

Criticism, self-criticism, generative criticism – developing self-awareness and confidence in students of design

M. Lecanides-Arnott

Faculty of Informatics and Design

Cape Peninsula University of Technology

Cape Town, South Africa

e-mail: mari.arnott@gmail.com

Abstract

In the complex field of design, which bridges art and science, designers need to be critically aware and versatile. They should possess breadth and depth of knowledge, skills and understanding that can be transferred and adapted to new and different situations, enabling sustainable and innovative design solutions. Designers need to communicate within a global 'networked knowledge society'. It has been argued that 'designers create culture' and that the knowledge and hand skills traditionally required of an artist/designer are essential, as design outcomes are purpose driven and practical. Self-awareness and confidence have been identified as necessary attributes for 'creative design action'. This article reports on a longitudinal, interpretive study of the role of tertiary design foundation education and in particular an integrated, multidisciplinary Design Foundation Course in the South African context. In raising students' critical awareness by instilling an understanding of 'core ideas' and the 'visual language' specific to the fields of art and design, emphasis was placed on 'learning to see' through the act of drawing and the use of colour. Transference from one studio-based subject to another, that takes place through studio group critiques applying comparative analysis as a means of formative assessment, was examined. The iterative nature of the design process in encouraging 'design thinking', described as 'reflection in action', and which leads to the development of generative self-criticism, was investigated. It is argued that generative self-criticism in students provides an essential benchmarking instrument for the assessment of practical design outputs.

Keywords: critical self-awareness, confidence, tertiary foundation education, studio-based design subjects, integrated multidisciplinary curriculum, visual language, design thinking, creative design action

INTRODUCTION

In order to deal with complex situations, diverse cultures and fast-changing technologies, there is a greater need for designers from different design disciplines and other fields of knowledge to collaborate closely (Leifer 2010; Manzini 2009, 448–449; Ranjan 1999, 1–3; Schön 2009). Confidence and self-awareness are seen as necessary attributes of designers (Buchanan 2006; Garraway 2010; Leifer 2010; Nelson and Stolterman 2003, 22; Sonntag 1969). Designers' responses to

problem solving should go beyond function, technology and skill in pursuit of deep understanding and meaning (critical awareness) of cultural, social and economic issues (Buchanan 2006, 15; M'Rithaa 2009; McCoy 1990, 21).

'Design thinking' is essential for innovative action (Cross 2007, 53; Nelson and Stolterman 2003, 13) and is seen to be 'research in context' (Leifer 2010) necessary for arriving at workable design solutions (Cross 2007; Dorst 2010; Leifer 2010). Therefore, 'design thinking' should be considered a 'core idea' in the field of design (Bruner 1977; Tyler 1949; Wiggins and McTighe 2005). At the same time, with the widespread use of computers, the plethora of new technologies and 'knowledge explosion', design is rapidly becoming a knowledge-driven discipline often resulting in the loss of basic design skills, thereby emphasising a need for basic design education at postgraduate level (Ranjan 2005, 1–5).

What is demonstrated is that design education needs to be more than just skills based (McCoy 1990, 21), but also that basic design skills cannot be ignored because of the extensive use of computers (Ranjan 2005, 4). This points to the traditionally acknowledged dilemma of the need to integrate theory with practice in art and design (Goldstein 1996, 7, 273; Gombrich 1984, 218; Lecanides-Arnott 2012, 23–29; McCoy 1990, 20; Sonntag 1969; Tynan 2006).

