lecturer guidance. Observations during all four session focussed on the following – the students' demeanour, participation and communication (a summary of observations is detailed in Table 2.

Table 2: Engagement objectives and session observations

	Observation Category		
Session	Demeanour	Participation	Communication
#1 Traditional lecture with lecturer guided discussion. Attendance: 41 students	Students paid attention during the first session but returned from break less focussed. Students sitting in the front three rows were actively involved – taking notes throughout. Only two of the students in the back two rows took notes.	Five students asked a number of questions during both lecture sessions. During class discussion seven students actively participated without being prompted. Five students, who were not participating, were asked by the lecturer to give their thoughts and produced adequate and topic- specific comments	During the class discussion students spoke among themselves– when asked, they stated that they were discussing the question at hand but did not feel like contributing to the larger group.
#2 Small group discussion followed by a lecturer led group discussion. Attendance: 36 students	All students, except thee, actively contributed during the small group discussion. During the group discussion only seven students took notes It was noted that students returned to the	A greater student participation was noted in the group discussion following initial small group discussions. Instead of a single student offering an opinion, it was noted on more than one occasion	Students spoke among themselves during the discussion. However, instead of two individuals speaking, it was noted that groups of individuals from the same small discussion group were conferring.

	seats they occupied during the first session.	that members of the smaller group would band together during the class discussion.	
#3 Reading task with optional lecturer led group discussion. Attendance: 41 students	Students returned to the seats, or row, they had occupied previously. All students paid attention to reading the topic and briefing, however only six took notes (four of those students were in the front two rows)	Eleven students remained for the optional discussion. All eleven actively contributed to the discussion.	Students were notably silent and paid attention during the briefing session. The eleven students who contributed to the optional discussion did not talk among themselves during the discussion session but rather to the group.
#4 Student led session. Attendance: 40 students	Students again returned to the seats, or rows, they had occupied previously. A heightened state of awareness was noted. None of the students took notes.	Only one student who was randomly selected to lead discussion sessions was unprepared. A greater number of students asked questions and made contributions to the discussion (thirty one in total)	A number of small discussion groups appeared during the session. During the larger class discussion however, these discussions more often than not led to comments from the participants to the larger group.

One of the main observations was that small group, or paired, discussions were prominent during lecturer led and student led sessions. In a number of instances, the initial peer dialogue resulted in a question or comment to the larger discussion group. Students did participate more in a student led discussion group, which highlights the impact of learner or peer driven learning experiences in the educational design studio. To gain further insight 40 of the participating students completed an anonymous qualitative questionnaire regarding their experience and the way the module was presented. The questionnaire posed a number of questions, with the opportunity to elaborate and explain. When compared to the observations made during the sessions, the findings from the questionnaire offer insights into students' views of their participation and engagement.

The problem based nature of design education benefits greatly from group discussion. In early studies relating to this, Bloom noted that (1953:169): "...if the objective is the development of abilities and skills which are problem solving in nature, the least efficient discussion is superior to most of the lectures." These ideas are supported by Wenger, McDermott and Snyder (2002) who reflected that group communication and peer interaction is key in facilitating higher levels of engagement. Students noted that, although all of them believe that classroom discussion is beneficial, only 60% feel they participate actively in class. This contradicts observations made during lecturer led large group discussion where the number of participating students are much lower. It is important to consider that this may be influenced by a student's nature, culture and language abilities. Eight students indicated that they do not feel comfortable asking questions during a large group session and prefer either small peer group discussion or to confer individually with a lecturer. One student noted: "I try to, however being a very reserved individual, and do not enjoy being the centre of attention, I do not speak as often as I could". Another student stated that: "I am more of a listener than a speaker, I take in what is being discussed and

formulate my opinion." The combination of small and large group discussion was noted as successful as students have an opportunity to engage in a group size in which they feel comfortable.

Another interesting contradiction noted in students' views is the level to which they play a role in the success of their studies. When asked whether they thought students should take ownership of their learning, 38 students (95%) indicated that this was instrumental to success within a subject. When asked whether they learn by getting involved, 38 students again responded positively. One student noted that small independent research groups "can develop your own understanding of the topic before the lecture...", another stated that: "...interesting facts come out and you learn a lot from your peers' opinions." The positive view regarding independent research groups and personal engagement contradicts data from another question where 11 students (27%) stated that they thought a lecturer should teach them what they need to know without the need to 'figure things out' for themselves.

Overall, the teaching and learning activities designed for the module did produce a more engaging environment. The majority of students participated at least once during the session and small discussion groups formed as part of the module are still active. Students responded positively to the design of the module:

I like the way it's being run now. Discussions, open arguments, personal views, perfect for a designer's way of progressing. (ID3.Q5)
I think we are using a good method now. The group work helps me understand concepts better. (ID3. Q8)
Discussion is a very good technique. Getting the whole class involved makes a difference. (ID3. Q20)
I feel this method of learning (research groups, class discussions, mini presentations) helps [me] understand and learn better than previous methods.(ID3. Q28)

The engaged environment, created through the application of engagement theory, produced a learning situation that encouraged participation and empowered students to share their views.

Conclusion

The level to which students are involved in their studies is dependent on a number of social, financial and environmental factors. As modern life becomes more complex, with students often working to support themselves or a family, the traditional measure of student involvement may not reflect the students' level of commitment or involvement in the classroom or studio (Duggan, 2004:5). Astin (1984:518) refers to the level of personal growth and learning being: "associated with any educational program is directly proportional to the quality and quantity of student involvement in that program." Acknowledging the complexity of modern life, Astin's statement, referring to both quantity and quality, speaks to the need for learning experiences that are engrossing and focused on the development of required knowledge. The theory of student involvement acknowledges that the amount of time and mental focus that students have, are limited (Astin, 1984:523). It is necessary then to ensure that the time available to students be used for active learning through engaged experiences. The theory of engagement proposes that learning experiences can be more focused and productive if they reflect real-world situations, embrace collaborative practices and engage with associated communities of practice.

The findings from comparing the engagement test scores in this project revealed some surprises. The class participation scores (asking questions in class) for the industrial design students of 34% ("very often" and "often" participate in class) seem to indicate a lack of interest in class participation, backed up with a 60% for "sometimes". This was elaborated upon in the questionnaires. However, this does not indicate a general lack of interaction. Interaction with peers was astonishingly high, compared with the US and AUS students. At nearly 40% more than the US students, the industrial design students work in collaboration with their classmates. The scores for working with peers outside the class were almost as high. It is unclear whether these high scores indicate the collaborative nature of the design discipline, or

teaching and learning practices that are more focused on student engagement. It appears that a combination of small and large group discussions would better suit this group of industrial design students, who are willing to engage, but do not all feel comfortable, for a variety of reasons, including language and cultural factors, to ask questions in the large class group.

The redesign of teaching and learning experiences, which reflect a focus on enhanced engagement, produced positive student feedback. Through the inclusion of a variety of activities, students had the opportunity to participate and develop new knowledge. Activities focused on collaborative discussion (small and large groups) and individual communication skills, all prominent in the Industrial Design profession, instead of traditional theoretical lecturing techniques. The impact of the engaged learning experiences documented in this article requires further reflective review, in order to gauge its extent. However, the immediate effects include greater student participation, a deeper understanding of content and the development of independent research and work groups

References

1. Ahlfeldt, S., Mehta, S. and Sellnow, T. 2005. Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use. *Higher Education Research & Development*. 24 (1): 5–20
2. Astin, A.W. 1984. Student involvement: a developmental theory for higher education. *Journal of College Student Personnel*. 25 (4): 297–308.
3. Bloom. B.S. 1593. Thought processes in lectures and discussions. *The Journal of General Education*. 7 (3): 160-169
4. Bransford, J.D., Brown, A.L., Rodney, R.R. (eds). 2000. *How people learn: brain, mind, experience, and school*. Washington D.C.: National Academy Press

5. Carini, R.M., Kuh, G. D. and Klein, S. P. 2006. Student Engagement and Student Learning: Testing the Linkages. *Research in Higher Education. 47(1): 1-32.*

6. Duggan, F. 2004. The changing nature of the studio as an educational setting. CEBE Transactions.. 1 (2): 70-77. Available: http://www.heacademy.ac.uk/assets/documents /subjects/cebe/Transaction/FionaDuggan.pdf (accessed 18 June 2012)

7. Hardy, C. 2009. Student engagement: paradigm change or political expediency? *The Higher Education Academy.* Available: http://www.adm.heacademy.ac.uk/resources/
8. features/student-engagement-paradigm-change-or-political-expediency (accessed 25 June 2012)

9. Jones, R. 2008. Strengthening Student Engagement. *International Center for Leadership in Education*. Available: http://www.leadered.com/pdf/strengthen%20student%20engagement%20white%20paper.pdf (accessed 13 April 2012)

10. Kearsley, G. & Schneiderman, B. 1999. *Engagement theory: a framework for technology-based learning and teaching*. Available: http://home.sprynet.com/~gkearsley/engage.htm (accessed 3 April 2012)
11. Kuh, G.D., Kinzie, J., Schuh, J.H. amd Whitt, E.J. 2011. Fostering student success in hard times. *Change*. 43 (4): 13–19. Available: htpp://www.changemag.org/Archives/Back Issues/2011/July-August 2011/fostering-student-full.html (accessed 25 June 2012)
12. Malinowski, B and Redfield, R. 1948. *Magic, science and religion and other essays*. N.Y: Keesinger Publishing

13. McInnes, C. 2004. Studies of Student Life: an overview. *European Journal of Education*. 39 (4): 383–394.

14. National Survey of Student Engagement 2011. *Fostering student engagement campus wide, annual results 2011*. Bloomington, IN: Indiana University Center for Postsecondary Research.

15. Radloff, A. and Coates, H. 2009. *Doing more for learning: Enhancing engagement and outcomes, Australasian Student Engagement Report.* The Australian Council for Educational Research. Available: http://www.acer.edu.au/research/ausse/reports (accessed 15 April 2012)

16. *Schlechty Center 2009. Theory of engagement. Tools for change. Available:* http://www.cs.kent.edu/~volkert/science-learning/files/Schelchty-engagement.pdf *(accessed 4 April 2012)*
17. Segelstrom, F, Holmlid, S. and Alm, B. 2009. *Back to the roots: a new ideal for ethnographic research for interface design*. In: Proceedings of the *International Association of Societies of Design Research,* Rigor and Relevance in Design, 18-22 October, Seoul: 195 -1961

18. Stacey, R.D. 1996. *Complexity and creativity in organizations.* Berrett-Koehler: San Francisco.

19. Van Dijk, G. 2010. *Design ethnography: Taking inspiration from everyday life*. Available: http://www.stby.eu/wp/wp-content/uploads/2011/01/designet.pdf (accessed 1 June 2012)

20. Wenger, E., McDermott, R. and Snyder, W.M. 2002. *Cultivating communities of practice: A guide to managing knowledge*. Boston: Harvard Business School Press.

A student-grown Facebook forum in an architecture class: seed or weed?

L Nagel
University of Pretoria Pretoria, South Africa
Lynette.nagel@up.ac.za

M Verster
University of Pretoria Pretoria, South Africa
Verster.mia@gmail.com

Abstract:

Architecture students' main subject at the University of Pretoria is design, which is learned in a studio environment. Other theoretical subjects are taught in traditional lectures and support design. To ease communication regarding the theoretical subjects, a second year class started a FaceBook (FB) group near the end of their second year (2010). Its aim was to share resources, have discussions and coordinate class activities and group work. The research question of this paper is: How did the Facebook group influence the social and teaching presence in this class. After completion of their 3-year degree, a large sample of the class completed the quantitative CoI survey instrument. One researcher was a student in this class who participated in the FB forum, and, heeding participant consent and ethical clearance captured data directly from FB and analysed the FB posts according to the CoI framework.

Analysis of the FB transcripts showed that during the active period of the group, students used it regularly for academic and social purposes, using the dropbox and posting and liking comments. The group had a strong social presence, with humour as affective construct and group cohesion emerging, which served to strengthen the group's architectural identity; and cries for support when workloads weighed them down. Teaching presence was evident in academic content that the students discussed, clarifying understanding and sharing resources that related mostly to the theoretical and subjective subjects and very little to Design. The success of using FB was due to the provision of a platform for simultaneous sharing of exchanges and the speed of communication.

Keywords: FaceBook, social presence, teaching presence, architecture

Introduction

Computer mediated communication has been part of higher education and particularly e-learning for several years. Recently, social networking sites (SNS) have become an integral part of students' social networking activities in countries like the United Kingdom and the United States (Madge, Meek, Wellens, & Hooley, 2009; Mason, 1991). Some institutions use FB purposefully to facilitate student's social assimilation into student life, others use it for diverse academic activities and purposes (Arnold & Paulus, 2010; Madge et al., 2009; Vignare, 2009). For the most part, academics do not regulate, participate or study students' SNS activities, and how it relates to learning. Boyd calls for more studies on student SNS usage outside the United States (boyd & Ellison, 2008). While Universities prefer to institutionalise communication, many see the use of SNS's as counterproductive to learning, due to the amount of time students spend on these sites, seemingly detracting from more productive learning activities (Leslie & Landon, 2008).

Context

The blended learning model used at the University of Pretoria corresponds mostly to multimodal technology-enhanced classrooms (Picciano, 2009) where contact teaching is extended to relevant on-site practical tuition and enhanced by the learning management system (LMS). Totally web-dependent tuition does not feature in undergraduate classes, due to limited availability and high cost of internet

access. The university offers a three-year BSc degree in Architecture, which is taught as a studio-based course. Students enrol for a degree in architecture, landscape architecture or interior architecture and the three degrees follow a similar syllabus, with no distinction between the disciplines during the first year. From the second year on, the three specialisations vary in theoretical subjects, and the main subject of all three courses, namely design, is taught separately. Design is a studio-based subject, where students benefit equally from discussions with lecturers and with fellow students. The students in this study were expected to work in the studio during all allocated time-slots, amounting to roughly 25 hours a week. Each year group had their own studio with drawing boards, tables, computer points and a variety of loose furniture. The studio environment formed the heart of social and academic interaction, as this was where students spent most of their time, inside and out of the dedicated times. The subject was assessed by means of critiques, where students pinned up their work in designated passages of the building and engaged in a discussion about their work with a group of lecturers and external examiners. These crits were considered public and students were allowed to witness each other's crits. The majority of students' time was spent on design, which was most often the source of the most stress.

Other theoretical subjects were presented using traditional lectures and assessed by written tests and examinations, although projects and oral examinations were used increasingly towards the completion of the degree. During the final examination at the end of the third year, four subjects were assessed during a single crit in which the students pinned up their entire final year portfolio.

Towards the end of 2010, the second year group experienced frustration with the general means of communicating in the faculty, namely sticking posters onto the walls of the studio. The need arose for an electronic forum and the students spontaneously started a Facebook (FB) group with a linked Dropbox account. Its aim was to share resources, have discussions and coordinate class activities and group work. By their third year, 123 architecture students (Architecture, Landscape Architecture and Interior Architecture) had access to the group. The majority of the Facebook group members (roughly 85) were registered for Design, while the rest were taking only theoretical subjects. The group was formed prior to the November examination period of the group's second study year and was still active after the end of their final examination a year later. The success of using FB was due to the provision of a platform for simultaneous sharing of exchanges and the speed of communication.

This class presented a unique opportunity to study the dynamics in this discussion forum, the contribution of social media and social presence. What makes this study unique is the absence of a facilitator; an angle that will contribute to the body of knowledge on the community of inquiry framework.

Research questions

The main question: How did a student-led Facebook forum contribute to learning in an architecture class?
The following sub-questions need to be answered:
how widely did students participate in the FaceBook forum
how did the Facebook posts contribute to each of the Community of Inquiry Presences

Literature

3.1 Social media sites

3.1.1 SMS and social networks

Higher education students over the globe use social media as an integral part of who they are and how they relate to their peers. FaceBook is the most-used SMS, with reports of 62% (Hargittai, 2007) to 90% (Hewitt & Forte, 2006) students in the USA being on FB.

3.1.2 FB and learning

SNS is often incorporated into blended learning (Arnold & Paulus, 2010). Their SNS (Ning) served effectively as information repository, while blogs and discussion forums provided areas to reflect and

review others' work. Unintended outcomes included community building and modelling (Arnold & Paulus, 2010).
Limitations of using the technology without a clear sense of purpose, are decreased usefulness, while lecturers can inhibit students' sense of spontaneity, and sense of learning through using authoritarian approaches to SNS (Young, 2012). Many students, particularly females strongly prefer lecturers not to be present on FB, and do not like to receive tuition or assessment from the sites; they like to separate social and academic lives (Hewitt & Forte, 2006; Madge et al., 2009).

3.1.3 FB and university structures

SNSs present "represents both an opportunity and a threat to institutions and educators: opportunity because the qualities which help these applications thrive align well with socio-constructivist and other contemporary theories of learning which have resonated strongly with online educators and learners and sparked massive interest and growth in adoption; threat in part because they are often developed and adopted by learners outside the bounds of their formal relationships with institutions, and in part because they depend on network characteristics that can be in tension with the more closed environments and online approaches found within most institutions" (Leslie & Landon, 2008, p. 2). Institutional LMS's are closed environments, and do not readily integrate with many applications on the outside (Mircea, 2012). We present an argument for encouraging the flexible use of such "outsider" applications, such as FB, as they contribute benefits to the learning environment not possible inside the LMS. Students appreciate the importance of FB as a social networking space that they own and use for social purposes, and universities could enhance student transition to University (Madge et al., 2009); provide the means to participate to less-privileged students (Hargittai, 2007) and encourage newly enrolled students to use this forum . Universities should, however, be careful not to intrude into the social space, not misusing it for academic purposes, teaching, marketing or pastoral activities, rather using the LMS or other virtual environments for those.
According to boyd and Ellison (2008), scholars, particularly outside the USA, know little of how and to what purposes students are using SMS sites. They propose that "richer, ethnographic research on populations more difficult to access (including non-users) would further aid scholars' ability to understand the long-term implications of these tools" (boyd & Ellison, 2008, p. 210). This research is therefore attempting to address part of the suggestion.

3.2 Community of Inquiry

Computer mediated communication (CMC) has been at the heart of online learning for a long time, initially without academics understanding which characteristics of the CMC contributed to productive learning. Garrison, Anderson and Archer (2000) formulated a practical guide to evaluate and improve discourse in an online course. They proposed that in a well-functioning online course that was designed and facilitated along social constructivist pedagogical principles, a Community of Inquiry (CoI) develops. Three overlapping elements in this community collectively contribute to the success in the course. Many have since established the integral role of social presence in online and blended learning (Garrison et al., 2000), as verbal cues and affective communication are notably absent in such courses, resulting in poor completion and less satisfaction (Richardson & Swan, 2003). Together with teaching presence and cognitive presence, it contributes to the establishment of a learning community. These presences have been researched qualitatively through analysis of online discussions and operationalized in the Community of Inquiry framework. After refinement, the CoI survey instrument has been developed and validated in hundreds of studies worldwide comprising more than half a million learners (Garrison, Anderson, & Archer, 2010; Ice, 2009).

3.2.1 Cognitive Presence

It is based on the Practical Inquiry model learning cycle (Garrison, Anderson, et al., 2010). Online discussions that foster critical thinking can raise cognitive presence (Richardson & Ice, 2010), though students often did not proceed further than the exploratory phases. Critical thinking is both process and outcome, indicating deep and meaningful understanding of a concept. Cognitive presence comprises four

phases: triggering event (questioning), exploration, integration (formulating possible solutions), and resolution of the problem (Garrison, Anderson, & Archer, 2001). Initially, a dilemma or problem is proposed or encountered; tasks can also present triggering events. Students should be interested and feel motivated to explore the problem. In the exploration phase, students explore ideas by reflecting privately and discussing in the online space the merits of their ideas. They typically explore a variety of resources to find relevant information and brainstorm ideas with the others in the forum. In the Integration phase, students combine new information to construct new possible solutions. They reflect on the content and discussions and develop deep understanding of the concepts. The final, or resolution phase indicates that students developed ways to test and apply the new knowledge, or solutions that can be implemented in practice, even apply solutions to areas outside the class (Arbaugh et al., 2008).