The Design Foundation Course at the Cape Peninsula University of Technology (CPUT) in Cape Town, South Africa was the context for this longitudinal, interpretive study (Denzin 2002, 349–365). In this article it is argued that 'design thinking' and the development of design skills (handicraft and technological), of integrating theory with practice, should be addressed from the start, at foundation level of the National Diploma: Design (DHET 2012). The practical and action-based creative/scientific method (Popper 1978, 132), and the theory of optimism (Deutsch 2012), together with the principle of continuity and change, underpin the research framework (Lecanides-Arnott 2010, 2012). In this light the suitability of the iterative design process (Schön 1983) as the basis for curriculum development in design education will be discussed (Bruner 1977; Tyler 1949; Wiggins and McTighe 2005). The intention is to integrate theory and practice (Raein 2004; Ranjan 2005) and to provide a conceptual and practical framework for designers to 'learn to see' and to gain a critical awareness of design, to enable the assessment and evaluation of creative outputs through criticism, self-criticism and generative criticism (Arens 2010; Blair 2010; Yorke 2003).

RESEARCH APPROACH

Initially, grounded theory was chosen as the research approach, which then developed into theory building from case studies. As the research study developed, the theoretical approach evolved into a research framework which encompassed aspects of various theoretical approaches, such as action research, constructivism and design research. The development of a research framework rather than a single theoretical approach is appropriate because design is a complex field that is not easy to fit into one 'box' (Lecanides-Arnott 2012, 80–84).

The data collection for the longitudinal interpretive study which is addressed in the article began with the 2008 Design Foundation Course (extended first-year) student group and ended with the same group of students reflecting on their four years of study in design in 2011, on completion of the undergraduate National Diploma: Design in one of the seven design disciplines offered for study at CPUT (fashion, graphic, interior, industrial, jewellery, surface design and architectural technology).

Owing to the complexity of the study, and in order to address the issues of reliability and validity, combined data collection methods were used (Babbie 2010, 152–155; Huberman and Miles 2002, 7–9; Lecanides-Arnott 2012, 92–95). The data was captured making use of coding and pattern (Lecanides-Arnott 2012, 309–351). A design matrix (see Table 1) was developed to assist with the analysis of the data. For the requirements of the current article, emphasis has been placed on the studio-based design outputs and the filmed interview of the 2008 foundation student focus group (Lecanides-Arnott 2012, 465–481) from which it has been possible to discern the level of critical awareness of individual students. In order for triangulation to take place, the results from the filmed interview and the design studio-work project outcomes have been analysed in conjunction with responses from the design staff in the open-ended questionnaire that was sent via email (Lecanides-Arnott 2012, 329–351).

The research approach confirmed the ‘core idea’ from the literature (particularly with regard to design foundation studies), that in educating the designer, consideration needs to be given to both the artist (designer) and the object (design outcome) (Leifer 2010; Sonntag 1969, 392). It also established that specialist educators in design foundation and specialists in the design disciplines are essential to the teaching and assessment process (Bruner 1977, 52). This in turn reinforced Denzin’s (2002, 363) view that in an interpretive study the ‘interpreter must be an “informed reader” of the phenomenon’. For the purposes of the article, specific reference has been made to interviews, observations and the student projects: design artefacts.

Table 1: Research design matrix (Lecanides-Arnott 2012, 95)

Research question: What aspects of the curriculum, assessment methods and teaching approach should be considered in a design foundation programme towards the development of a conceptual framework to educate knowledgeable, skilled, critically aware and versatile designers?							
Elements of the research question	Interviews	Observations	Questionnaires	Marks	Documents	Student projects: research & prep	Student projects: Design artefacts
Design Foundation Education	✓	✓	✓	✓	✓	✓	✓
Curriculum	✓	✓	✓	✓	✓		

Assessment methods	✓	✓	✓	✓		✓	✓
Teaching approach	✓	✓	✓	✓			
Knowledge	✓	✓	✓			✓	✓
Skills		✓		✓		✓	✓
Critical awareness	✓	✓					✓
Versatility		✓					✓

GENERIC FOUNDATION EDUCATION – INTERNATIONAL AND LOCAL

As a result of growing urbanisation because of unprecedented technological advances since the 1990s, and consequent globalisation, research in foundation education and academic support is extensive, both internationally and locally. Academic support in South Africa is essential to redress decades of poor education under the apartheid regime (Kloot, Case and Marshall 2009). Internationally, and domestically in South Africa, the need for academic support has resulted in prolific research in academic development, particularly in language and numeracy (Bernstein 1999; Rose 2008, 15; Volbrecht and Boughey 2004).