3.2.2 Social Presence

Social presence reflects an affective dimension of participants feeling socially and emotionally connected to each other, brought about by open communication, group cohesion and a shared identity. The affective component represents feelings of having a sense of belonging in the course, when they get to know the others and form distinct impressions of them. Open communications means that participants feel comfortable to converse participate and interact with the others in the discussions. Closely related is the group cohesion, which is indicated when students feel they can disagree without losing a sense of trust and feel their viewpoint is acknowledged by others. experiencing a sense of collaboration also contributes to social presence (Arbaugh et al., 2008).

Students who do not feel connected to their class, often feel isolated, and often drop the course. The constructs that contribute to this presence are: personal, affective expression, openness in communication and group cohesion. There is a strong relationship between social presence and satisfaction with online courses (Richardson & Swan, 2003). Social presence contributes to cognitive presence and learning only when it is directed towards learning outcomes, and not by itself (Garrison et al., 2000).

3.2.3 Teaching Presence

Teaching presence is defined as the "design, facilitation, and direction of cognitive and social processes for the realization of meaningful learning" (Ice & Nagel, 2010, p. 3). The core roles of the online instructor reflect in teaching presence and are instrumental in developing and maintaining online learning communities (Garrison, Cleveland-Innes, & Fung, 2010). The design and organisation of the course should include clearly communicated course topics, course goals, due dates and frames for learning activities. The lecturer fulfils a facilitative role through being helpful in identifying areas of agreement and disagreement, guiding, keeping everybody in track, encouraging the exploration of new ideas and encouraging students to collaborate. Direct instruction comprised of directing and maintaining focus to the relevant topics and providing relevant and timely feedback (Arbaugh et al., 2008).

3.3 Group identity

Michinov and co-authors (Michinov, Michinov, & Tocsek-Capelle, 2004) have studied the productive functioning of online groups and the consequences of virtual group membership in synchronous computer-mediated communication. According to them, members of a group identify with their group and this social identity determines their behaviour. They found that groups with a strong group identity communicated more task-relevant information and made more positive comments about each other's performance, building morale. Michinov et al (2004) found no correlation between group identity and flaming.

Methodology

We followed a mixed methods approach to investigate the use of a Facebook forum by architecture students over a period of more than a year. For this paper, we analysed the messages posted during the month of their last examination before graduating. The reason for choosing this period, is that the group

had had ample time to mature into a functional community of learners (Collison, Elbaum, Haavind, & Tinker, 2000), and a community of inquiry (Garrison, Anderson, et al., 2010). During this period there was a high level of activity with plentiful online interactions to analyse. This period of observation was the type of event for which the forum was initiated in the first place; this window into the forum would most likely represent the most relevant topics. Findings from the qualitative investigation of the forum itself were crystallised (Tobin & Begley, 2004) with quantitative findings obtained from the survey and descriptive statistics.

4.1 Roles and ethical considerations

Buy-in and permissions for the research was obtained from the third-year Design lecturers, as well as the HOD of the Department. The roles of the two researchers were clearly delineated before research started. The research coordinator provided the questionnaires, captured the data electronically. The co-researcher who was a student in the class, obtained permission from students in FB, captured the FB data and analysed the data in ATLAS.ti. As it is very important not to infringe upon students' privacy in their FB group, they all had to give explicit permission for their posts to be included in the research, even though the exploration in that forum was conducted by one of them. We adhered to Denzin and Giardina's (2007) principles of respect, beneficience and justice, where "Respect involves caring for another, honoring that person, and treating him or her with dignity" Denzin and Giardina (2007, p. 24). About half the students completed the survey anonymously. Ethical clearance for the project was obtained from the EBIT Faculty.

4.2 Quantitative analysis

The researcher, who was a student in the class and an active member of the forum, captured and analysed the FB posts electronically in 2012, grouped and counted them according to calendar months, reported as descriptive statistics. Volunteers from the class also completed the paper-based CoI survey that consisted of 34 items with a Likert-like scaled response after their end-of-year examinations. This survey also included a few demographical questions and items to indicate whether they were active participants in FB, followers of the discussions, or not part of the forum. Because we could not identify students in the survey, we cannot link individual responses from the survey to the forum messages. The CoI survey could at best indicate the perception in the class regarding the teaching in the blended tangible and virtual environments.

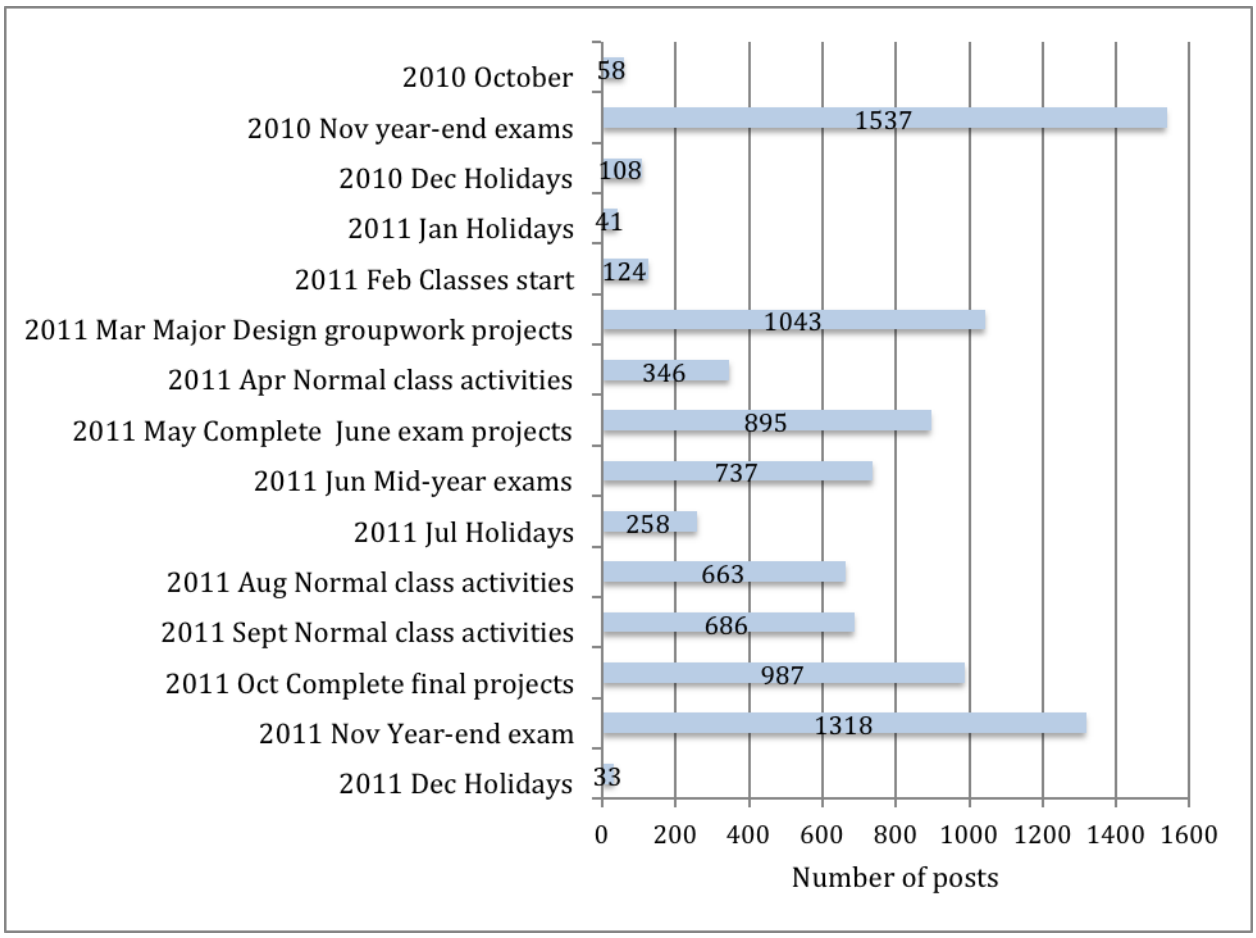
4.3 Qualitative analysis

The FB posts from November 2011 were analysed using Atlas.TI qualitative analysis software, using an inductive approach (Hatch, 2002) to create codes for similar messages. As unit of analysis, we decided to use messages, as posts were sometimes very long, and often addressed more than one topic. Using the codebook and the CoI framework and survey as guidance, codes were deductively grouped into families that corresponded with the CoI constructs, and super families that corresponded with the CoI presences. The validity of the qualitative findings rests on the analysis being performed consistently by one person who interpreted posts in the bigger context.

Results and discussion

In answer to the first research sub question, we present in figure 1 the number of FB posts per month for the period October 2010 –December 2011

Figure 1: Distribution of posts in a class FB forum over a 14 month period.



The description of the academic calendar events in the respective months sheds some light on the great variation in month-to-month activity. It is evident that the highest activity corresponded with periods of high academic activity, project deadlines and concomitant stress. The 1318 messages during Nov 2011 (figure 1) were posted by 69 students, of whom 42 posted once or twice, 17 students posted between 3 and 6 messages, while 18 students contributed 8 to 36 messages. This means that 56% of the class were visible on the FB forum.

There were 29 students who completed the CoI survey and the additional questions about FB, of whom 17 (60%) indicated that they posted messages on FB while the rest only followed without contribution. The benefit of taking part in FB therefore was therefore shared by the spectators, who did not ask or answer questions, but derived enough value to continue returning to the site.

Table 1 shows the results of how the 29 volunteers (contributers and observers) completed the CoI survey. Table 1 therefore shows how these students experienced the presences of the CoI in all subjects and all modes of delivery at the end of their degree. Because the teaching model was blended learning with a major focus on face to face tuition, of which practical studio work dominated the curriculum, the online components consisted of content in the LMS and informal interaction in FB. The survey instrument therefore indicated a more holistic picture of their studies than the activity in FB alone, which represented a mere segment of the learning interaction.

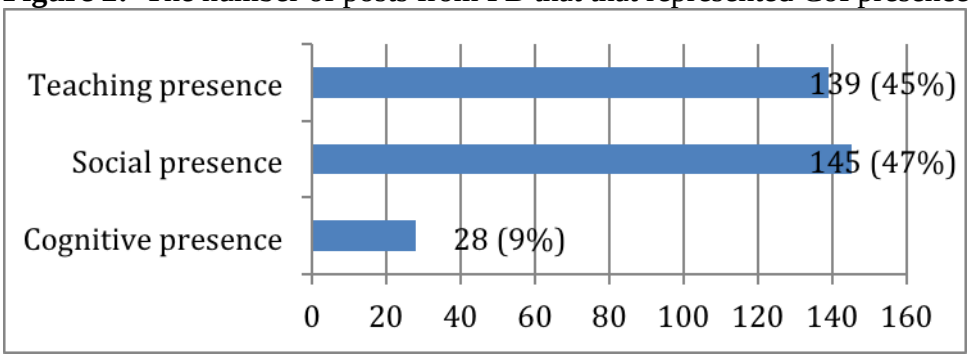
Table 1: CoI survey results of students who participated in FB by either reading or posting

Presence	Average per presence	Construct	Average per construct
Teaching	4.2	Design and organisation	4.4
		Facilitation	4.0

		Direct instruction	4.1
Social	4	Affective	4.1
		Open communication	4.0
		Group cohesion	3.9
Cognitive	4	Triggering event	4
		Exploration	4.1
		Integration	3.9
		Resolution	4.1

From table 1 it can be seen that design and organisation (4.4) was the most prominent construct students experienced in the course considering all delivery modes. None of the other constructs stood out. This table does, however, not show what the contribution of FB was towards the CoI presences. Qualitative analysis of all posts at the end of the course showed a more detailed view of the contribution of FB to the learning in this course, attempting to answer the second sub-question.

Figure 2: The number of posts from FB that that represented CoI presences at end of course



Throughout the 14month duration of the forum, teaching and social presence-type of messages were more prominent than cognitive presence, the latter contributed by a small number of highly active students, and therefore varying greatly month-on-month.

Teaching presence in FB in the absence of a teacher was surprising, particularly as organisational material that was made available to others in this easily accessible virtual space, mostly originated from students. Within the teaching presence, design and organisational messages were the most plentiful with 129 messages. Shortcomings in the design and organisation (D&O) of courses could have been the reason half these messages were questions about organisational issues and unclear instructions asked to the forum, which could otherwise have been addressed to and answered by a lecturer. The D&O category seems to have functioned as a Q&A forum.

Fifteen messages reinforced the development of a sense of community through sharing personal notes and resources, or arranging to meet in person to help someone. Those messages must also be read together with the 34 group cohesion messages of a purely social nature that had the same effect. Although *design* was the most important and time-consuming subject, only about 20% of posts related to it, as 80% of all posts were about theoretical subjects. A low usage of the LMS in the theoretical subjects contributed to the high teaching presence in FB. Communication in studio seemed sufficient to resolve design-related issues

As was expected, *Social presence* was the most prevalent presence in the forum, representing only 45% of the classified messages. Open communication portrayed how tired students were and how much they suffered. Humour relating to the design activities in the course inevitably followed the “tired” posts.

Other posts here portrayed the networking in the class. Purposeful use of SNS in a course was shown to increase students' perception of social presence (Joyce & Brown, 2009)

Among the social posts, the most popular were internal jokes or humorous messages. Affective messages included 27 emoticons, 19 instances of appreciation or encouragement, consistent with Michinikov et al (2004), who found that groups with a strong group identity voiced appreciation and encouragement. One of the constructs of social group cohesion (Richardson & Swan, 2003) was illustrated by students who openly voiced negativity or derogatory humour (10), which in some instances could be construed as flaming. Students clearly felt secure enough in the group to show emotions that would in other circumstances have been kept private. Flaming was not an indicator of lack of group identity. By far the majority of affective expressions were of a positive nature.

The C*ognitive presence* in the posts consisted mostly of triggering event messages (74% of this presence). Other researchers reported that students do not move to the latter stages of the practical inquiry cycle by themselves, often not progressing past exploration (Garrison et al., 2001). The low cognitive presence that is more or less restricted to triggering events, indicate the limited higher order thinking and problem solving that took place in FB. These activities did occur in the class, as indicated in table 1, but not in FB.

Conclusions

Answering the first sub question: How widely did students participate in the FaceBook forum?, we report that more than half the class posted messages and were therefore visible members of this forum. As replies to a concomitant survey showed that about 40% of students did not post, but followed the posts, we can assume that the influence of the forum was more than was visible, and possibly reached the whole class.

The second sub-question: How did the Facebook posts contribute to each of the Community of Inquiry Presences?, can be answered that in both qualitative (FB forum) and quantitative (CoI survey) findings from the same period, social presence obtained the highest score, followed by teaching presence, with cognitive presence as the lowest average score. It is probable that the high numbers of teaching and social presence posts in FB did to some extent contribute to the high scores for those presences in the survey which reflected students' experience from multi-modal delivery. The cognitive presence in the blended learning environment as measured with the CoI survey was not attributed to high cognitive presence activities in FB, but more than likely originated in studio.

This FB forum was started with the aim of sharing information and resources related to perceived unimportant theoretical subjects. The content of 80% of the posts after 14 months still reflect this as the most salient trigger of communication, resulting in a high teaching presence of 46% of all messages. At the same time, an equally strong social presence developed representing 37% of the messages. Social presence embodied the affective behaviour and group cohesion between the members that supported and inspired students through stressful and challenging periods. This presence also strengthened their identity as architects. Facebook therefore contributed numerous positive aspects to this class' learning experience, which seeded greater cohesion, identity and facilitated the study of theoretical subjects.

References

1. Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. (2008). Developing a community of inquiry instrument: Testing a measure of the Community of Inquiry framework using a multi-institutional sample. *Internet and Higher Education, 11*, 133-136.

2. Arnold, N., & Paulus, T. (2010). Using a social networking site for experiential learning: Appropriating, lurking, modeling and community building. *The Internet and Higher Education, 13*(4), 188-196. doi: 10.1016/j.iheduc.2010.04.002
3. boyd, d. m., & Ellison, N. B. (2008). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication, 13*(1), 210-230.
4. Collison, G., Elbaum, B., Haavind, S., & Tinker, R. (2000). *Facilitating Online Learning: Effective Strategies for Moderators.* Madison, WI: Atwood Publishing.
5. Denzin, N. K., & Giardina, M. D. (2007). Introduction In N. K. Denzin & M. D. Giardina (Eds.), *Ethical Futures in Qualitative Research. Decolonizing the Politics of Knowledge*. Walnut Creek, California: Left Coast Press.
6. Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education. *The Internet and Higher Education 2*(2-3), 87-105.
7. Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical Thinking, Cognitive Presence, and Computer Conferencing in Distance Education. *The American Journal of Distance Education, 15*(1), 7-23.
8. Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *Internet and Higher Education*(13), 5-9.
9. Garrison, D. R., Cleveland-Innes, M., & Fung, T. S. (2010). Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *Internet and Higher Education, 13*, 31-36.
10. Hargittai, E. (2007). Whose Space? Differences Among Users and Non-Users of Social Network Sites. *Journal of Computer-Mediated Communication, 13*(1), article 14.
11. Hatch, J. A. (2002). *Doing Qualitative Research in Education Settings*. Albany: State University of New York Press.
12. Hewitt, A., & Forte, A. (2006). *Crossing Boundaries: Identity Management and Student/Faculty Relationships on the Facebook*. Paper presented at the Computer Supported Cooperative Work Conference, Banff.
13. Ice, P. (2009). Using the Community of Inquiry Framework Survey for Multi-Level Institutional Evaluation and Continuous Quality Improvement. In S.-C. E. Practices (Ed.).
14. Ice, P., & Nagel, L. (2010). *Introduction to the community of inquiry framework and applications for programmatic improvement*. Paper presented at the 12th ZA-WWW conference, Durban, South Africa.
15. Joyce, K. M., & Brown, A. (2009). Enhancing Social Presence in Online Learning: Mediation Strategies Applied to Social Networking Tools. *Online Journal of Distance Learning Administration, 12*(4).
16. Leslie, S., & Landon, B. (2008). Social Software for Learning: What is it, why use it? *The observatory on borderless higher education* (Vol. 44, pp. 2-27). London: Association of Commonwealth Universities and Universities UK.
17. Madge, C., Meek, J., Wellens, J., & Hooley, T. (2009). Facebook, social integration and informal learning at university: 'It is more for socialising and talking to friends about work than for actually doing work'. *Learning, Media and Technology, 34*(2), 141-155.
18. Mason, R. (1991). Moderating Educational Computer Conferencing. *The Distance Education Online Symposium, 1*(19), 1-11.
19. Michinov, N., Michinov, E., & Tocsek-Capelle, M.-C. (2004). Social identity, group processes, and performance in synchronous computer-mediated communication. *Group Dynamics: Theory, Research and Practice, 8*(1), 27-39.
20. Mircea, M. (2012). SOA adoption in higher education: a practical guide to service- oriented virtual learning environment. *Procedia - Social and Behavioral Sciences, 31*(0), 218-223. doi: 10.1016/j.sbspro.2011.12.045
21. Picciano, A. (2009). Blending with Purpose: The Multimodal Model. *Journal of the Research Center for Educational Technology, 5*(1), 4-14.

22. Richardson, J. C., & Ice, P. (2010). Investigating students' level of critical thinking across instructional strategies in online discussions. *Internet and Higher Education, 13*, 52-59.
23. Richardson, J. C., & Swan, K. (2003). Examining Social Presence in Online Courses in Relation to Students' Perceived Learning and Satisfaction. *Journal of Asynchronous Learning Networks, 7*(1), 68-88.
24. Tobin, G. A., & Begley, C. M. (2004). Methodological Rigour Within a Qualitative Framework. *Journal of Advanced Nursing, 48*(4), 388-396.
25. Vignare, K. (2009). What to expect from a virtual university. [Article]. *New Directions for Higher Education*(146), 97-105. doi: 10.1002/he.350
26. Young, J. R. (2012). A tech-happy professor reboots after hearing his teaching advice isn't working. *The chronicle of higher education*, 3. Retrieved from College 2.0 website: http://chronicle.com/article/A-Tech-Happy-Professor-Reboots/130741/

Digital storytelling and authentic learning: A case study in Industrial Design

Victoria Barnes
CPUT , Cape Town | SA
barnesv@cput.ac.za

Daniela Gachgo
CPUT , Cape Town | SA
gachagod@cput.co.za

Eunise Avala
CPUT , Cape Town | SA
avalae@cput.co.za

Abstract

Plagiarism is one of the major challenges in undergraduate students' written assignments. Against a background of general under preparedness of students entering higher education, poor academic literacy levels, limited knowledge about plagiarism and an increasing affinity among students towards visual learning resources, this paper reports on a research study that investigated the potential of digital storytelling as an alternative assessment method in a first year Industrial Design course, at a University of Technology, South Africa. In this course, Technology 1, digital storytelling was used for student assessment instead of a paper-based essay. Digital stories are usually short movie clips, created with off-the-shelf equipment and techniques, combining text, images, videos, music and narration. Drawing from the principles of authentic learning, the researchers investigated benefits and challenges of using digital stories as alternative assessment method. Qualitative methods of collecting data were used, which included focus group interviews with the students and in-depth interviews with lecturers. Findings of the study showed that digital storytelling promoted authentic learning, which led to high levels of student engagement with their studies and hence meaningful understanding of the subject matter. However, findings also revealed the importance of providing support to students in developing a high-quality, polished end product. More research is needed to explore the potential of transferring this highly independent, student-led project into other disciplines.

Keywords: digital storytelling, authentic learning, assessment methods, student engagement, industrial design

Introduction

Plagiarism is one of the major challenges in undergraduate students' written assignments. Furthermore there is an increasing critique that students are not ready for industry as a result of the fact that Higher Education (HE) is teaching theory and not linking theory to practice (Bennett, Harper, & Hedberg, 2001; T. Herrington & Herrington, 2006). Against this background and the increasing affinity among students towards visual learning resources (Hull, 2003), this paper reports on a research study that investigated the potential of digital storytelling as an alternative assessment method in a first year Industrial Design course, at a University of Technology, in Cape Town, South Africa.

This study adopted a theoretical and analytical framework of authentic learning, which places a particular emphasis on learning happening in a real world context. This study adopts a qualitative research approach, analyzing staff and students' self-reported perspectives through an authentic learning lens. Although originating from digitally saturated contexts, the increasing access to mobile technologies has made digital storytelling viable in less resource rich environments. However, limited research evidence exists to support the above claim (Lundby, 2008). This project will aim at contributing to this small but growing field of knowledge of the use of digital storytelling for authentic learning in resource poor

environments. The conclusions drawn from this study and recommendations for future digital storytelling projects, as well as areas for further research will conclude this paper.

Background of the study

The subject Technology 1 is an introductory course, within the Industrial Design programme at a South African University of Technology. The average class size is fifty students, which becomes substantial when dealing with one-on-one tuition and feedback on practical assignments (Tucker & Reynolds, 2006: 40). Over the preceding years, the subject lecturers had noticed a significant change in the level of preparedness of students, especially evident in their lack of academic writing skills. This resulted in a substantial number of students fully or partly plagiarising their written assignments, or using incomplete or incorrect referencing techniques. Apart from adding to an already heavy burden on the lecturers assessing the work, it led to general frustration among students and lecturers alike. The combination of these factors necessitated a change of teaching and learning approach.

The digital storytelling project was an experimental project, devised by the lecturers as an alternative form of assessment replacing an essay-style assessment. The intention was to ensure that the students engaged with the material, learnt from their peers, showed an understanding of referencing techniques, and that the time needed to assess the work was reduced. If the results of the digital storytelling project were reasonable, these stories would also form the start of a more updated library of Technology resources.

Literature review

Increasingly, Higher Education classrooms in South Africa have become more diverse. While in the past the student body was considerably smaller and could be expected to be of greater homogeneity in terms of level of preparedness and student demographics, today's student body is not only larger, but comes into Higher Education with diverse levels of preparedness and diverse demographic backgrounds, such as gender and age (Duggan, 2004: 5; Scott et al., 2007). In order to meet the needs of this diverse student body, a variety of teaching and learning activities have to be introduced, as well as different and varied assessment methods. Furthermore, due to the general drive to open access to South Africa's Higher Education and changes in the school curriculum, learners who are unfamiliar with academic writing and referencing need to be accommodated (Scott et al., 2007; Teferra & Altbach, 2004).

Industrial Design studio-based education, with its pedagogical approach firmly rooted in cognitive apprenticeship model (Duggan, 2004; Tucker & Reynolds, 2006), subscribes to a teaching and learning approach that is highly interactive, project based and with a strong link to real-world problems (Docherty, Sutton, Brereton, & Kaplan, 2001: 235).

However, assessment methods often follow the traditional academic patterns, such as essays and other written work and are thus less authentic. Authors such as Allen (2009) and McLaren (2007) argue that traditional approaches to assessment such as essays, tests, student-centred discussions and presentations will begin to appear inauthentic if they do not, to some extent at least, recognize and embrace multi-modal, internet-enabled knowledge networking.

Increasingly lecturers are introducing digital storytelling as an alternative means to appropriating knowledge or content in and outside the classroom, based on the belief that knowledge is context-dependent and should therefore be acquired in realistic contexts (Duffy and Cunningham cited in Bennett 2001). Digital stories are usually short movie clips, created with off-the-shelf equipment and techniques, combining text, images, videos, music and narration (Lundby, 2008).

Digital storytelling foregrounds the importance of not only textual literacy and reasoning that predominate schools and universities, but facilitates the development of a full range of digital literacies,

necessary for 21st century graduates (Hull, 2003). These literacies require students to know how and when to use tools and technologies. By allowing students to tap into existing visual and technological literacies, they can at the same time develop their academic literacies (Kajder, 2004).

Theoretical and analytical framework: authentic learning principles

This study adopted an authentic learning framework as a theoretical and analytical framework. Guided by a socio-constructivist philosophy and drawing from cognitive apprenticeship theory and situated learning (Dennen & Burner, 2008), authentic learning is defined as learning where students are situated in authentic learning contexts and where they are exposed to learning activities that are as close as possible to problems they will encounter in their real world professional context (J. Herrington, Mantei, Herrington, Olney, & Ferry, 2008). This can thus bridge the boundaries of formal education and the professional workplace and between theory and practice (J. Herrington & Reeves, 2003).

Herrington and Herrington (2006) identified nine characteristics of authentic learning:
Authentic contexts, that reflect the way the knowledge will be used in real-life and can serve as an authentic rationale for the study of a complex problem, guided by genuine practices of professionals (p.4).
Authentic activities, that are complex and comprise ill-defined problems and investigations, which have real-world relevance (p.5).
Access to **expert performances** enabling modeling of processes, which allows students to observe how relevant tasks are performed in the real world (p.5).
Multiple roles and perspectives providing alternative solution pathways, which allow students to examine problems from a variety of stakeholders' perspectives to conduct a sustained and deep exploration of a problem (p. 6).
Collaboration allowing for the social construction of knowledge, mirroring the often collaborative problem-solving encountered in real-life work experiences (p. 6).
Opportunities for **reflection,** a social process, whereby through collaboration a reflective process can become apparent (p. 7).
Opportunities for **articulation** to enable tacit knowledge to be made explicit, and whereby students through presentations have to defend their arguments publicly (p. 7).
Coaching and scaffolding by the teacher - and other students - at critical times. Complex problems of this kind would be extremely difficult without the guidance and support of the teacher and by other students within collaborative groups (Reeves, Herrington, & Oliver, 2002).
Authentic assessment that reflects the way knowledge is assessed in real life and is seamlessly integrated with the activity, often leading to polished products (Herrington & Herrington, 2006: 8-9).

However, one dimension that is implied in Herrington's above mentioned characteristics of authentic learning, but that is not explicitly mentioned, is student engagement. Learning needs to be significant, meaningful, and seen to involve the interests of students. A strong link to intrinsic motivation developed through the challenge, relevance, interest and involvement in the contexts they study (Riggs & Gholar, 2009). Similarly Herrington et al (2003) found that students involved in authentic learning are motivated to persevere despite initial disorientation or frustration, as long as the exercise simulates what really counts—the social structure and culture that gives the discipline its meaning and relevance (Lombardi & Oblinger, 2007).

The use of emerging technologies can promote a number of the characteristics of authentic learning, such as collaboration across distance, sharing of results and communicating with experts (Lombardi & Oblinger 2007). One example of a mobile technology that can support authentic learning, is digital storytelling (Olney, Herrington, & Verenikina, 2009). Olney, Herrington and Verenikina's study (2009) in which early childhood educators developed an authentic digital story book, shows that in general, the

response of the students to learning new and potentially complex technologies and software was made much more focused and achievable through the use of an authentic task.

Methodology

In this study, a qualitative approach was employed with an aim of understanding lecturers' and students' perceptions on whether digital storytelling as an assessment activity in a first year Industrial Design course, at a South African University of Technology, promoted authentic learning. This approach was suitable for the study because of its strength in investigating experiences as they are ' lived' or 'felt' or 'undergone' by the participants (Sherman & Webb, 1988).

The study was conducted in 2011, and the population of the study was 49 first year Industrial Design students. Informed consent was sought from students and the lecturer of the course. Confidentiality was ensured by allocating alphabetical numbers to study participants in order to ensure anonymity in transcription and analysis. Two focus group interviews were conducted, each comprising 10 students (thus a total of 20 students participated in the study), and two in-depth interviews were carried out with the lecturer teaching this course.

The coding system used in this study was informed by the nine elements of authentic learning (Herrington and Herrington, 2006). Data was analyzed through constant comparison in order to establish whether the production of digital stories as an assessment activity promoted authentic learning (Morgan, 1993).

Members of the research team discussed the research process, the congruency of the emerging findings with the raw data, and tentative interpretations which promoted validity. Audit trails (detailed accounts of the methods, procedure and decision points in carrying out this study) were recorded. Ethical clearance was obtained from Research Ethics Committee of the institution.

The researchers in this study acknowledge that findings can offer valuable insights into the use of digital storytelling for authentic assessment purpose could draw from, but are limited by the scope of the study.

Results

In this part of the paper we will report the findings from student focus group discussions and the lecturer's interview along the nine dimensions of authentic learning as identified by Herrington and Herrington (2006).

Dimension 1: Authentic context

The real-world context of an Industrial Designer includes team work, division of tasks based on individual strengths and skills, sourcing of information and materials from various sources and working to a brief by a client, under time and resource constraints.

Students worked in and out of the studio, some filming on the authentic location. As one of the main advantages of this project, the lecturer mentioned that this project allowed students to acquire content in a more visceral way than by doing an online search:

Lecturer: "The best thing a film where two students had gone to Newlands Forest: they literally walked until they found the burr[iii] to film. Previously you would get a diagram and later you could show students a burr and ask them what that is and they wouldn't know…because the disconnect between the diagram and the actual thing was huge... , but for this project they actually went out into a forest and found one on a tree ... they will never forget what that is."

In terms of authentic contexts and resource-restrained environments, one of the students argued that responding to unforeseen challenges and developments helped them to be creative in their problem-solving:

Student D: "The day that we were supposed to shoot …we had a campus riot […] strikes and what ended up - that really interrupted our shooting schedule because we had specific locations, specific ideas and we couldn't get access to those areas …Because we had the information ready and so we used the strikes as a backdrop and used it to our advantage…"

Dimension 2: Authentic task

An authentic task in an Industrial Design real world scenario, would involve a brief by a client defining the requirements of the task, specifying materials and target group and limitations in terms of time and financial resources. In this course the project brief was set up along specific requirements in terms of content and deliverables (e.g. topic of movie, length of movie), but was broad in terms of processes, allowing for students' freedom and creativity. The lecturers deliberately did not show any model stories, in order to not limit students' imagination.

Students appreciated the freedom and creativity this project offered them:

Student A: "I found it interesting how everyone had a different style for their movie so it like really got the creative juices flowing and different ways as well it wasn't like a set. With each brief there's like a very set skill that we have to learn, so everyone's designs are reasonably similar but this was so vast we could do whatever we wanted. It was nice."

Dimension 3: Expert performances

Because of the openness of the brief and the diverse skill set involved in developing a digital story, which group members might not have possessed, students approached the wider community of friends and families to support them in carrying out the task, such as asking a brother to act in a movie, sourcing necessary equipment or asking friends to help with editing. They also interviewed experts on the content, such as visiting a lumber mill. This helped them in establishing networks of experts, a highly important skill in their future career.

Student E:" … from a shooting perspective I've never shot a film so I actually got a friend in to like explain how you need to shoot a film if you're going to edit it where you like have a two second pause at the beginning and at the end so that if you mixing things together..."

Dimension 4: Multiple roles and perspectives

As mentioned before, students relied on a variety of resources to develop their movie, such as the Internet, but also field trips, expert interviews, their own experience and support from the wider community of family and friends.

Student C: "I just think it's wonderful to try new things all the time and to push yourself to look at things from a different point of view."

Dimension 5: Collaboration

In this project students were grouped randomly, to prepare students for what they would encounter in a real world, where students have to work and collaborate with a diverse group of colleagues. In students' responses one can see varied levels of collaboration.

Student B: "I found it was quite nice to write the script with all three of us because we kind of like, I don't know it becomes fun and you start feeding – as I said you start feeding off each other's – so like someone will come up with a basic outline of the story and then like you start putting in little details, which was quite cool."

However, most groups applied a more strategic approach, dividing tasks according to skills and interest of students and also gaining knowledge about group dynamics and how to achieve best results in a collaborative project.

Student F: "I for instance did some, most of the scripting, the other guy did the editing and one guy did most of the recording and we also did and took turns with the recording because we needed more people in the shot but … a natural division of labour happened. People migrate towards what they kind of feel comfortable with."
Student B: "I think also different people have better skills at certain things. So if you can find what you're good at and you find what they're good at then it's better in the end."

The lecturer referred to the importance of students' learning to divide tasks based on their skills:

Lecturer: "That was something the students commented on, to work towards peoples' strengths...they may not have previously known what that person's strengths were...because they were in a situation where they had to divide task, they had to be realistic about what they could do..."

While the collaboration increased motivation among some of the groups, the most challenges that students mentioned in the project were also based around the collaborative aspects of the project, especially around planning the project and communicating among geographically dispersed group members.
Student F: "When working with the group you will kind of feel obliged to actually work as hard as you can because if you're not you're letting down the group so it's basically everyone just putting in, ja the motivation because you don't want to let down another group basically…"

Student B: "I think there are different pros and cons for each. Like if you're working in a group it's nice to bounce ideas between each other and like improve on someone else's idea. But then you also have your time management problems and like your leadership problems …."

Dimension 6: Reflection
Because of the experimental and self-directed approach this project took on, students experienced, albeit not formally structured, reflection in and on action (Schoen, 1987).

Student B: "…but we had a lot of trial and error because we'd end up shooting about like two or three different movies. Because the first one we sort of got the group members to act in it and that was quite funny really it just, so then what we sort of did was actually split the movie into not just the movie itself because we needed referencing on all the notes so then one person did that and then the other guy basically just introduced the movie but he did it really well."

Their participation in the focus groups at the end of the project could also be seen as part of their reflective process.

Dimension 7: Articulation
At the end of the project, on due date, a public screening was arranged for the digital movies to be shown. This screening took the form of an Oscar ceremony, awarding prizes for different categories. Team members introduced their movie and their groups, but did not have to defend their movie (e.g. answer questions on content of the movie). The idea of showing the stories to an authentic audience, i.e. their peers played a big role in their motivation to submit a high quality end product, as the following quotes show.

Student B: “I just wanted to say is something that I think you have the audience in mind throughout the production which made it a little bit different than your essay or for example an essay.”

Students appreciated sharing their stories and listening to and learning from each others’ movies, not just about the content of the movie, but also the creative process that groups went through.

Student A: I think where the movie is very successful because doing a movie a presentations got to fit standard to it … by doing a movie you entitled to do just about anything just as long as you get your point across. So because it’s so diverse and interesting you watching other peoples’ movies you’re much more engaged because you can relate to it because you did the same thing and then you learn a whole lot more.

Dimension 8: Coaching and scaffolding

This project was designed in a way that put a high level of responsibility onto the student groups. Lecturers issued a brief and suggested intermediate deadlines to help students plan their work. Students perceived lecturers as “clients” or “the audience”, but also see the importance of learning on their own for their future careers as industrial designers.

Interviewer: “What was the role of your lecturers in this process?”
Student: “Just to review the outcome really so very little input in actually how we were able to or going to approach our subject matter.”

Student A: “But it’s also - its tertiary education. You are here to learn for yourself you’re alone you’re not going to be held you know your hand’s not going to be held the whole way through each thing but you we will be going out into the working world and people are going to be setting parameters on everything that we design.”

Dimension 9: Assessment

The assessment of the digital films was carefully planned, in order for the project to be marked on the day of the presentation. Using a rubric enabled the lecturers to evaluate the presentation in categories such as the introduction of the film, logic and sequencing, the visual impact of the film and content. Marks were given for the group as a whole, but students were also asked to rate their group members’ contribution, which could potentially influence the individual student’s final mark.

The public screening of the movie led to immense pride among group members in their movie. The awarding of Oscars introduced a competitive element that also increased students’ sense of ownership and achievement during this project.

Lecturer: “…they were terribly impressed with their own achievement...there is (pride), we handed out some Oscars at the day they viewed their films, for best film and best actor and best editing, most creative presentation..we had 5 categories and they smiled very broadly when you gave them an Oscar...”

Lecturer: “Competitive element? I did not expect it, but there was a terribly competitive element…they couldn’t care less what lecturers thought of their movie, they were much more concerned what their colleagues thought....”

The time constraints and lack of ability for time management among students, resulted in some of the movies not to be of the quality level students would have liked to achieve, which again is an important lesson for them to learn for their future work:

Interviewer: “would you submit something to a client that’s not perfect?”
Lecturer: “You would, because there is a time constraint and that’s the point of ending...and you could continue and never see a client your whole life. At a certain time you have to choose, this is the best I can do with this time frame…”

Students' comments on the peer marking system revealed students' discomfort with assessing each other's work:
Interviewer: "So does it mean that the guy who didn't do anything you gave him like zero marks?"
Student B: "I think we felt a bit bad and we weren't completely. So we didn't completely cut him out but we did ja mark him down. I think we should have been more harsh actually to be honest. Ja we were a probably bit nice in a way."

Discussion

In this project Industrial Design students groups developed digital stories. While the context they developed this task in can be classified as authentic, reflecting the practices of their profession, such as collaborative work, based on a client's brief under resource constraints, the task of developing a digital story might not be considered authentic for a future Industrial Designer. However, authenticity is subjective and "many authentic environments are the creation of the teachers', authors' and instructional designers' imaginations, and are thus inevitably someone's view of what is authentic" (Herrington and Reeves 2003). Jonassen and Rohrer Murphy (1999) suggests that an authentic activity may simply be one that is personally meaningful to the learner - that is engaging and relevant in a way that assists them in their own meaning-making. These students' responses show a high sense of ownership and pride in their final product and a sense that what they are doing is relevant to their own lives as individuals, as students and future professionals, all elements of authentic pedagogy (Snape & Fox-Turnbull, 2011).

Developing digital stories requires a diverse skill set that is essential for 21st century graduates. Students acquired digital literacies, such as scripting, storyboarding, shooting and editing a movie, but also crucial intra and interpersonal skills such as negotiation, leadership, collaboration, time and resource management (Hull, 2003; Kajder, 2004). Skills were acquired as the need arose and to achieve a real purpose, in what can be defined as an authentic way (Olney et al., 2009).