Specific to art and design education in the United Kingdom (UK), it has been demonstrated that the issues of ‘widening of access and participation’, in work-based foundation degrees in art and design, are best addressed through the curriculum. In South African foundation/extended programmes there has been a shift from bridging courses to providing epistemological access and participation through the integration of academic skills and subject content. In the UK and in South Africa, educational needs of the ‘non-traditional’ culturally diverse student body from different socio-economic backgrounds are addressed through the curriculum (Bernstein 1999, 171; Boughey 2005, 230, 240; Scott 2000; Tynan 2006, 39).

Design foundation studies at the core of design education

The visual field of art and design has a grammar and a vocabulary, as in any other field of knowledge and science, and the first two years have been identified as being the most important years of study for students in art and design. The Design Foundation Course as the first year of study in undergraduate art and design programmes is seen as essential (Sonntag 1969, 388, 392; Tyler 1949, 28–33).

Foundation education in design is seen as important for diagnostic reasons as well as for developing a critical awareness of design and an understanding of the ‘visual’ language, achieved through imaginative experimentation, thereby building up confidence and self-belief (Gombrich 1984, 444; Sonntag 1969, 388, 393; Yorke 2003, 479).

It is recommended that the fundamental principles, that is, the ‘core ideas’ related to a specific field or subject, should be introduced from the foundation level. ‘Big ideas’ should be dealt with to meet the needs of beginning students and should be reinforced through transference in new and more complex situations in order to

develop critical awareness (see Table 2) (Bruner 1977, 52–54; Tyler 1949, 83–86).

Table 2: Big ideas at the core of various fields contrasted with basic terms. Included is the core idea of ‘negative space’ as opposed to the basic term of the ‘composition of a picture’ in the fields of art and design (Wiggins and McTighe 2005, 67)

Basic Terms	Core Ideas
Ecosystem	Natural selection
Graph	‘Best fit’ curve of the data
Four basic operations	Associativity and transitivity (cannot divide by zero)
Story	Meaning as projected onto the story
Composition of a picture	Negative space
Offence and defence	Spreading the defence, thus opening up space for the offence
Experiment	Inherent error and fallibility of experimental methods and results
Fact versus opinion	Credible thesis

The learning experiences and the teaching approach should be dealt with at the appropriate level to meet the needs of the students concerned, generating interest and presenting challenges that foster a sense of achievement and self-worth (Bruner 1977, 40, 52). A sense of achievement and a sense of self-worth develop students’ confidence, self-awareness, and consequently cultural awareness, all of which are needed to enable positive design action, essential for ‘innovation and change’ to take place (Garraway 2010, 32–33; Leifer 2010; McCoy 1990, 21; Nelson and Stolterman 2003, 22; Sonntag 1969, 387, 392).

THE DESIGN FOUNDATION COURSE

In keeping with the design foundation courses of the Bauhaus in Weimar and Dessau, Germany (1919–1933) (Schmitz 2006a, 360); the School of Design in Ulm, West Germany (1953–1968); and the National Institute of Design (NID), Ahmedabad, India (1970), the purpose of the current Design Foundation Course at CPUT is to teach students the ‘visual’ grammar to enable them to become visually literate and to raise their critical awareness of design (Sonntag 1969, 391).

The Design Foundation Course has been developed to address the needs of a diverse group of students (Scott, Yeld and Hendry 2007) from different cultural backgrounds and with different levels of understanding and ability, both academically and in the visual arts (see DHET 2012; DoE 2006). The objective is for all students to benefit from the dual function of the foundation course (extended first-year) by gaining an understanding of the basic principles of the visual language of design and at the same time being exposed to the fundamental nature of each of the seven design programmes (all the years of study of the National Diploma: Design qualification in one of the following: fashion, graphic, interior, industrial, jewellery, surface design and architectural technology) in the Faculty of Informatics and Design at CPUT (DHET 2012; Dorst 2010; Lecanides-Arnott 2012, 110).