The design of the project helped students explore these skills and strategically decide which skills to self-develop and which to outsource and thus to grow expert networks, another skills that is essential for their future careers. In this process they not only got to know each other's strength and weakness but also started to develop their own sense of personal and professional identity. The importance of collaboration was emphasized in this project and students learnt to engage across their own social boundaries with peers, exploring opportunities and challenges of collaboration. Although cooperation would not be defined as authentic by Herrington and Herrington (2006), we argue, that the strategic decision to either to collaborate or cooperate in a project (Johnson, Johnson, & Smith, 1998) would be a necessary skill for a future Industrial Designer.

Confirming findings of other studies (Olney et al., 2009), students had the opportunity, through the group process and the final screening of the movies, to articulate their growing understanding of the tools and technologies they were engaged with, both through in and on-action reflection (Schoen, 1987), while making decisions on how to proceed in their process of developing digital stories. Peer critique and peer marking are other important elements of the reflective process and important skills for students to acquire to be able to give and receive critique in the workplace. However, students need to be supported to provide, accept and respond to constructive feedback appropriately (Walker & Barwell, 2009).

This particular initiative proved that by trusting students' collective resourcefulness, they can be empowered to own their learning process. This project showed that a strong link to intrinsic motivation developed through the challenge, relevance, interest and involvement in the digital stories project (Riggs & Gholar, 2009). Scaffolding processes should focus on establishing safe environments, providing the external parameters for students to explore their own individual and collective growth. In a project where such weight lies on the final polished outcome, greater support should be provided with the final editing

of the movies, since it is this final product that is going to be screened, seen and marked by lecturers and students alike. More emphasis on the quality of the final product would also increase its potential to be part of a student-generated updated library of Technology resources for the department.

Conclusion

This project set out to investigate the potential of digital storytelling as an authentic learning intervention to address the issues of plagiarism in under-prepared first year Industrial Design students. Both from the perspective of the lecturer and the students this project proved that when trusting students collective abilities complex projects can succeed with minimal support from lecturers, relying on students' own resourcefulness. This project created an authentic learning environment for students on many levels and improved their skills as future industrial designers in a way that traditional essays could not have done.

This project also showed that a strong link to students' intrinsic motivation developed through the challenge, relevance, interest and involvement in the digital stories project. However, although this project set out to assess under-prepared students, these students broadly represent a more privileged group of students and one that is focused on visual and digital literacies because of their academic field, compared to the rest of the institution's student body. More research is needed to establish whether this approach promoting students' independence and self-directed learning, which is highly conducive to authentic learning, would be as successful in other contexts and disciplines.

References

1. Allen, M. 2009. Authentic Assessment and the Internet: Contributions within Knowledge Networks. In T. Bastiaens (Ed.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2009* (pp. 1505-1510). Chesapeake, VA: AACE.
2. Bennett, S., Harper, B., & Hedberg, J. 2001. Designing real life cases to support authentic design activities. In G. Kennedy, M. Keppell, C. McNaught, & T. Petrovic (Eds.), *Meeting at the Crossroads. Proceedings of the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 73-82). Melbourne: Biomedical Multimedia Unit, University of Melbourne. Available: http://www.ascilite.org.au/conferences/melbourne01/pdf/papers/bennetts.pdf
3. Dennen, V. P., & Burner, K. 2008. Cognitive apprenticeship in educational practice: research on scaffolding, modeling, mentoring and coaching as instructional strategies. In J. Spector, M. Merrill, J. Merrienboe, & M. Driscoll (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 425–440). New York: Lawrence Erlbaum.
4. Docherty, M., Sutton, P., Brereton, M., & Kaplan, S. 2001. An Innovative Design and Studio-based CS Degree. *Proceedings of the thirty-second SIGCSE technical symposium on Computer Science Education* (pp. 233 – 237). Available: http://delivery.acm.org/10.1145/370000/364591/p233docherty.pdf?ip=155.238.4.86&acc=ACTIVESERVICE&CFID=112074168&CFOKEN=62779657&__acm__=1339752696_0ad33a393cce77ead9421744bc40a7b5
5. Duggan, F. 2004. The changing nature of the studio as an educational setting. CEBE Transactions. 1 (2): 70-77. Available: http://www.heacademy.ac.uk/assets/documents/subjects/cebe/Transaction/FionaDuggan.pdf (accessed 18 June 2012)
6. Herrington, J., Mantei, J., Herrington, A., Olney, I., & Ferry, B. 2008. New technologies , new pedagogies : Mobile technologies and new ways of teaching and learning. *Ascilite2008 Melbourne* (pp. 419-427).
7. Herrington, J., & Reeves, T. C. 2003. Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology, 19*(1), 59-71. Available: http://www.ascilite.org.au/ajet/ajet19/herrington.html

8. Herrington, T., & Herrington, J. 2006. *Authentic learning environments in Higher Education*. Hershey PA: Information Science Publishing.
9. Hull, G. A. 2003. At Last: Youth Culture and Digital Media: New Literacies for New Times. *Research in the Teaching of English*, *38*(2), 229-233. Available: http://www.jstor.org/stable/pdfplus/40171638.pdf?acceptTC=true
10. Johnson, D. W., Johnson, R. T., & Smith, K. A. 1998. Cooperative Learning Returns To College: What Evidence Is There That It Works? *Change*, 27-35.
11. Jonassen, D. H., & Rohrer-Murphy, L. 1999. Activity Theory as a Framework for Designing Constructivist Learning Environments. *ETR&D*, *47*(1), 61-79.
12. Kajder, S. B. 2004. Enter Here: Personal Narrative and Digital Storytelling. *The English Journal*, *93*(3), 64-68. Available: http://www.jstor.org/stable/pdfplus/4128811.pdf?acceptTC=true
13. Lombardi, M. M., & Oblinger, D. G. 2007. *Authentic Learning for the 21st Century : An Overview*. *EducauseLearningInitiative*.
14. Lundby, K. 2008. *Digital storytelling, mediatized stories: Self-representations in new media* (p. 326). New York: P. Lang. Available: http://www.seminar.net/index.php/reviews-hovedmeny-110/72-reviews/157-digital-storytelling-mediatized-stories-self-representations-in-new-media
15. McLaren, S. V. 2007. An International Overview of Assessment Issues in Technology Education: Disentangling the influences, confusion and complexities. *Design and Technology Education: An International Journal*, *12*(2), 10 – 24. Available: http://ojs.lboro.ac.uk/ojs/index.php/DATE/article/view/Journal_12.2_0707_RES1
16. Morgan, D. 1993. Qualitative content analysis: a guide to paths not taken. *Qualitative Health Research*, *3*(1), 112-121.
17. Olney, I., Herrington, J., & Verenikina, I. 2009. Digital story telling using iPods. *New technologies, new pedagogies: Mobile learning in higher education* (pp. 36-44). University of Wollogong. Available: ro.uow.edu.au/newtech
18. Reeves, T. C., Herrington, J., & Oliver, R. 2002. Authentic learning and online learning. *HERDSA* (pp. 562-567).
19. Riggs, E. G., & Gholar, C. R. 2009. *Strategies that promote student engagement*. California: Corwin Press.
20. Schoen, D. 1987. *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass.
21. Scott, I., Yeld, N., & Hendry, J. 2007. *Higher Education Monitor A case for Improving Teaching and Learning in South African Higher Education*. *Higher Education*. Available: http://www.che.ac.za/documents/d000155/HE_Monitor_6_ITLS_Oct2007.pdf
22. Sherman, R., & Webb, R. 1988. *Qualitative research in education: Forms and methods*. Lewes, UK: Falmer.
23. Snape, P., & Fox-Turnbull, W. 2011. Perspectives of authenticity: implementation in technology education. *International Journal of Technology and Design Education*. doi:10.1007/s10798-011-9168-2
24. Teferra, D., & Altbach, P. D. 2004. African higher education: Challenges for the 21st century. *Higher Education*, *47*, 21–50. Available: http://www.springerlink.com/content/x0u36w41016m805q/full
25. Tucker, R., & Reynolds, C. 2006. The Impact of Teaching Models, Group Structures and Assessment Modes on Cooperative Learning in the Student Design Studio. *Journal for Education in the Built Environment*, *1*(2). Available: http://dro.deakin.edu.au/eserv/DU:30003698/tucker-impactofteaching-2006.pdf
26. Walker, R., & Barwell, G. 2009. Click or clique? Using educational technology to address students' anxieties about peer evaluation. *International Journal for the Scholarship of Teaching and Learning*, *3*(1). Available: http://www.georgiasouthern.edu/ijsotl

Innovative business models: the ambush of disruptive technologies on business.

E. Francke
Department of Information Technology,
Cape Peninsula University of Technology,
Cape Town, South Africa
franckee@cput.ac.za

B. Alexander
Department of Information Technology,
Cape Peninsula University of Technology,
Cape Town, South Africa
alexanderb@cput.ac.za

Abstract

The purpose of the study was to interrogate how the development of ICT particularly in Web 2.0, Social Media, Mobile Computing and Cloud Computing has impacted the way businesses function and the consequences to these businesses if they do not respond appropriately.

These pervasive technologies are described as disruptive technologies which are new technologies that unpredictably dislodge established technologies. The status quo and functioning of small businesses across various sectors will be significantly impacted by these technologies. Disruptive technologies are adopted easier by the corporate sector because of their capacity to do so and these could become technologies of competitive advantage. The Small Medium and Micro Enterprises (SMME) sector on the other hand might lack the same capacity to readily respond to technological innovation. This could cause a tension between them and the corporate sector and if they do not respond appropriately, they might experience significant losses. Design changes creative ideas into novel products, services and systems. Design connects creativity to innovation and has the ability to substantially improve brand image, sales and profitability of a business. Creativity and design have distinct roles in innovation and the broader business performance context with design appearing as a key differentiator for businesses. Design progressively plays a new role, one of competitive advantage and differentiator, establishing new markets by linking technology with commercial and user concerns. Digital Equipment Corporation (DEC) was an internationally renowned Information Technology (IT) enterprise in the 1970s, largely due to its strong and brilliant management team. When the minicomputer manufacturer started spiralling downward in the 1980s and eventually collapsing in 1988, its demise was ascribed to the incompetence of the once lauded management team. The reason for the implosion of the minicomputer industry was not just the rise of the personal computer, but what the personal computer represented: a disruptive technology to which the minicomputer companies could not respond. This qualitative research project involved a literature analysis focussing specifically on the business modelling and systems design aspects in the deployment of said disruptive technologies. The literature indicates that from a business perspective, technology can be broadly categorised into two classes, namely sustaining and disruptive technologies. Sustaining technology depends on gradual improvements to conventional technology. Disruptive technology is unsophisticated, lacks performance due to its novelty, appeals to a narrow audience, and may not yet have a tested practical application. The study has shown that businesses could possibly do all that seems to be correct by listening to their clients, investing in research and development, and by competing uncompromisingly. Despite this they could still fall prey to innovative

technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing or a business model that initially appeared to be ridiculous. The study recommends that businesses might have to consider recreating or reinventing themselves beyond just their products or services. Business Model Innovation is recommended to radically transform the business that competes not only on the value proposition of its offerings, but aligns its profit formula, resources and processes to enhance that value proposition, capture new market segments and alienate competitors.

The paper raises the notion of an innovative architectural business model for small businesses to be able to respond to the challenges of a wave of disruptive technologies that is impacting the industries within which these businesses are operating.

Keywords

Business, Business Model, Innovation, Design, Disruptive Technology, Web 2.0, Social Media, Mobile Computing, Cloud Computing.

Introduction

According to Evans (2011) technologies are becoming pervasive in the modern world and an increasing amount of people have access to the Internet, personal computers and associated technologies. Much of the innovation is happening in the knowledge space and not everybody has access to it so it requires a new strategy. What is critical now seems to be how well businesses react to what is available to them.

Johnson, et al (2008) indicates that in light of this, the new business model has to respond at various business levels namely the customer or the client; the product or the service; the internal capacity around the human resources provision and lastly around its governance. In fact part of the provision to customers and clients in terms of differentiation is in fact both externally to its customers and clients and internally to its employees. The business would need to establish a culture of responsiveness which then becomes the hallmark of the brand of the organisation which must be understood and internalised by its employees and customers. Innovation of the business model needs to be exercised both at the production and service provision as well as branding of the company so that it is intrinsically understood. This then shows what sort of business it is in terms of its ability to modernise its operation and benefits to the customer and is also inspirational to its employees.

The second aspect is that the industries in which small businesses operate will definitely respond to the disruptive technologies and the industry is in actual fact defined by the corporate sector. Normally the SMME sector lags in terms of adopting new technologies because of their under-resourcing. The SMMEs effectively work on the deficit model so they need to prioritize in the way that they respond as they are at most risk when they do not adequately respond to innovations around these disruptive technologies. The new agile and innovative business unit must evolve to develop strategies in order to respond. Christensen (1997) suggests that these strategies would be based on the awareness and engagement of the opportunities around such disruptive technologies as well as capacity to meeting these challenges.

According to Fisher (2001) business leaders need to accept that with the advancement of technology, the world is immensely more competitive and by creatively connecting technology with real business problems they can increase their ability to compete. Technology that that does not translate into improved business systems or effective products or services is futile. The business that misses the mark to be adequately creative is merely investing more time and money in obsolete ideas. Astutely managed creativity in a business is pivotal to innovation and ultimately business sustainability and competitiveness.

Plummer (2011) presents Gartner's recent survey of their top predictions of strategic technologies for 2012 and beyond. It illustrates the IT trends and events that will alter the nature of business today and over the next few years. Gartner defines a strategic technology as one that is likely to profoundly impact business over the next three years. It is characterized by a high probability for disruption to IT or the business, the necessity for significant financial investment, or the threat of being adopted late. Business leaders should be aware of the opportunity for innovation through emerging disruptive technologies and solutions.

Driven by the propagation of Web 2.0, Social Media, Cloud Computing and Mobile Computing over the last few years, businesses have large volumes of information at their disposal but these volumes present a challenge in the manner in which businesses comprehend and handle the information. "The IT organization of the future must coordinate those who have the money, those who deliver the services, those who secure the data, and those consumers who demand to set their own pace for use of IT." (Plummer, 2011)

Evans (2011) suggests that the Internet is one of the most significant and influential creations in all of human history. The Internet has already had a significant impact on communication, business, education, science, government, and humanity in general. As an extension of this, the Internet of Things (IoT), will change everything and everyone. The IoT represents the next evolution of the Internet, now extending beyond the ability to gather, analyse, and distribute data that we can turn into information, knowledge, and finally, wisdom.

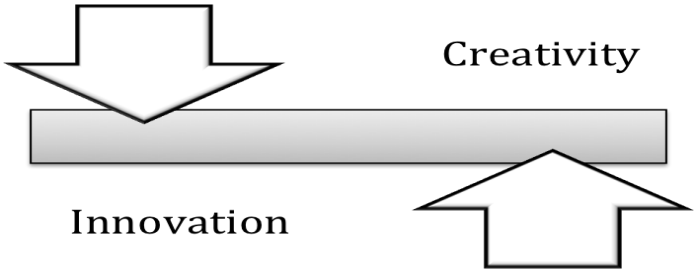
The business challenge is to determine how all of these Information Communication Technology (ICT) developments will impact business models and the importance for them to respond appropriately through innovation.

Literature Review

2.1 The value of design to business

There are numerous definitions of design with much of these focusing in on creative or industrial undertakings. Business leaders would have to consider how good design, not only in products and services but also in their business models, could improve their business for competitive advantage and sustainability.

Cox (2005) states that creativity is the generation of new ideas either by viewing existing problems differently or exploiting new opportunities through emerging technologies or fluctuations in markets. Innovation on the other hand is the successful exploitation of the new ideas. It is the entire transformation of the ideas into new products, new services, new ways of managing the business as well as conducting



business entirely. Design is what links creativity and innovation and it may be described as creativity deployed to a specific end. It shapes ideas to become practical and attractive propositions for users or customers.

Figure 1: Design linking Creativity and Innovation.

The views of Cox (2005) is corroborated by Hollenbeck and Van Cruysen (2009:41) who suggest that design changes creative ideas into novel products, services and systems. Design connects creativity to innovation and has the ability to substantially improve brand image, sales and profitability of a business. Creativity and design have distinct roles in innovation and the broader business performance context with design appearing as a key differentiator for businesses. Design progressively plays a new role, one of competitive advantage and differentiator, establishing new markets by linking technology with commercial and user concerns.

2.2 The proliferation of disruptive technologies

There has been significant acceleration in the development of disruptive technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing. Christensen (1997) describes disruptive technology as a new technology that unpredictably dislodges established technology. The author distinguishes between sustaining and disruptive technologies. Sustaining technologies depend on gradual improvements to entrenched technology. Disruptive technologies are unsophisticated, lack performance due to their novelty, appeal to a narrow audience, and may not yet have a tested practical application. An example of this would be Alexander Graham Bell's invention of the "electrical speech machine" in 1874, while he was toying with an earlier idea, the "harmonic telegraph" that could send more than one telegraphed messages at once. These are the pioneering technologies to not only the telephone but also modern smartphones and tablet computers.

On the other hand Fisher (2001) defines sustaining technologies as innovation that empowers industry leaders to improve things for their existing customers. Disruptive technologies are viewed as products or services that the best customers cannot use with lower profit margins than the business can support. Businesses disregard disruptive technologies for what appears to be good reason but ultimately at their peril. Businesses tend to focus too much on their most demanding customers which create an opportunity for disruptive technologies to impact their business.

Even though Christensen (1997) predates many modern disruptive technologies, the author's argument is still true today. "Large corporations are designed to work with sustaining technologies. They excel at knowing their market, staying close to their customers, and having a mechanism in place to develop existing technology. Conversely, they have trouble capitalizing on the potential efficiencies, cost-savings, or new marketing opportunities created by low-margin disruptive technologies."

Facebook (2012) reports that at the end of December 2011, Facebook recorded 845 million monthly active users with 80% of its users beyond the borders of the US and Canada. Of these there was an average of 483 million daily active users. Facebook mobile users exceeded 425 million in December 2011 and Facebook is available in more than 70 languages.

At the same YouTube (2012) states that it has over 800 million unique users each month. More than 4 billion YouTube videos are viewed daily and sixty minutes of video is uploaded to YouTube every second. More than 3 billion hours of YouTube video are watched each month with more than 1 trillion views, equating to approximately 140 views for every person on Earth. YouTube is hosted in 39 countries and available in 54 languages.

The ITU (2011) states that there are 5.9 billion or 87% of the world's population that are mobile subscribers. Of this China and India have nearly 1.8 billion subscriptions. The Global mobile statistics 2012 report states that mobile devices sales rose in 2011, with smartphones showing the resilient growth but feature phones are still selling intensely. Nokia remains the number one handset manufacturer, but Samsung is now the leading smartphone hardware vendor with the top smartphone operating system being Android. There are 1.2 billion mobile Web users worldwide, with the highest usage in Asia, particularly in South Korea and Japan who lead in mobile broadband penetration with 91 and 88 percent respectively. Mobile devices account for 8.49 percent of global Website hits. In the US, 25 percent of mobile Web users are mobile-only, i.e. they do not, or very rarely use a desktop, laptop or tablet to access the Web. Japanese mobile users are still more progressive in mobile behavior, using mobile Web, apps and email more, but US and European users prefer to text (up to 8 trillion text messages worldwide in 2011) and play more games on their mobiles. Most popular mobile destinations are news and information, weather reports, social networking, search and maps.

Gartner (2008) defines a disruptive technology as, "One that causes major change in 'the accepted way of doing things', including business models, processes, revenue streams, industry dynamics and consumer behaviour."

One such technology that is radically changing the way data is stored today is illustrated by Tran et al. (2011) who indicate that the shift from traditional storage devices to the migration to the cloud is likened to the disruption in the IT sector when organizations shifted from mainframe computers to minicomputers as well as from standalone desktop computers to networked systems.

Schadler (2012) states that businesses can improve efficiencies to their customers, partners, and employees with systems of engagement brought about by mobile, social, big data, and cloud technologies. Systems of engagement refer to the capability to empower all the business stakeholders with context-rich applications and smart products to assist them to make decisions and to take immediate actions at the appropriate time and place. What makes this technology different is that it does not focus on process but rather people. An example of how systems engagement will improve on existing systems in a hotel is by improving the checking-in process. By means of Global Positioning System (GPS) or location context technology, an application on a smartphone will detect that a new guest has entered a hotel and would likely want to check in. The hotel reservation system will then default to the concierge and room service tabs and in so doing providing immediate access to the relevant hospitality services. A returning guest can via the same technology be recognised by the system, immediately transmitting the relevant information which then reduces checking-in time considerably. In this way the checking-in process is expedited and personalised for the customer and in so doing systems of engagement lends itself to improved customer experience and satisfaction.

"These new systems harness a perfect storm of mobile, social, cloud, and big data innovation to deliver applications and smart products directly in the context of the daily lives and real-time workflows of customers, partners and employees. The compelling notion of context is the sum total of what your customer has told you and is experiencing at the moment of engagement is made possible with cloud delivery and predictive analytics applied to a blend of data from device sensors, social feeds, personal preferences, and systems of record" (Schadler, 2012).

Gartner (2008) is of the opinion that social networking technologies, web mashups and cloud computing are amongst the ten most disruptive technologies that will form the IT landscape over the next five years. Business systems will start to emulate the features used in social media applications like Facebook, as organizations seek ways of improving employee collaboration and harnessing the community feedback of customers. The true value of this for the business lies in its ability to reconcile this feedback into an integrated system that mirrors collective attitudes, which will then assist to shape a business strategy. Web mashups, that combine content from publicly available sources on the Internet, will be the foremost model for the design of new business applications. What is required is the establishment of an official mechanism for evaluating emerging trends and technologies, with the help of competent staff, and affording them time to research new ideas and innovations, especially those that are being driven by consumer and Web 2.0 technologies.

Tynan (2008) reports that IT is extremely dynamic and its development certainly has a means of grasping established ideas and engrained industries and turning them on their head. Information technologies will often pair up to become disruptive technologies. A few significant partnering disruptive technologies are listed in table 1.

Disruptive Technology One	Disruptive Technology Two	Impact on Industry
Digital Video Recorders	Entertainment on Demand	The ubiquitous model of media consumption is turning the entertainment industry and the consumer electronics industry on their heads, and forcing advertisers to rethink ways to capture our attention.
YouTube	Cheap Digital Cameras and Camcorders	Digital video has encouraged mass movie production. Social media applications afford the masses an opportunity to stage their amateur movies which is having a significant impact on sectors like journalism, politics, and entertainment.
MP3	Napster	The concept that music should be portable and free is disruptive.
Cloud Computing	Always-On Devices	Cloud computing provides business with benefits of a data center without the expense and trouble of maintaining one. It offers the average user lower cost of storage with fewer devices and ubiquitous access to data and applications. Hardware and communication networking industries are significantly impacted by this.

Table 1: Disruptive technologies' impact on industries (Tynan, 2008)

Mulholland (2011) identifies technological devices that have been impacted by disruptive technologies. What was once indispensable devices are now being replaced by smarter and ostentatious ones. A few of these are listed in table 2.

Old Technology	Disruptive Technology	Possible reasons
Camcorders and compact cameras	Smartphones and tablet computers	Smartphones are equipped with up to 12-megapixel cameras that compare well with many cameras. While all the sophistication might not presently exist, the evolution of these phones will lead to improved photos and videos.

iPods and other portable music players	Smartphones and tablet computers	Apple has fallen prey to its own success as sales of its iPhone and iPad are reducing sales of its iPod music players. Sales of IPod peaked in the U.S. in 2008, one year after the iPhone appeared, and have been plummeting ever since.
GPS devices	Smartphones and tablet computers	External GPS navigation devices are being threatened by smartphones largely due to the Android operating system that extends Google Maps to phones and tablets.
Answering machines	Smartphones and tablet computers	In the world of instant communication, answering machines and voicemail services are regarded as being too slow. Facebook, Twitter, instant messaging and email are the preferred options.
eBook Readers	Tablet computers	Recently books were being threatened by e-readers, now they have in turn become threatened by tablets.
External storage devices	Cloud computing	The ability to store data in the cloud is threatening the continued existence of zip drives, flash drives and perhaps the computer hard drives.
Watches, alarm clocks and wall calendars	Smartphones and tablet computers	These devices are able to reliably and conveniently provide users with the time and date which threatens the sale of calendars, alarm clocks and watches in general.

Table 2: Old technologies being replaced by disruptive technologies (Mulholland, 2011)

It appears that the major business benefit of disruptive technologies is business innovation, distinguished products and services, and profitable growth. The business leader should be the channel from the business to the technology but also understanding that these technologies should be used to solve a problem that has been identified in the business.

2.2 The importance of Business Model Innovation (BMI)

Tucci (2011) states that Digital Equipment Corp. (DEC) was an internationally renowned IT enterprise in the 1970s, largely due to its strong and brilliant management team. When the minicomputer manufacturer started spiralling downward in the 1980s and eventually collapsing in 1988, its demise was ascribed to the incompetence of the once lauded management team. "The reason for the implosion of the minicomputer industry was not just the rise of the personal computer, but what the personal computer represented: a disruptive technology to which the minicomputer companies could not respond" (Christensen, 1997). This author continues to say that DEC required Business Model Innovation (BMI) in order to respond to the disruptive technologies of the time. BMI refers to the creation, or reinvention, of a business itself. While innovation ordinarily manifests in a new product or service, BMI results in a completely different type of business that competes not only on the value proposition of its offerings, but aligns its profit formula, resources and processes to enhance that value proposition, capture new market segments and alienate competitors.

According to Meyer (2009) businesses should not only focus on customers when they look at innovation. It is important to understand the "job" that the product is hired to do by those customers. As an illustration of this the author makes use of research into milkshake sales of a retail store. The store discovered that many of their clients who bought their milkshakes were adults who bought the shakes in the morning. They would typically buy one milkshake as take-away and no other products at all. Further research indicated that these clients were commuters, and the "job" of the milkshake was to provide distraction on a long travel and to sustain them until lunch. The competitor products to this "job" were bananas, donuts, breakfast bars and coffee. These clients preferred milkshakes because milkshakes take a

long time to eat, don't splash or leave crumbs, and can be held in one hand or be put into a cupholder during the drive. Afternoon and evening sales of milkshakes revealed a very different client with the majority being parents with kids. The "job" here was that of parents wanting to treat their kids. The two "jobs" of the milkshakes required different innovations with morning sales requiring thicker and more wholesome milkshakes for the mornings and thinner and more tastier milkshakes for the afternoon.

The BMI for this store considers that innovations that would improve sales in the morning would not necessarily meet the needs of the afternoon and evening. The BMI would be to have two different shake formulations for mornings and the rest of the day. "The point is to understand why someone buys the product, not who buys the product. The demographics of milkshake buyers are less important than the fact that one segment buys the product as a distraction and protracted meal while the other buys it as a sweet attraction and quick desert" (Meyer, 2009).

Christensen, et al (2008) define the role of BMI by stating that initially, a simplifying technology is needed to trigger the disruption, a new business model is then needed to extend the reach of the technology and a comprehensive value network must ultimately evolve to support it.

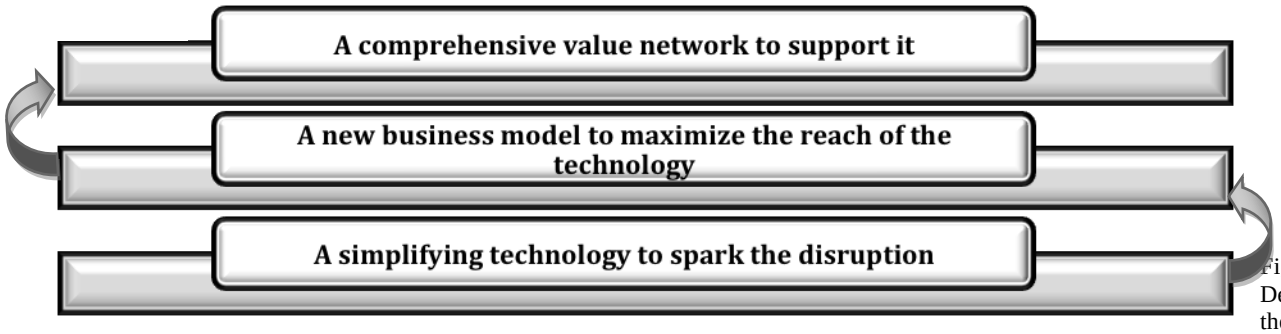


Figure 2: Defining the role of Business Model Innovation (Christensen, et al, 2008)

Johnson, et al (2008) established the 4-box model for BMI suggesting that a business model comprises four interlocking elements that, taken together, create and deliver value. Innovation can occur in one or more of these areas simultaneously.

1. Customer Value Proposition - find a way to create value for customers
2. Profit Formula - how the company creates value
3. Key Resources - required to deliver the value proposition
4. Key Processes – how to deliver the value to customers

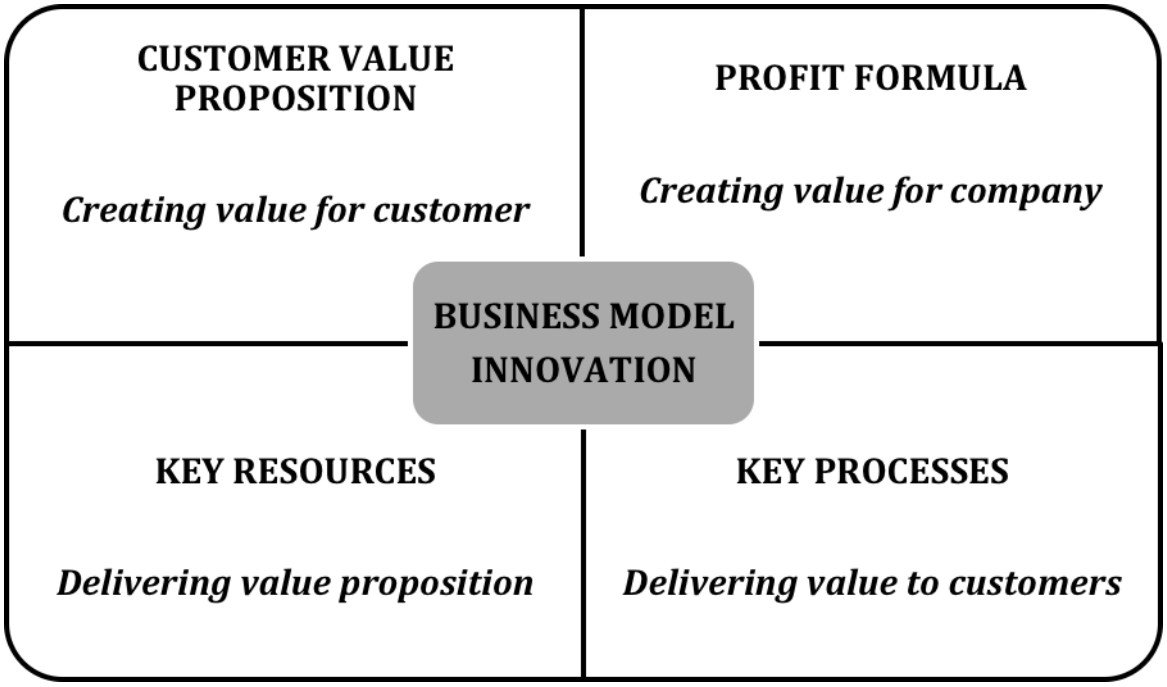


Figure 3: The 4-box model for BMI (Johnson, et al, 2008)

Research methodology

In this research project, a literature analysis has been done to determine how disruptive technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing impact the way businesses function and the consequences to these businesses if they do not respond appropriately.

Emerald, EBSCOhost and Google Scholar were the preferred means of searching for accredited journal articles, conference papers, white papers, associated business journals and other academic sources in order to produce a comprehensive overview of Design, Web 2.0, Social Media, Cloud Computing, Mobile Computing, Disruptive Technologies and BMI.

Due to the plethora of available literature, it was not realistic to make a comprehensive study of all previous knowledge of the relevant research themes. Instead, the focus was on searching and selecting high-impact references, with distinguishing accent on research providing concrete empirical evidence particularly when it applied to usage and adoption statistics. Information technology professionals' insights posted on reputable websites and blogs as well as in business magazines were also deliberated. The purpose of linking the professional with the academic viewpoints was to reap more considerations from diverse sources as well as current statistics, to augment the research project.

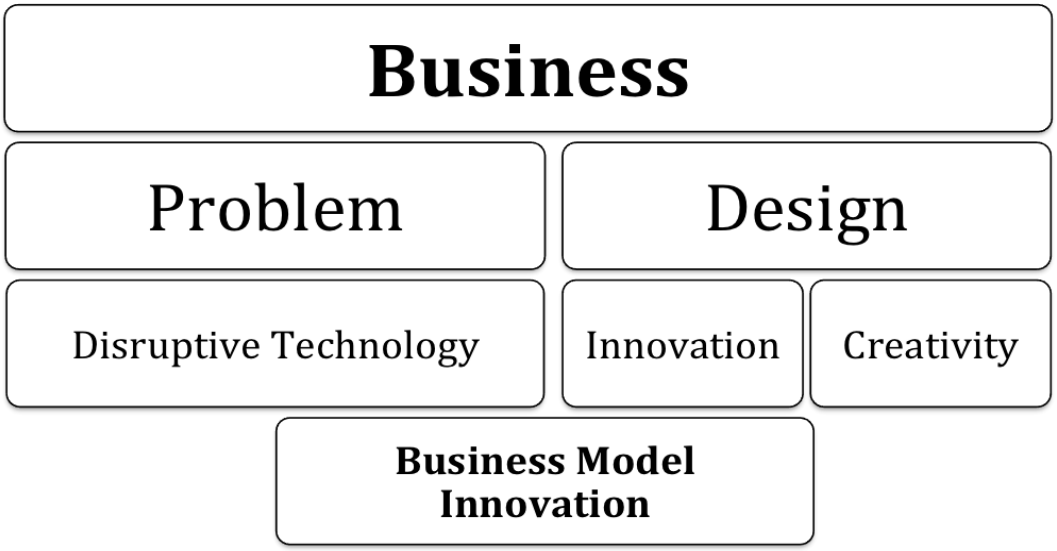


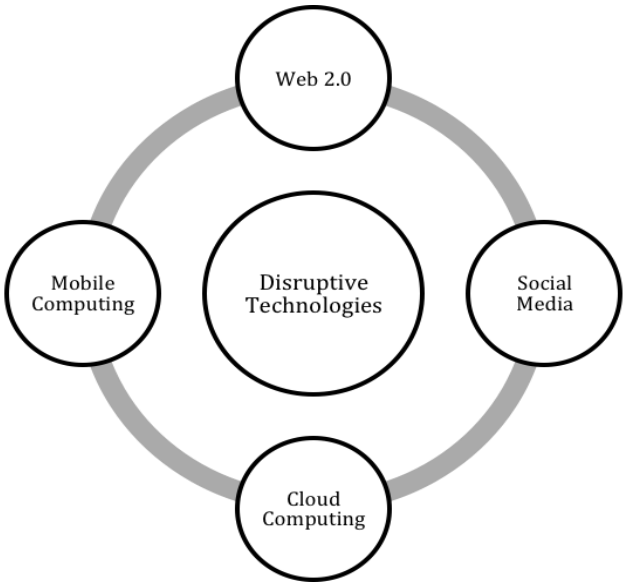
Figure 4: An overview of the literature study

Discussion

The literature indicates that a distinguished US based minicomputer manufacturer called Digital Equipment Corporation (DEC) collapsed in 1988 due to the eminence of the personal computer. Critics blamed the ineptitude of the once acclaimed management team to respond appropriately. The reason for DEC's demise was however not just the popularity of the personal computer, but that it epitomized a disruptive technology to which DEC could not retort.

It appears that good design in business models and not exclusively in products and services could develop a business to be more competitive and sustainable. By linking creativity and innovation, design transforms creative ideas into innovative products, services and business systems.

There has been substantial development of disruptive technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing over the last few years. These technologies have already and are highly likely going to continue to impact business with considerable consequences. Many industries as well as established technologies have already been reengineered and some have been made obsolete.



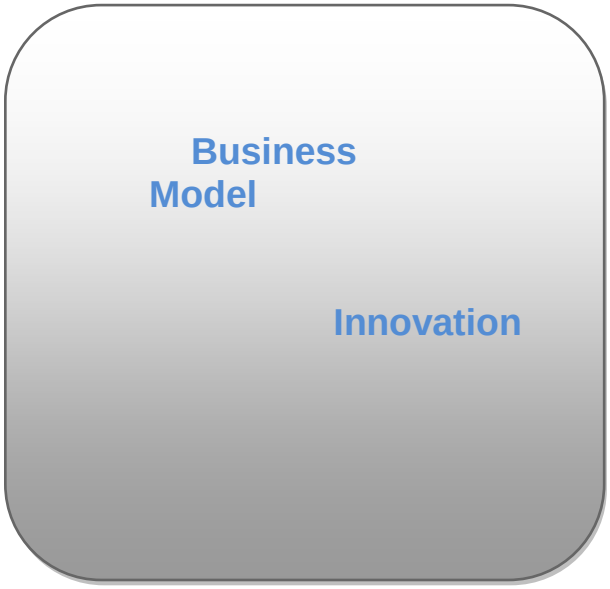


Figure 5: The relationship between the disruptive technologies and BMI

Disruption to industries is seldom the result of a single device or innovation but rather when two or more technologies unite – by this researcher's own proposition. What was once essential technological devices have been crushed by disruptive technologies and are now being replaced by smarter and flashy ones.

It seems that the foremost business value of disruptive technologies is business innovation, distinguished products and services, and profitable growth. BMI is required to assist businesses to respond to disruptive technologies. While innovation ordinarily manifests in a new product or service BMI refers to the creation, or reinvention, of a business itself.

The old concept of the company where everyone lives in the boundaries of the company is outdated. We have seen in the last many years how the notion of a "bounded" company has changed to that of a "networked" company where outsourcing is typically used to deal with different aspects of the business. The networked company is more agile and flexible and is not limited in responding to disruptive technologies as bounded and more hierarchical companies would be. The branding of the networked company is most important to it being identified in the marketplace. The brand value needs however to be built on product quality and service delivery. There are of course governance issues to be considered that may impact the extent of the company network.

It is imperative that the SMME sector needs to strategise around the adoption of disruptive technologies. The corporate sector will adopt much of these technologies and convert these into competitive advantage and SMMEs have to respond to the gap that will result. The SMME sector needs to be aware and responsive at the business levels of the customer, employee configuration, production or service towards profit and governance considerations. This then redefines the notion of an agile company where both the branding as well as competitiveness of the business is established within the same conceptual framework. There are four categories that inform the architectural model of this new agile company, namely - the customer, the employee, the production/service and governance. The tenets of this innovative architectural business model will be explored in future research.

It is conceivable that a new theory will emerge to explain the state and dynamics of business operations modelling for environments impacted by disruptive technologies. The theoretical proposition will be based on the Johnson 4-box model Business Model Innovation which proposes a process model which launches the conceptions around the architectural model. This model will drive business efficacy which in turn is driven by the interests of the business stakeholders. This will inform the strategic alignment and operational imperatives of SMMEs to remain sustainable and competitive in the world of pervasive disruptive technologies.

The research project has also revealed that businesses would have to be mindful as to how good design of their business models can enhance their competitiveness and long term sustainability. Design can be used to gain competitive advantage by assisting the business to establish new markets, products and services.

Advances in disruptive technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing have already and will continue to impact various industries over the next few years. They have radically redesigned many sectors of the market and have led to the downfall of several businesses and once popular technologies. Businesses need BMI as a means of countering disruptive technologies by recreating themselves. A failure to respond to these disruptive technologies can lead to significant losses or perhaps the demise of the entire business.