Most of the students who enter the Design Foundation Course have a limited understanding of the field of visual arts, particularly in design. They have not been exposed to the creative design process through which design concepts are developed, nor do they have a critical awareness of design. Some students mistake it for a course in which they will be receiving technical skills training in the discipline of choice in order to gain entry into the regular first year (McCoy 1990). Design is a broad and complex field bridging art and science (see Table 3), and the purpose of design foundation education is to provide a thorough grounding for designers (Buchanan 1989, 91–92; Cross 2007, 122–125; Nelson and Stolterman 2003, 4).

Table 3: The researcher’s understanding of the key educational functions of language and art from Tyler (1949, 28–33), and for science from Tyler (1949, 28–33), Ellis (personal communication, 9 May 2013), (Lecanides-Arnott 2012, 20)

Main educational functions of language, art and science as fields of study		
Language and literature	Art	Science
Language is about the communication of ideas.	Art provides a visual language, a parallel medium to verbal media for communicating ideas and feelings.	Science contributes to the improvement of individual and public health.
Language and literature involve critical thinking and critical interpretation and are not only about the gaining of knowledge, skills and habits.	Art extends the student’s range of perception through art production and art criticism.	Science develops an understanding of the use and conservation of natural resources.
Literature can extend the reader’s understanding of the world (internally and externally) through vicarious experience.	Art leads to personal integration, through the use of symbolic expression.	Science leads to a clearer understanding of the world and the place of the world in the larger universe.
Two further educational functions have been attributed to art as a field of study for which there were no parallel functions for language and science		
	Art encourages the development of interests and values, particularly the development of aesthetic values, which are seen as significant in the formation of high life values	
	Art develops technical competence (e.g. acquiring skill in drawing or music or dance), which can have meaning and significance to the student.	

Complex, integrated, multidisciplinary curriculum

The essential difference between the Design Foundation Course curriculum at CPUT, and the historical design foundation courses of the Bauhaus, the Ulm School of Design and the NID, is that generic design principles are taught through the specific content of the design disciplines (see Figure 2). Unlike the assignments at the Bauhaus and the Ulm School of Design, which were generally abstract and non-object oriented, the Design Foundation Course projects are contextualised within the framework of the different design disciplines with specific practical and functional outcomes. Often connectivity is emphasised between design disciplines through the structure of project briefs. The 3-D puzzle, including its packaging, is an industrial design project, whereas the labelling for the packaging is a graphic design project (see Figure 1) (Lecanides-Arnott 2010, 3).



Figure 1: Industrial design: 3-D puzzle (corex card with stick-on colour film detail) and box (white printcote card); Graphic design: Labelling for 3D puzzle box (gouache paint on ariston paper) (Design Foundation Course student work, 2012). The students had to use the contrast of hue (pure colour) and black and white for the colour detail on the 3-D puzzle and on the labels on the box for the 3-D puzzle)

The benefits of this approach have been described as working ‘through all the different design disciplines [to gain] a broader outlook on how to solve design problems’ (Graduating architectural technology student 2011, from 2008 foundation student

group) (Lecanides-Arnott 2012, 107). The specialist design staff members agree unanimously that underprepared students benefit from participating in the Design Foundation Course (Lecanides-Arnott 2012, 104), succinctly described as follows:

Mainly the development of emotional preparedness, alongside the exposure to possibility, development of work ethic, development and improvement of skills such as visualisation, colour awareness, and knowledge of the idiosyncrasies of the various fields. The ability to discern one's aptitude is invaluable for students' confidence that they land up registered for the discipline that they are most suited to. This ensures a higher retention, resulting in smoother running of the undergraduate programmes (Graphic design senior lecturer: feedback from the open-ended staff questionnaire) (Lecanides-Arnott 2012, 340).