Conclusion

This study has shown that there has indeed been much development in disruptive technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing over the last few years. It is not unusual for businesses to dismiss the value of disruptive technologies because they do not support current business goals, only to be ridiculed as these technologies mature, gain in popularity and market share and disturbs the status quo. A strategic focus on the developments of these disruptive technologies, the prospective benefits and their successful implementation is crucial to the long-term success of the business.

As an extension to this research project, an empirical study will be conducted to determine the influence of current disruptive technologies like Web 2.0, Social Media, Mobile Computing and Cloud Computing on businesses within South Africa. Furthermore, research could be done to develop frameworks that could assist businesses in deciding with more self-assurance whether it is appropriate for them and if so, how to approach the disruption.

This research project has explored the field of BMI and should assist businesses who are either re-evaluating their present business status and how to ensure sustainability by adapting their business model or possibly for businesses growing in new markets. It has proven that these businesses engaging in innovations need to consider significant changes in customer value proposition, the profit formula, key resources and key processes.

This paper raises a clear caution that investment in technology without investing in new business models could be catastrophic.

References

1. Christensen, C. 1997. The innovator's dilemma: when new technologies cause great firms to fail. *Harvard Business School Press*, ISBN 978-0-87584-585-2. Boston, Massachusetts, USA.

2. Christensen, C; Grossman, J & Hwang, J. 2008. The Innovator's Prescription: A Disruptive Solution for Health Care. McGraw Hill. ISBN 0071592083.

3. Cox, G. 2005. Cox Review of Creativity in Business: building on the UK's strengths. Available www.hm-treasury.gov.uk/cox (accessed 11 April 2012).

4. Evans, D. 2011. The Internet of Things - How the Next Evolution of the Internet Is Changing Everything. Cisco Internet Business Solutions Group (IBSG). California, US.
5. Facebook fact Sheet. 2012. Available http://newsroom.fb.com/content/default.aspx?NewsAreaId=22 (accessed 06 April 2012).

6. Fisher, L. 2001. The thought leader interview. Strategy and Business. Fourth Quarter, Issue 25. California, US.

7. Gartner Identifies Top Ten Disruptive Technologies for 2008 to 2012. [2008.]. Available http://www.gartner.com/it/page.jsp?id=681107#_ftn1 (accessed 12 April 2012).

8. Global mobile statistics 2012. 2012. Available http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats#phone-shipments (accessed 12 April 2012).

9. Hollanders, H and van Cruysen, A. 2009. Design, Creativity and Innovation: a scoreboard approach. PRO INNO /INNO Metrics: Design, Creativity and Innovation. Maastricht, Netherlands.

10. International Telecommunication Union. 2011. Key Global Telecom Indicators for the World Telecommunication Service Sector. Available http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html (accessed 12 April 2012).

11. Johnson, M; Christensen, C & Kagermann, H. 2008. Reinventing Your Business Model. Harvard Business Review. Volume: 86, December Issue, Industrial Research Institute, Inc., Pages: 57.

12. Meyer, A. 2009. Job-focused innovation. Available http://workingknowledge.com/blog/?p=478 (accessed 11 April 2012).

13. Schadler, T. 2012. A Billion Smartphones Require New Systems Of Engagement. Available http://blogs.forrester.com/ted_schadler/12-02-14-a_billion_smartphones_require_new_systems_of_engagement (accessed 11 April 2012).

14. Tran, V; Keung, J; Liu, A & Fekete, A. 2011. Application Migration to Cloud: A Taxonomy of Critical Factors. *ACM Workshop SECLOUD '11*. Waikiki, Honolulu, HI, USA.

15. Tucci,L. 2011. Available http://searchcio.techtarget.com/news/2240033844/The-CIOs-dilemma-Disruptive-innovation-vs-performance-improvement (accessed 11 April 2012)

16. Tynan, D. 2008. The 10 Most Disruptive Technology Combinations. Available http://www.pcworld.com/printable/article/id,143474/printable.html (accessed 12 April 2012)

17. YouTube Statistics. 2012. Available http://www.youtube.com/t/press_statistics (accessed 06 April 2012).

Towards Contextual Alignment of an Undergraduate ICT Curriculum for Universities of Technology in South Africa

Denise Lakay
Department of Information Technology
Cape Peninsula University of Technology
Cape Town, South Africa
lakayd@cput.co.za

Bennett Alexander
Department of Information Technology
Cape Peninsula University of Technology
Cape Town, South Africa
alexanderb@cput.co.za

Keywords
Curriculum alignment, curriculum development

Introduction:

This study will explore curriculum alignment "as a major design element" (Squire, 2009) towards delivering a new and relevant undergraduate ICT curriculum for Universities of Technology (UoTs) in South Africa. The potential role of the UoT as a technology leader and human resource provider within the broader South African socio-political-economic landscape will be interrogated. The landscape for Higher Education is qualified mainly with respect to the newly proclaimed National Development Plan (2011), the Green Paper for Post-School Education and Training (2012) and Roy du Pre's (2009) seminal work on the role of UoTs within the South African landscape.

This paper interrogates the notion of the efficacy of UoTs to bring about the necessary advancement in the status of the ICT industry and economy. This is underscored by the National Development Plan and the Role of the UoTs as being technology leaders and ultimately drivers of the South African ICT economy. The literature is abounding with criticism of the curricula of universities in being isolated from the real needs of industry (1, 3, 5). Traditional curriculum development approaches go through a normally prescribed process where industries and universities engage in discourse to the effect of establishing a curriculum. It is often said jokingly that the needs of the ICT industry is probably one of the most elusive commodities, in that often industries, as a non homogenous entity could not possibly know what the needs are. Often the needs of a competitiveness environment that exist within the industry are often conflicting in needs and interest with academics. Therefore, the actual needs of industry could not possibly be the only strategy for directing a curriculum. University academics have often been tasked to close this gap from an academic aspiration and predictive stance and to determine what the needs are on a long term basis in terms of aggregating the needs that they would synthesis from the interactions with industry. This however remains a massive problem. Industry and academic staff have different views on curriculum development and this is highlighted at our Industry Advisory meetings.

This paper proposes to develop an expert system that exceeds the capacity of the individual academics to understand how a curriculum should be shaped to meeting the needs to all the stakeholders. The stakeholders that are involved in setting up a curriculum are the subject specialist, ICT industry representatives, ICT academic community and curriculum officers. We would refer to this curriculum as the traditional curriculum.

This paper is directed at the student, that is subjected to significant influence by their peer groups and the physical environment within which the curriculum is delivered, bearing in mind that these students will participate in an academic project given by the learning facilitator.

This research will present the unfolding curriculum development case of a suite of new ICT qualifications commissioned by HEICTA (the Higher Education ICT Association) to be piloted and implemented by the Cape Peninsula University of Technology (CPUT). The curriculum model features a broadening of the education mandate of the UoT to extend the traditional model of technology skills transfer to include a wider and open-ended approach to professional development of students. The new curriculum model is intended to promote the acquisition of skills and the skilfulness of students to meet the challenges of the workplace. The curriculum is also intended to improve the competitiveness of the local ICT industry within a global context.

Classical approaches to curriculum alignment inform approaches to instruction and the benchmarking of assessments to predefined standards (Tweed, 2007). This study introduces a novel framework for curriculum alignment that emphasises personal and environmental variability and dynamism as the foundations of curriculum alignment as opposed to the traditional approach that treats the class as a homogenous entity. The proposed framework is an extension of Benjamin's Eight-Facet Structural Analysis of Social Behaviour (SASB) Model (Lorr and Strack, 1999). The framework argues for a differentiated outcomes modelling of the learning experience informed by specific individual and environmental conditions and aspirations.

Method:

The research methodology is governed by the Critical Realism philosophy (Danermark et al, 2003; Fox, 2009) of science where ontology is informed by the (typically) structured environment for education at UoTs; and epistemology is informed by the experiences of the broad stakeholder community. The Delphi method (Okoli & Pawlowski, 2004) will be deployed to recruit expert opinion and a novel framework for curriculum alignment is tested using a Focus Group method. The emerging extended Benjamin Model will explore synergies with the Burrell and Morgan (1979) four-quadrant model to explain motivation for engagement of the curriculum.

We believe that Burrell and Morgan essentially establish four paradigms for engaging systems research. These four quadrants are defined by notions of evolving of the system against radically changing the system. It also speaks to the notion of an individualized access vs. a consolidated group access. This then results in parademic orientation would be referred to as functionalist, Interpretive, radical humanist and radical structuralist paradigms 4 as in Burrell and Morgan.

The action research method will be adopted to develop a macro curriculum alignment model. This model will represent the incorporation of the traditional method of curriculum development which will form the foundation for the extended model. The method that will be followed would draw from expert opinion in terms of the shaping of the research approach but the intention is that a conceptual model for progressive curriculum alignment will be proposed and then tested.

This model will not only recognize the curriculum and sub curriculum objects but it would recognize the variability in student preferences and student profiles, learning facilitator variability and profiles, the

nature of the peer group environment and the nature of the physical environment. The research will explore at a propositional level the extension of the Benjamin's structural analysis of social behaviour model (SASB) for applicability to an education environment. It is hoped that the definition of the so called extended SASB in education model would provide sufficient ground for an expert system to be evolved that would allow progressive and comprehensive assessment of the curriculum context to be explored and that reporting could be made to relevant stakeholders in trying to direct there realignment or reconsideration to placing the curriculum to better effect. The central notion is that if the curriculum is placed within a optimized context that it will deliver better qualified graduates from under graduate programmes and that such graduates would be more holistically developed with regards to technology skills but also in broader knowledge, skills and skilfulness. This progressive curriculum model hopes to advance the improvement of the competitiveness of the local ICT industry as is required by the national development plan and the green paper for post school education and training to improve the efficacy of departments of ICT in advancing the aspirations of the ICT industry.

Discussion

Figure 1 below illustrates the core concepts of the SASB model. The model interrogates how an individual within a generalized environment draws inspiration for adapting the self to the environment. The model illustrates that every individual (self) will manifest certain characteristics to the outside environment or their external environment. Naturally others in the environment are doing precisely the same so that the self and others are in continuous engagement through projecting certain specific characteristics. The Benjamin model presents the view that the others and the objects are able to impact on the individual that is operating within the same environment.

The process of others and objects in the environment, impacting on the individual in the environment or the self, is referred to the process of introject. Introject is the process of an individual taking on board characteristics that they draw from the environment i.e. others and objects in the environment.

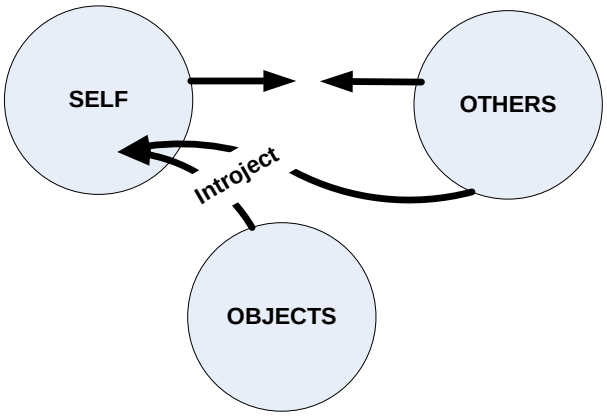


Figure 23: Modified / Revised SABS model (Benjamin, 1996)

Figure 2 below illustrates the core aspects of the extended model which will be referred to as the extended SASB in education model (ESASBie). This model places the student at the centre of the curriculum debate, showing specific dimensions of the students' character, personality and capacity to the environment. The environment of education is a more complex entity and needs to be represented by interactions with the learning facilitators (LF), the students peer group (Pr), the traditional curriculum itself (Cu) and the physical environment within which the curriculum is presented to the student (En). It is important to note that the curriculum referred to is the traditional curriculum and it should be noted that the traditional curriculum is considered to have evolved by merging academic requirements with industry needs. The traditional curriculum is intended to deliver learning content which consists of skills components, knowledge components and a new component that we refer to as skilfulness or what would

be more typically referred to as holistic education. As per the ESASBie model the introject component is now the component that reflects on the development of the student.

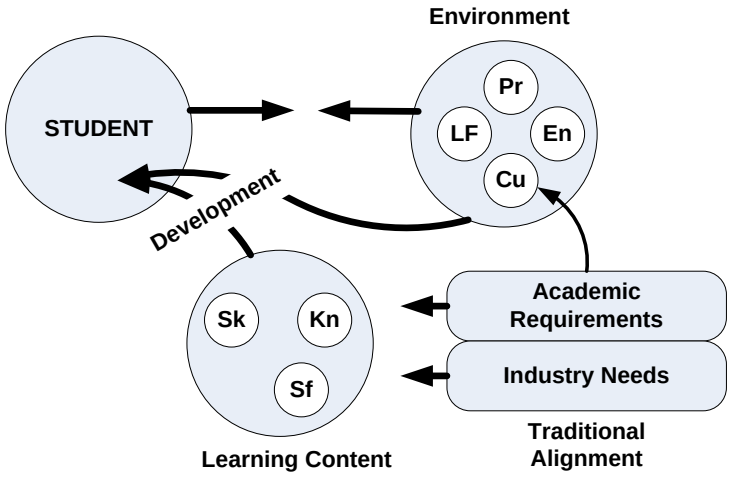


Figure 24: Extended SASB in education Model (ESASBie)

The proposed progressive alignment of the curriculum is illustrated in figure 3 below. The curriculum is considered to be the majority component in this mechanism (as illustrated by the large circle in figure 3). It is also shown that that there is a range of curriculum objects that define the curriculum as a whole. It should be noted that curriculum objects and the curriculum as a whole is a variable entity within the education environment. The characteristics of students and their aspirations and their capacities are variable and are shown in the diagram to manifest such variability. A similar situation pertains to learning facilitators and the peer group. The physical environment is represented as one of the elements that are subject to progressive alignment within the progressive curriculum alignment model.

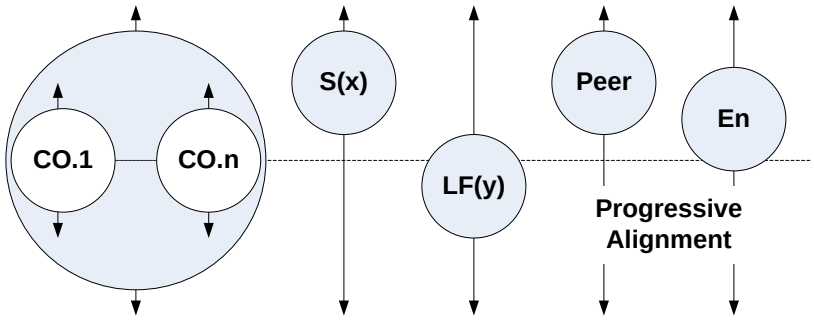


Figure 25: Progressive Curriculum Alignment Model

Table 1 below illustrates the dimensions extended SASB in the education model. The Benjamin structural analysis model is replicated in the table and is essentially defined by the SASB dimensions which recognize that within a social environment, individuals are either differentiated or enmeshed in the environment. The environment would be friendly or hostile to the aspirations of the individual. The ultimate goal of the education project is the promotion of the acquisition of knowledge, skills and skilfulness. The extended SASB in education model will now be discussed in some detail.

Each of the elements representing the eight dimensions as proposed by Benjamin is interrogated relative to the components we need to support within the extended SASB in education model.

The central components of the model are:

1. Focus on the student;
2. Focus on the traditional curriculum;
3. Focus on learning facilitation;
4. Focus on the peer group and

5. Focus on the physical environment.

We will discuss one element by way of illustration and we will choose to present the focus on the traditional curriculum. The dimensions of differentiated alignment in this category are noted as being open-ended. In this case the open-endedness of the curriculum reflects the separateness of the components of the curriculum to the aspirations of the student. We show that the friendly dimension would be co-defined as the curriculum being accessible. When the traditional curriculum is differentiated and friendly, we would consider such a curriculum to be flexible. When a curriculum is regarded as enmeshed, it is considered to be structured. When the curriculum is friendly and enmeshed, we propose that such a curriculum is engaging. When a curriculum is hostile, it is taken that such a curriculum is irrelevant to the course of learning as proposed by the academic project, but when a curriculum is enmeshed and hostile it can be considered to be challenging. When a curriculum is differentiated and hostile it is regarded as being inaccessible. A similar strategy was adopted and applied to focus on the student, the learning facilitator, the peer group and on the learning environment.

Table 1: ESABSie Dimensions

	Benjamin's Structural Analysis of Social Behaviour (SASB) Model			**Extended SASB in Education Model (ESASBiE)**					
***SASB Dimensions**	**Focus on Self:**	**Focus on Others:**	**Introject:**	**Focus on Student:**	**Focus on Traditional Curriculum:**	**Focus on Learning Facilitation**	**Focus on Peer Group:**	**Focus on Physical Environment:**	****Curriculum Alignment?**
D	Separate	Emancipate	Self-emancipate	Individual	Open-ended	Emancipate	Liberate	Unstructured	No
DF	**Disclose**	**Affirm**	**Self-affirm**	**Contributor**	**Flexible**	**Affirm**	**Recognise**	**Functional**	**Yes**
F	**Love**	**Love**	**Self-love**	**Participant**	**Accessible**	**Enable**	**Embrace**	**Conducive**	**Yes**
EF	**Trust**	**Protect**	**Self-protect**	**Enabler**	**Engaging**	**Mentor**	**Guide**	**Purposeful**	**Yes**
E	Submit	Control	Self-control	Member	Structured	Control	Define	Organised	No
EH	Sulk	Blame	Self-blame	Monitor	Challenging	Pressure	Constrain	Problematic	No
H	Recoil	Attack	Self-attack	Critic	Irrelevant	Disregard	Exclude	Dysfunctional	No
DH	Wall Off	Ignore	Self-neglect	Aggressor	Inaccessible	Dismiss	Ignore	Obstructive	No

***SASB Dimensions: D: Differentiated; E: Enmeshment; F: Friendly; H: Hostile**
****Promoting the acquisition of Knowledge, Skills and Skilfulness**

The next phase would be to develop an expert system to link all the multitude of aspects that would inform progressive alignment of an expert system as illustrated in figure 4 below. The essential elements of such an expert system are that it must provide strategic management on a rules base reasoning platform and also case based reasoning algorithms. The seeding of the case based reasoning algorithms would be an extended process that analyses typical environmental configurations that speaks to learning facilitators at risk, students at risk and subjects at risk. Therefore a conditionality in terms of the multitude of factors

emanating from focusing on students, curriculum, learning facilitators, peer groups, physical environment and other factors need to be brought together to create context or conditionality within which such learning facilitators, students and subjects could be regarded as being at risk. There are also rules based systems which clearly indicates that within any curriculum that only the friendly aspects of the curriculum could ever be regarded as being acceptable. The rules based reasoning system the student needs to be engaged on the bases of being a contributor, participant or an enabler to his or her own learning and learning of others. The traditional curriculum must be regarded as being flexible, accessible and engaging and in focusing on the learning facilitator, the learning facilitator has to affirm, enable and mentor students. Focusing on the peer group, the student needs to be recognized, embraced and guided by the peer group. This is the one area that is most challenging because traditional curriculums typically do not tend to socialize students. And finally the focus on the physical environment needs to be functional, conducive and purposeful.

It is proposed that input data as per figure 4 below would be drawn from students, learning facilitators, experts and researcher in establishing a strategic management system which links to the case based reasoning algorithm and rules based reasoning system to form the core of a progressive curriculum alignment system.

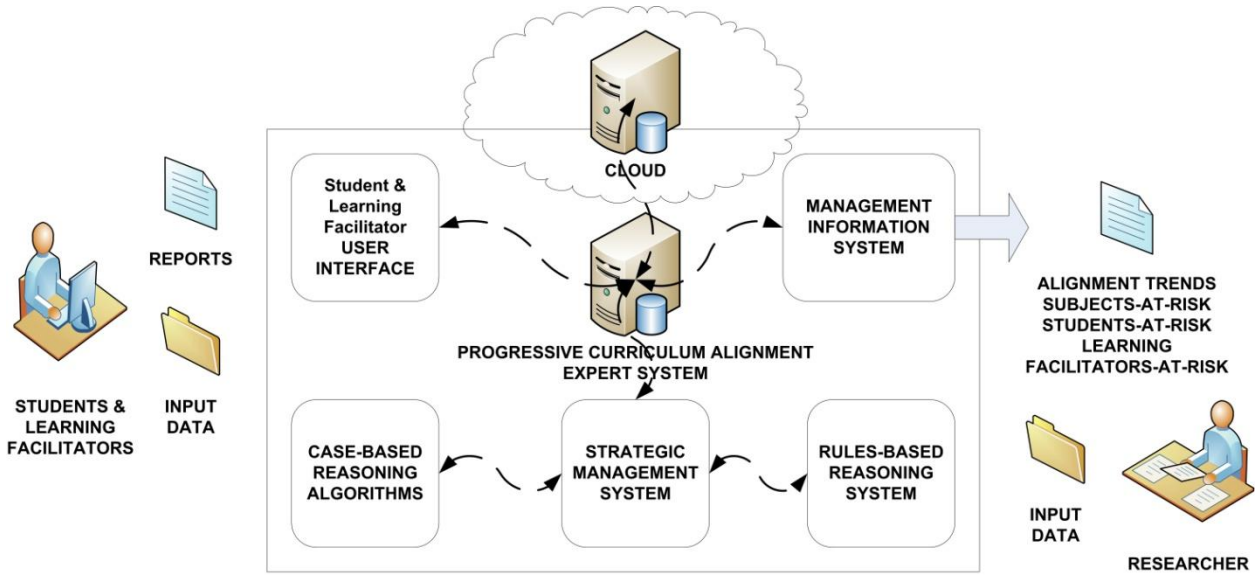


Figure 26: Progressive Curriculum Alignment Expert System

Conclusion:

It is envisaged that this study would make an important contribution to understanding the needs, capacities and aspirations of stakeholders within a dynamic environment for ICT education which is increasingly energised by new technological developments.

The paper will put forward proposal for a contextual alignment of curricula at UoTs. This paper also deals with the strategy which will be adopted in the near future for ensuring the progressive alignment specifically of the undergraduate ICT curriculum at CPUT. It is proposed that an expert system needs to be developed in order to cater with the multiplicity of factors impacting curriculum alignment and this would be the work of future research and development endeavours.

1. **References:**
2. Benjamin, L.S. A Clinical-Friendly Version of the Interpersonal Circumplex: Structural Analysis of Social Behavior (SASB), Journal of Personality Assessment, Vol. 66(2), 248-266 (1996)

3. Burrell, G. & Morgan, G. 1979. Sociological Paradigms and Organisational Analysis. London: Heineman.
4. Danermark, B., Ekstrom, M., Jokobsen, L. & Karlsson, J.C. 2003. Explaining society: Critical realism in the social sciences. London: Routledge.
5. Du Prè, R. 2009. The Place and Role of Universities of Technology in South Africa. www.satnonline.net
6. Fox, S. 2009. Applying critical realism to information and communication technologies: A case study. Construction Management and Economics, 27(5):465-472.
7. Lorr, M. & Strack, S. A study of Benjamin's Eight-Facet Structural Analysis of Social Behavior (SASB) Model, Journal of Clinical Psychology, Vol. 55(2), 207-215 (1999)
8. Okoli, C. and Pawlowski, S.D. The Delphi method as a research tool: an example, design considerations and applications, Information & Management, Vol. 42, 15-29 (2004)
9. South Africa. 2011. National Development Plan: Vision for 2030. Available WWW: http://www.npconline.co.za (Accessed 06 May 2012.)
10. South Africa. 2012. Green Paper for Post-School Education and Training. Available WWW: http://www.dhet.gov.za (Accessed 07 May 2012)
11. Squires, D.A. 2009. Curriculum Alignment: Research-based Strategies for Improving Student Performance. Thousand Oaks, California: Corwin Press.

Online portfolio curricular appropriation, Visual Arts classroom changes and conversations.

T M Noakes
Centre for Film and Media Studies: University of Cape Town
Cape Town, South Africa
travisnoakes@gmail.com

Abstract

There is a research gap into the curricular appropriation of online portfolio software within the Visual Arts. This paper contributes to closing the gap by using Multimodal Theory and Activity theory to explore how an appropriation in an independent, secondary school Visual Arts classroom offered learners multimodal choices that necessitated wide-ranging and in-depth changes to its activity system as learners used online portfolios as adjuncts to their traditional analogue ones. A review of all learners' conversations in five online portfolio lessons found that learners spoke about their online portfolio design choices, concerns about the online portfolio creation process and other issues. Select examples of each conversation type were situated using the changes post- online portfolio appropriation as background. Educators can learn from these examples and may consider preparing for similar changes, discussions and conversations when appropriating online portfolios into their curricula.

Keywords

activitytheory, multimodal, onlineportfolio, visualarts, classroom, changes, discussion, dialogue.

Introduction

Visual Arts disciplines have traditionally been assessed through the use of portfolios, which involve students in the production of a set of physical artefacts to showcase their creative work. Recently, Visual Arts secondary school educators have started teaching their students to adopt digital production and distribution methods, enabling them to supplement their traditional portfolios with online portfolios.

Educators have only recently been able to appropriate online portfolio software for enabling their students to create digital portfolios at low cost to their Visual Arts department and there is a gap in the international literature on: the curricular adoption of online portfolio software; its use by secondary school learners and the formal conversations that occur. This paper aims to make a contribution to closing this gap by exploring the changes that occurred in appropriation and describing how these were reflected in classroom conversations.

Learners at an independent school in Cape Town have been using online portfolios as an adjunct to their traditional, analogue, Visual Arts ones. My PhD research fieldwork saw classroom conversations being video-recorded over a period of three years from April 2010 to April 2012. These recordings followed an educator and the same year of learners: from grade 10, in 2010, when they were first introduced to online portfolio creation, until the online portfolio syllabus' end in grade 12. For this paper, five online portfolio review lessons, between September and November in 2011, were chosen for review and the most relevant conversations were transcribed.

To create digital portfolios, learners were taught to digitize their artworks and provided with guidelines on making portfolio design choices using the online software, Carbonmade. In following their educator's online portfolio syllabus, learners spoke about a wide range of subjects. After reviewing these, three high-level categories were identified to group conversations under common topics; the first was 'learners'

online portfolio design choices', the second 'learners concerns about the online portfolio creation process' and a third for 'other topics'.

This paper makes a contribution to closing a gap in the research literature by: describing examples of learners' discussions on multimedia choices; listing the changes that occurred to an activity system's components as learners' appropriated online portfolios; and showing how understanding these changes is useful for situating classroom conversations about design choices, processes and other topics:

This paper explored select examples of each discussion type and analyzed them using a combination of Multimodal Theory and Activity theory. Multimodality (Kress, 1996, 2010) was used to describe the design choices that learners discussed, while Activity theory (Engeström, 1987, 2001, 2005) provided a framework to situate learners' conversations on choices, processes and other issues inside the complex environment of their educator's secondary school classroom:

Kress (2010) and Jewitt's (2006) research shows that digital multimedia afford multimodal choices. In creating and maintaining an online portfolio, learners could be engaged in making complex decisions about which writing, image, colour and layout mode to use and how to use and combine these modal resources in configuring their online portfolio pages.

This paper uses the second-generation framework of Activity theory (Engeström, 1987, 2001, 2005) to contextualise learners' multimedia discussions. In Activity theory, the basic unit of analysis is an activity system, which in the first generation comprises a 'subject' who works with a 'tool' on a problem space, or 'object', to achieve an outcome that supports 'objectives' (Leontiev, 1974, 1981; Vygotsky, 1978, 1987; Wertsch, 1985). Second-generation Activity theory expands the activity system's framework's components to include 'community', 'rules' and 'division of labour' (Engeström, 1987). Engeström's (2005) research suggests that it is important to understand how shifts occur in an activity system's tools, objectives, outcomes, community, rules and division of labour as it changes from a traditional one into a new one (such as using traditional portfolios, to creating digital, online portfolios as an adjunct).

Literature survey

To understand conversations between learners and their educator in Visual Arts classes, the researcher combined insights from New Media Theory, Multimodal Theory and Activity theory literature:

New Media Theory

New Media Theory provides the rationale for formal exposure to new media production: learners increasingly experience multimodal communications outside class, but seldom receive formal education in using digital media for multimodal creation (Kress, 2010). As a result, learners may not be formally introduced to skills that could help them better understand digital media.

It is important to make changes to contemporary education in response to the increased presence of information technology at home and in work (Lankshear and Knobel, 2003). Learners need to learn about digital media and their meanings though new media production (Buckingham, 2007).

This research project supported an educator at a well-resourced, independent, boys-only school with giving his Visual Arts learners the novel opportunity to create online portfolios. This has given Visual Arts and Design educators, and other key decision makers, the chance to see whether these digital portfolios have the pedagogical benefits suggested by research in well-resourced contexts (Owen, 2009).

My research fieldwork (2010-2012) assisted online portfolio curricula to be appropriated on a sustained basis in a well-resourced, independent school., No similar projects involving the curricular appropriation of online portfolios in the Visual Arts were found when searching the international research literature.

Multimodality

Multimodal Theory was used to explain learners' online portfolio choices in constructing and maintaining webpages using the modal resources and affordances of writing, layout, still image and color. According to Kress (2010), a 'mode' is a socially shaped and culturally given semiotic resource for making meaning. Multimodality avoids the limitations of earlier semiotic traditions which tended to look at discrete signs and their simple, straight meanings in terms of what they connote or symbolise by considering the way signs are used in combination (Machin, 2011). As a result, a sign's meaning lies not so much in the sign itself in isolation, but through it being part of a code, a system of visual grammar, giving it potential to mean. Kress and van Leeuwen (1996) describe this as a grammar approach to visual communication. An advantage of this approach is that it enables an account of the possible design choices available to learners and the finite rules for multimodal configurations that can produce an infinite number of utterances or visual statements within their online portfolios. Other important advantages are its lack of bias and systematic, descriptive rigour: It avoids the monomodal bias towards communication that has tended to favour the language mode in academic disciplines. Central to the multimodal approach is the idea that all modes need to be considered with the same kind of detail as semiotic systems in themselves; foregrounding the description and documentation of potential choices, patterns and grammar, thereby supporting a more structured approach to media research (Machin, 2011).

Activity theory

Activity theory has been used in many countries, including South Africa (Hardman, 2005, 2007) in order to understand the use of ICT in education (Kaptelinin and Nardi, 2006) and it is well suited to explain the use of software in the complex social environment of a secondary school.

This project uses the second-generation framework of Activity theory: the first originated in the former Soviet Union (Leontiev, 1974, 1981; Vygotsky, 1978, 1987; Wertsch, 1985), Scandinavian researchers reformulated and expanded the Soviet tradition's descriptive framework into a second-generation (Engeström, 1987, 2001, 2005) and it is currently in its third (Edwards, 2005; Russell, 2002).

Activity theory's basic unit of analysis is an activity system, which in the first generation comprises a 'subject' who works with a 'tool' on a problem space, or 'object', to achieve an outcome that supports 'objectives'. In the case of a learners' formal use of online portfolios, the subject of the activity system is a learner working with tools (such as a curriculum, a scanner, a digital camera and Carbonmade software) to create and maintain an online portfolio. This activity can support the learner's conscious objectives. An example is helping him to get good grades from his educator's online portfolio assessments.

Second-generation Activity theory expands the activity system's framework to include 'community', 'rules' and 'division of labour' (Engeström, 1987). In the case of this project, the community comprised the researcher, decision makers, educators, learners, their online audiences and the online portfolio software's developers. The community's actions are likely to be guided by observing rules; principles of control affording and constraining behaviour. For learners, the rules included curricular tasks, terms and conditions of software use, copyright laws and e-safety guidelines, as well as a wide range of tacit and sometimes conflicting 'rules' youth learn through their informal use of Web2.0 sites; such as Facebook, Flickr and MySpace. A division of labour that comprises a horizontal division amongst community members and a vertical division between the power- and status-holders also shapes the community's actions. For example, an educator is the expert in class and uses a new curriculum to teach online portfolio creation to his learners. If a learner misses the lesson, he may ask a peer to help him 'catch up'. Peer-to-peer instruction would mark a change in the division of labour that is typically expected in class.

This project uses the second-generation of Activity theory to explore the formal context of online portfolio conversations. It did not use third-generation, which looks at the interactions that occur when two activity systems come together by incorporating the idea of boundary objects that operate at the

interface of many contexts (Edwards, 2005). While this would provide a common language for discussion across these contexts and could serve as an opportunity for the assumptions, values and beliefs that underpin each activity system to be made more explicit (Robertson, 2008), the conflicts between the independent school's different activity systems are outside this paper's focus.

Research method

The research question addressed in this paper is:

- What activity system component changes post- curricular appropriation were reflected in learners' online portfolio conversations?

To answer it, my Action Research project supported a Visual Arts Head of Department (HOD) at a leading independant school to prepare a syllabus that enabled his learners to create online portfolios using free membership of the online service Carbonmade (at www.carbonmade.com). As a media study, my role was to assist the educator in enabling the intial curricular appropriation of the new medium in his class and to study learners' online portfolio choices. He selected a target population, all eighteen of his grade 10 learners, to be involved in a curricular appropriation from April, 2010, until April, 2012.

This project used Activity theory as its theoretical lens to answer the research question to avoid a common failing in the literature concerning the appropriation and repurposing of online media in education; few existing studies have adequate theoretical frameworks guiding their discussion of Web2.0 media (Hamid, Waycott, Kurnia & Chang, 2010). Activity theory offers a useful framework for situating learners' semiotic choices and use of technologies within the context of a curriculum subject and the classroom (Jewitt, 2006). Activity theory enables learners' meaning making with online portfolios and conversations to be linked to the broader issue of mind and learning. Activity theory builds on the social semiotic approach to learning of Vygotsky (1978, 1987) through its focus on how people's consciousness is formed through activity with shared tools, which bring them into contact with, and connect them to, the history, values and social relations of society. Activity theory represents the social relations that support semiotic mediation as an activity system (Jewitt, 2006). In this project, the activity system comprised the educator and his learners who shared the same curricular purpose of creating showcase Visual Arts electronic learning portfolios and shared common tool types to realise that purpose.

Online portfolio curricular rationale

This Action Research project helped a Visual Arts educator meet two important objectives of South Africa's Department of Education (DOE); learners were taught about 'Management and Presentation', an important focus of the Visual Arts National Curriculum Statement (2010). They have also been given an opportunity to develop ICT proficiency, an important aim in the Department of Education's (2004) "White Paper on e-Education".

In working with the school's Visual Arts teacher, an educator-focussed rationale also emerged for preparing online portfolio curricula: by being exposed to technologies, such as online portfolio software and related social bookmarking services, the educator has learnt about the opportunities that contemporary technologies offer his pedagogy. Fullard's (2010) research into teachers' perceptions of this independant school's 'one laptop per learner policy' revealed that few of them described the laptop as a tool to advance learning and most could benefit from training to gain knowledge of the teaching possibilities that technology now offers.

Research site

My PhD research takes place in Cape Town, the provincial capital of the Western Cape Province in South Africa. Although its fieldwork was done at two sites, an independent and a government secondary school, this paper only features the former as fieldwork is ongoing at the other site. Both schools fall within the Metro South educational district, which is one of seven districts that the province's Western Cape

Education Department (WCED) is responsible for. In 2009, the DOE (and WCED) Visual Arts curricular adviser gave approval for research into the use of online portfolios at both sites.

The research project first started at the elite, independent school site, where it followed the progress of a complete Visual Arts class' boys from grade ten into matric. The research site was a convenience sample, but also an environment in which learners' initial adoption of online portfolios was likely to succeed; it has a one-laptop-per-learner policy and would not face the typical resourcing barriers confronting the initial appropriation of software in developing world secondary schools. These fall under the four categories of access in educational institutions (Czerniewicz and Brown, 2005); 'technological' (i.e. availability of Information Communication Technology resources), 'personal agency' (i.e. access to digitisation and computer equipment), 'contextual' (i.e. formal enabling networks) and 'online content' (i.e. articles written for local audiences). The barriers associated with limited technological resources and no, or minimal, support of personal agency may pose an insurmountable challenge to appropriation in under-resourced schools (which lack dedicated arts studios or computer labs). For this reason, research was initially conducted in a school where these two barriers were unlikely to be major and the obstacles posed by limited contextual and online content resources could be overcome through collaboration between the educator and I.

The independent school's initial curricular appropriation was also likely to be sustained due to the Visual Arts HOD's commitment; the backing of his school's management; the school's one-laptop-per-learner policy and most learners' prior exposure to, and continued access to, technology (in class, at school and at home) for digitising artworks and using online portfolio software.

Using the online portfolio software, Carbonmade.

Carbonmade was selected as is met the following criteria for inclusion in the HOD's syllabi: it was free and made self-publication of digitized artwork easy-to-do and manage. It included provisions in its legal contract that protected its users' copyright. It offered sufficient storage (five folders and a 35 image limit) for learners' end-of-year, showcase exhibitions. Its brand was family-friendly and it did not promote content unsuitable for school. The service is popular enough with creative professionals to be a sustainable business and includes Fine Artists' portfolios that were easy to search for. The Visual Arts educator also perceived that his grade 10 learners were not mature enough to give appropriate feedback on their peers work; another criterion that Carbonmade met was that it did not provide social networking functionality.

Research process

This project supported the independent school's HOD with the curricular appropriation of online portfolio software; in 2010 and 2011 he gave ten lessons a year and six in 2012. I made video recordings of these and took journal notes, a review of which showed that several interesting conversations took place from August to October 2011, in 'online portfolio review lessons'. I reviewed these lessons videos and transcribed discussions pertinent to this paper's research question. The transcriptions referred to in this paper are available online (Noakes, T. 2012.). To protect the research subjects' privacy, pseudonyms have been used in transcriptions of the learners' names (i.e. Learner 'AH'), an exchange student ('Exchange student') and their educator ('Educator R').

Topics and types of conversation

Conversations in the five lessons fell into three high-level categories: first, different 'types of design choices' with online portfolio software; second, learners raising 'concerns about the online portfolio creation process' and, third, 'other issues'. These conversations have been titled as either 'discussions' in which different views were presented and analysis emphasized, or 'dialogues' based around a common

purpose, where participants suspend pre-formed opinions and try to share a common content (Bohm, 1996).

Conversations about design choices with Carbonmade

Carbonmade allows its users to design three distinct online portfolio page types; a 'homepage', an 'about' page and 'project folder artwork' pages. The homepage (see illustration 1) is an index page that shows the creative portfolio's title, its artwork folders and a footer.

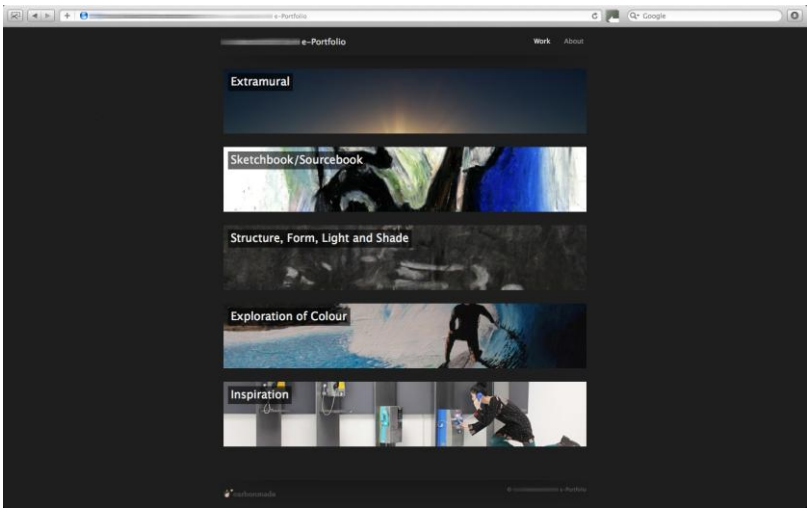


Illustration 1. Screenshot of learner AK's homepage (May, 2012).