In the South African context, the complex multidisciplinary nature of the Design Foundation Course distinguishes it from the typical extended first-year course of extended curriculum programmes in many other fields of study. A typical extended first-year course is vertical in structure and feeds directly into a specific programme, providing support for further study into that particular discipline.

An important aspect of the Design Foundation Course is that it incorporates the extended first-year curriculum for the different design disciplines offered at CPUT by integrating language skills, numeracy skills and life skills into the Design Foundation Course curriculum. Together with drawing and communication studies, this provides an embedded framework to support and facilitate a greater understanding of the studio-based design and drawing subjects (see Figure 2).

The curriculum has been developed so that the different components slot into one another with learning experiences delivered in a planned sequence that works both vertically and horizontally. Tyler (1949, 83–84) describes the vertical and horizontal relationship of learning experiences as 'the relationship of learning experiences over time' and 'the relationship of one area of study to another' (Lecanides-Arnott 2012, 68–69). Since 2005, there has been a conscious attempt to develop conceptual, formal and technical skills incrementally throughout the year with emphasis placed on the revisiting of 'core ideas' so that some components, such as drawing and colour studies, have developed into what is described as a 'spiral curriculum' (Bruner 1977, 12, 40, 52, 54).

As in the Bauhaus foundation course, foundation studies are seen as essential for the development of independent creative thought (Sonntag 1969, 387). Formal lectures and studio-based methods of teaching, similar to those developed by Otl Aicher at the Ulm School of Design, are used (Ranjan 2005, 1–5) (see Table 4). The significance of the use of both teaching models has been acknowledged as essential to different educational needs (Bruner 1977, 52–54; Cronjé 2006; Sims 2008, 18; Trowler and Trowler 2010, 19; Wiggins and McTighe 2005, 314).