The online portfolio viewer can select any 'project folder' from its thumbnail on the homepage, then navigate through each of the folder's artworks in sequence (see illustration 2).

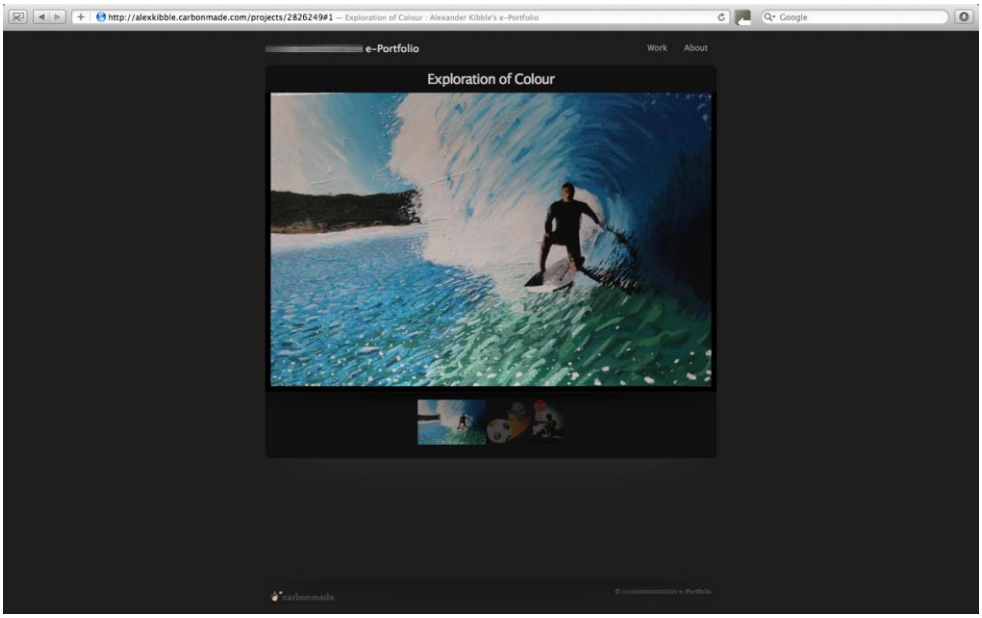


Illustration 2. Screenshot of a page in learner AK's 'Exploration of Colour' folder (May, 2012).

The viewer can also select 'about' to view description of the portfolio's creator (see illustration 3).

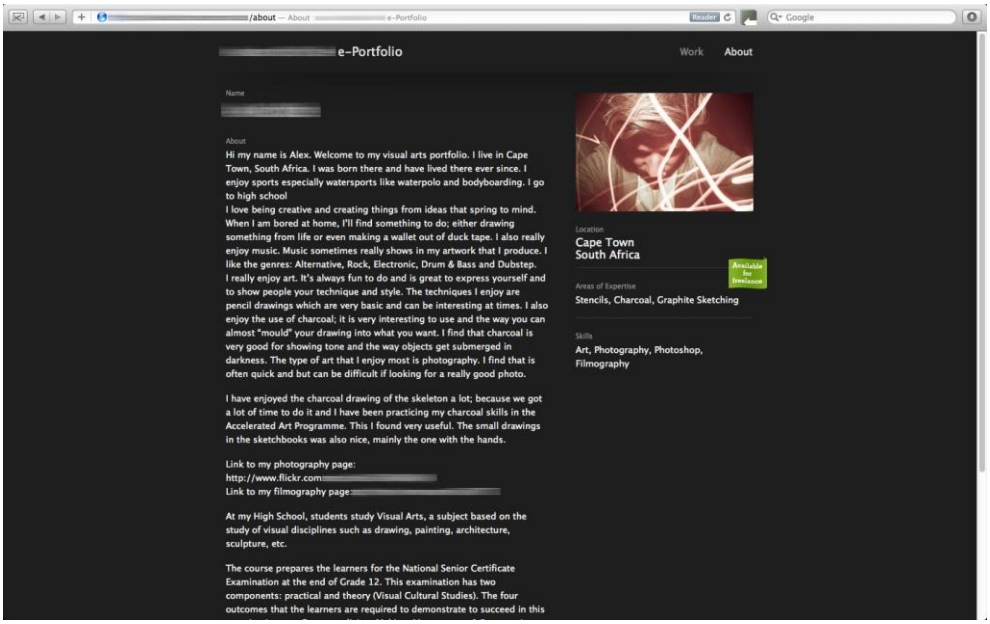


Illustration 3. Screenshot of learner AK's 'About' page (May, 2012).

it is helpful to understand learners' online portfolios as a contemporary, digital communication form differing from the traditional analogue Visual Arts portfolio in being database driven: each Carbonmade portfolio creator makes a selection from available options with its Graphic User Interface (GUI), or retains default settings, for each page-type. By selecting and defining these options, database entries are created for the member. These are used in turn by Carbonmade's back-end to assemble the member's online portfolio webpage into a seamless, visual artefact (Manovich, 2001) that every viewer can navigate.

The next section describes learners' conversations about their design choices and how these were bounded by an online portfolio class' activity system's components:

Conversations concerning 'About page' choices

Learners have diverse individual interests that influence their design choices with online portfolios (Noakes, 2011). However, learners' ability to express these interests were bounded by several changes to the classroom community (appendix 1) and influenced by twenty-nine new rules (appendix 2) that relate to online portfolio pedagogy: The community had expanded to include Information Technology support staff, as well as desirable and undesirable online audiences. The educator identified that he had to consider nine rule types before online portfolio curricular appropriation. Post-appropriation, the educator, DOE Visual Arts curricular adviser and I, compiled a list of twenty-nine rules that could influence the effectiveness and/or content of his online portfolio lessons. These included; DOE and school policies, promotion of new media literacies and ICT proficiency, resourcing support, new methods of assessment, teaching multimodal concepts, teenage patterns of media use and acceptable online behaviour.

Dialogue about a learner's self-description

An example of how a learner's choices were bounded is revealed in a peer dialogue between learners AH and SM concerning the former's introductory sentence to his profile on the 11th of October, 2011 (6:15.0 - 6:43.0 time on videotape):

> Learner AH: My Dad's like, 'you need to be more professional'.
> Learner SM: That is professional.
> Learner AH: (quotes from the introduction to his about profile description), 'Hi, my name is Andrew and I like to padi. Not my friends. I know for a fact they don't party. I PARTY.' That's professional? (laughs)
> Learner SM: (laughs) Just leave it in, please?

Learner AH: No, I won't. I can't.

Although learner SM tried to exert peer pressure on learner AH to retain his interest in 'partying', learner AH felt that he no longer could. His father had asked him to be 'more professional' and this meant to learner AH that he had to remove his initial introductory sentence. All grade 11 Visual Arts learners were to be assessed on their online portfolios, not their analogue ones, for their end-of-year exams and learner AH was aware that he could be marked down if his description did not effectively present himself as an aspirant creative professional. It is likely that both his father's and his educator's expectations of 'professionalism' contributed to learner AH removing his interest in partying from his personal description.

Argument about a learner's choice of profile picture

Other important influences on learners' choices may be their informal media experiences, the educator's formal authority and the guidelines he provided or omitted. In the argument below, the learner AH's values differed from his educator's on a choice the latter perceived to be 'problematic'. Learner AH had yet to upload a profile picture to his 'about' page on the 11th of October and asked his educator whether he could choose a picture of 'two lions mating in the middle of the Kruger Park' (12:37 - 13:20 time on videotape):

Learner AH: Sir, can I make my profile picture two lions mating in the middle of the Kruger Park?
Educator R: Firstly, that's a really stupid idea.
Learner AH: But, sir, that's such a rare occurrence.
Educator R: I actually find that offensive and you are behaving like a juvenile.

The full sequence of the transcript suggests that the learner believed the question was a 'genuine' one. This was unsurprising as his proposed choice matches a pattern typical of youth media use in which imagery is appropriated using a 'cut' and 'paste' approach with the objective of creating a 'cool' profile (Ito, et al., 2010). This appropriation method is often in direct conflict with implicit classroom norms of individual authorship, but guidelines for profile picture subject matter were absent, so there were no explicit rules to compare his proposed subject matter's choice against. There was only the verbal instruction to 'simply use any technology they could' for creating their digital self-portrait (Interview with educator R post-lesson, 11 October, 2011).

Based on what he had seen in class, educator R believed that, 'many (learners) had made unsuitable choices for their profile pictures (Interview with educator R post-lesson, 11 October, 2011). In response, he decided to add a rule to his online portfolio syllabi, whereby learners only used digitized self-portrait drawings or paintings for profile pictures. This reflected his Visual Arts pedagogical emphasis on drawing and painting as visual communication media and their elevated status within Fine Art's traditional hierarchy. However, in removing photography or design imagery, he simultaneously delegitimized learners' scope for appropriating popular culture or using parody or imitation; a significant part of learners' play (Buckingham, 1998).

Discussions about adherence to coherent messaging and on-going design

Educator R gave guidance on coherent messaging, as he had identified a general problem that learners struggled to conceptualise and create online portfolios that exhibited coherence between their profile page's description and choices, and the artworks they uploaded into their project folders. An example of this was a discussion in which he urged learner GH to create coherence between his 'about' description and the imagery in his 'Extra Mural' artwork folder. Although the learner had uploaded a painting to his extra-mural folder, the full extent of his extra-mural activities had not been described in his profile.

Educator R also identified that leaners were inexperienced with the concept of 'on-going design', whereby the text content in their profile descriptions needed to be updated each year to accurately reflect changes in their activities, skills, expertise and evolving personal interests. An example of this was Educator R asking learner GH to update information in his profile's description; the current course should be changed to '2011', since last year's entry of '2010' was no longer accurate.

Conversations that raised concerns about the online portfolio creation process

All learners worked in an activity system whose common curricular object was the creation of Visual Arts showcase portfolios. Conversations about its processes revealed concerns regarding; additional rules, new tools and the expanded community. They also reflected new labour roles in the online portfolio class' division of labour:

Discussions about 'Rules'

Several learners ignored copyright and failed to acknowledge or fully attribute when they sourced digitized imagery, despite being given written guidelines on how to acknowledge and reference third-party's imagery. In response, educator R recommended that learners create a folder titled 'Inspiration', in which they should only place appropriated imagery. An instance where this was reflected in conversation was when educator R urged learner SM to attribute the images he had sourced in his 'Inspiration' folder using complete hyperlinks.

Discussions about 'Tool' choice and availability

The online portfolio curriculum required increased use of digital tools; including scanners, cameras and software (appendix 3). Select discussions focussed on their choice and availability: Learner EG queried why Carbonmade was prescribed, as he believed being able to upload more than 35 images was an important criterion for selecting an online portfolio service. In the ensuing discussion, learner AK further argued that Flickr would be a preferable service to use, as it combined the functionality of both Carbonmade and the social bookmarking service, Diigo (at www.diigo.com), which educator R had recently taught learners to use. In response, educator R encouraged both learners to select only their best work for Carbonmade and to use external services to upload additional creations. He also said that he would ask the school's Information Technology (IT) helpdesk to unblock Flickr, so that learner EG, and others, could use it during normal school hours.

Educator R also added a new guideline to his syllabus that encouraged learners to provide links to any external portfolios from their Carbonmade description, as discussed with learner CG. Three learners (AK, CG and MH) did; providing links to accounts on Flickr, Wix, Vimeo and/or YouTube.

Discussions about new 'Tools'

Most of the learners at the school are from affluent homes and three other discussions highlighted new tools they were using: learner GH brought an iPad to class; learner CG described his use of a Go Pro helmet-mounted video recorder as well as the importance of working regularly on his boarding house's blog.

Dialogue about the 'Community'

The adoption of online portfolio software added new members to the Visual Arts class' community, who supported the use of its new tools or extended its community of practice. While educator R was pleased that he could include an online portfolio web address in each learner's report for parents and guardians, he was concerned about a potential undesirable audience. To minimise its threat of contacting learners he gave specific guidelines that learners should ignore entering the Carbonmade GUI email address field. However, many chose to provide theirs, including learner AH. He received an unsolicited email, which

he initially believed was a legitimate personal communication. However, in dialogue with learner SM he was told that it was part of an unsolicited, bulk email from Filter Foundry.

Dialogue about 'Division of Labour'

Discussions in class reflected changes to its traditional division of labour; in one instance there was peer-to-peer learning when learner CG requested learner AK's help with how to crop imagery. In another, learner AH used an image that learner SM created from a screenshot of a video of learner's AH dance group for the latter to use as his online portfolio picture. There was also a dialogue showing the learner JH's expertise to educator R in which he was told about learner JH's considerations when ordering artworks in Carbonmade's folders that an automated selection of homepage folder thumbnail imagery necessitated.

Dialogue about other issues

Issues outside learners' design choices and processes were seldom recorded, as the researcher focussed on recording the educator and the guidance he gave learners on these two issues. One example of an unusual topic was a dialogue in which an exchange student and learner AH gave learner SM feedback on the two search engine results that appeared when his full name was entered. Learner SM initially denied having two portfolios. However, he had in fact created them; this resulted from forgetting his password, his school's email server blocking Carbonmade's password reminders and therefor being unable to access his first portfolio. He had to create a new one, but as he could not delete the old portfolio without a password, both portfolios now appeared in his name's search result.

Findings

This project's exploration of recorded classroom conversations in five online portfolio lessons found that learners typically discussed their online portfolio design choices and concerns about the online portfolio creation process with their educator, or amongst each other. They also occasionally spoke about other issues.

There were many changes required to support online portfolio appropriation; particularly in the Visual Arts class' activity system's 'tools', 'rules' and 'division of labour'. Understanding these changes proved helpful for situating classroom dialogue and discussions.

Educators can learn from these examples and may consider preparing for similar changes and conversations when appropriating online portfolios into their curricula.

References

1. *Revised National Curriculum Statement Grades R-9 (Schools)* 2010, Department of Education, Pretoria, RSA.

2. Bohm, D. 1996. *On dialogue*. London, Routledge.

3. Buckingham, D. 2007, *Beyond Technology: children's learning in the age of digital culture,* Polity Press, Cambridge, UK.

4. Buckingham, D. (1998). “Pedagogy, parody and political correctness.” In D. Buckingham (Ed.), Teaching popular culture: Beyond radical pedagogy (pp. 63–87). London: UCL Press.

5. Cazden, C., Cope, B., Fairclough, N., Gee, J. & Kress, G. 1996, "A Pedagogy of Multiliteracies: Designing Social Futures" in *A Pedagogy of Multiliteracies: Designing Social Futures*, 1st edn, Harvard Educational Review, pp. 60-92.

6. Czerniewicz, L. & Brown, C. 2005, "Information and communication technology (ICT) use in teaching and learning practices in Western Cape higher education institutions", *Perspectives in Education,* vol. 23, no. 4, pp. 1-18.

7. Department of Education, South Africa 2004, *White Paper on e-Education*, Government Printers, Pretoria, RSA.

8. Edwards, R. 2005, "Contexts, boundary zones and boundary objects in lifelong learning", 14-17 September 2005.

9. Engeström, Y. 2005, *Developmental work research: expanding activity theory in practice,* Lehmanns Media, Berlin, Germany.

10. Engeström, Y. 2001, *Expansive Learning at Work. Towards an Activity-Theoretical Reconceptualisation.* University of London, London, England, UK.

11. Engeström, Y. 1987, *Learning by Expanding: An activity-theoretical approach to developmental research,* Orienta-Konsultit Oy, Helsinki, Finland.

12. Fullard, E. 2010, *(Case Study 1) Laptop Project: An investigation into the status of the Laptop Project at (Case Study 1)*, Pinock Consulting, Cape Town, RSA.

13. Hamid, S., Waycott, J., Kurnia, S. & Chang, S. 2010, "The Use of Online Social Networking for Higher Education from An Activity Theory Perspective", *PACIS 2010 Proceedings*, 2010.

14. Hardman, J. 2007, "Making sense of the meaning maker: tracking the object of activity in a computer-based mathematics lesson using activity theory", *International Journal of Education and Development using ICT*, vol. 3, no. 4.

15. Hardman, J. 2005, "Activity Theory as a framework for understanding teachers' perceptions of computer usage at a primary school level in South Africa", *South African Journal of Higher Education*, vol. 25, no. 4, pp. 258-265.

16. Jewitt, C. 2006, *Technology, literacy and learning : a multimodal approach*, Routledge, London; New York.

17. Kaptelinin, V. & Nardi, B. 2006, *Acting with Technology: Activity Theory and Interaction Design*, MIT Press, Cambridge, MA, USA.

18. Kress, G. 2010, *Multimodality: A social semiotic approach to contemporary communication*, Routledge, New York, USA.

19. Kress, G and Van Leeuwen, T. 1996, Reading Images: The Grammar of Visual Design, Routledge, London, UK.

20. Lankshear, C.K., Michele. 2006, *New literacies : changing knowledge and classroom learning*, Open University Press, McGraw-Hill International, California, USA.

21. Leontiev, A. 1981, *Problems of the Development of Mind*, Progress Publishers, Moscow.

22. Leontiev, A. 1974, "The Problem of Activity in Psychology", *Soviet Psychology*, vol. 13, pp. 4-33.

23. Manovich, L. 2001, *The language of new media*, MIT Press, Cambridge, Mass.

24. Machin, D. 2011, Introduction to Multimodal Analysis, Bloomsbury Academic, London, UK.

25. Noakes, T. 2011, *The Multimodal Choices Visual Arts Students Made In Creating Their Online Portfolios*, Proceedings of the 2011 Design Development and Research Conference, Cape Town. OpenJournals Publishing, 26 - 27 September, 2011, pp. 1.

26. Noakes, T. 2012. Field source data referenced in my 'Online portfolio curricular appropriation, Visual Arts classroom changes and conversations' article for the Design Development and Research Conference, 2012.

27. [Online]. Available: https://docs.google.com/document/pub?id=1r6gs9s8B77BdXL8Z-6vBHON0wKf3yuQIKXWYYDElOHc [24 August 2012]

28. Owen, H. 2009, "Portfolios Have Long Been a Part of Learning, Teaching and Professional Practice: Why Use E-portfolios And What Do Web 2.0 Tools Have To Offer?", *Learning Communities: International Journal of Learning in Social Contexts*, , no. 2: e-Portfolio Edition.

29. Russell, D. 2002, "The Kind-ness of Genre: An Activity Theory Analysis of High School Teachers' Perception of Genre in Portfolio Assessment Across the Curriculum." in *The Rhetoric and Ideology of Genre: Strategies for Stability and Change.*, eds. R. Coe, L. Lingard & T. Teslenko, Cresskill, NJ: Hampton, pp. 225-242.

30. Vygotsky, L. 1978, *Mind in Society; The Development of Higher Psychological Processes*, Harvard University Press, Cambridge, MA, USA.

31. Vygotsky, L. 1987, *The collected works of L.S. Vygotsky.* Plenum Press, New York, USA.

32. Wertsch, J. 1985, *Culture, Communication and Cognition: Vygotskian Perspectives.* Cambridge University Press, Cambridge, UK.

Acknowledgments

I would like to thank my supervisors, Dr Marion Walton (UCT) and Professor Johannes Cronje (CPUT) for their guidance and support with this PhD project and the outcomes, such as this paper, that result from its progress.

I also appreciate the feedback of my research colleagues from Digimobs SA (the Digital and Mobile Media postgraduate research group at UCT), TERPS (the Technology in Education Research Postgraduate Students group at CPUT), SAME (the South African Multimodal and Education Research Group at UCT) and colleagues in UCT's Centre for Educational Technology.

I am most grateful to the Visual Arts Head of Department, his school, students and their parents for their involvement and contribution to making this research possible.

I am thankful to the National Research Foundation for their NRF Grantholder bursary's financial support between 2009 and 2011.

[i] It is important to note that American and Australian sources refer to student involvement as *student engagement*. For this reason, the term engagement in Section 3 of this paper refers to the level of student involvement, as opposed to Engagement Theory, discussed in Section 4.

[ii] The contextual considerations here relate to the South African content.