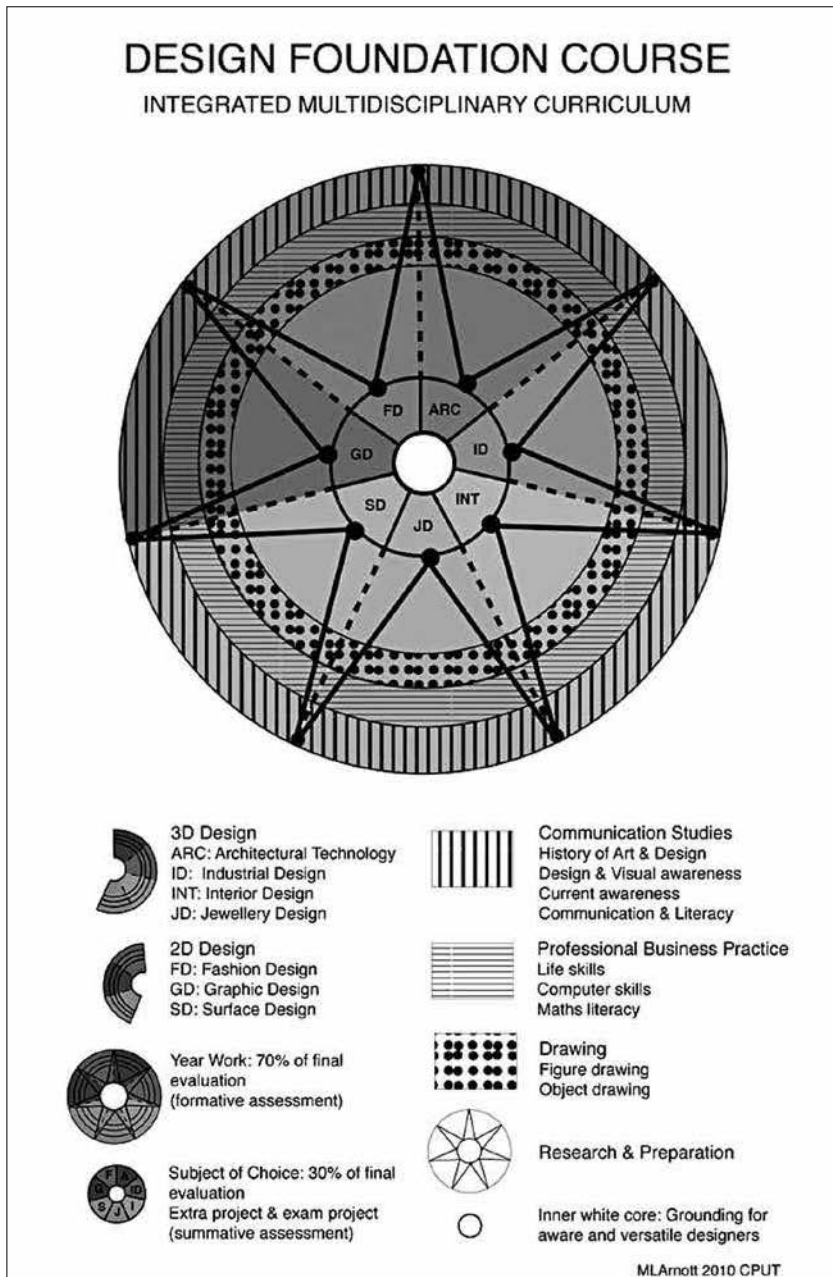


Figure 2: Diagram of the complex, integrated, multidisciplinary Design Foundation Course (extended first-year for the National Diploma: Design in one of the following design disciplines: fashion, graphic, interior, industrial, jewellery, surface design or architectural technology at CPUT) (Lecanides-Arnett 2010, 3; 2012, 110)

Table 4: Summary of Otl Aicher's description of his teaching models (Ranjan 2005, 5–6), table by researcher

Model 1: Pedagogical principle Organisation	Model 2: Pedagogical principle Free Community
Formal lecture	Free form of instruction Discussion
Authority of teacher and of the material	Teachers only in auxiliary capacity From practice to theory
Mass processing Facts	Working independently Enjoying the work Going deeper Unfolding of personal talents
Examinations Supervisions	Independent critical judgement Personal interest incentive
Syllabus	Teaching framework Experimental learning

Learning in the Design Foundation Course is facilitated through self-expression, exploration and experimentation. This process was described as a constructive experience by a past student:

I enjoyed every moment of my journey through the foundation course as it was a year of exploration, discovery and clearer observation (Graduating third-year industrial design student, 2011 from 2008 foundation group) (Lecanides-Arnott 2012, 112).

'LEARNING TO SEE'

'Seeing comes before words ... The child looks and recognizes before it can speak' (Berger 1972, 7). Humans acquire more information through vision than through a combination of all the other senses (Hall 2008, 120–131).

As the language of design is largely visual, 'learning to see' is a 'core idea' which should be addressed from the beginning in educating designers (Bruner 1977, 40, 54; Sonntag 1969; Wiggins and McTighe 2005, 296). Different ways of learning to see will be discussed starting with drawing (Lecanides-Arnott 2012, 125).

Drawing as 'seeing'

Drawing is about learning to see. In the Design Foundation Course, the drawing course is divided into two equal parts, comprising figure (life) drawing and object drawing, which complement each other and reinforce important concepts (Lecanides-Arnott 2009, 2012, 126).

Quality of drawing is directly related to how much a student is 'seeing' (Nicolaidēs 1969, 5). 'Seeing' in this context is not just looking, but observing and understanding (Tzonis 2001, 22). 'Seeing is making use of all the senses through the portals of the eyes. It is about engaging with the world in a tangible and tactile way' (Lecanides-

Arnott 2010, 4). Drawing is an activity that is fundamental to design, a foundation from which ideas are realised and developed visually (Lecanides-Arnott 2010, 4; Tzonis 2001, 22).

The human figure and 'learning to see'

'In our consciousness the human figure is iconic. It is a paradigm that we carry within us and for which we design' (Lecanides-Arnott 2010, 4). Drawing from the nude figure is an established and accepted practice in art and design education (Goldstein 1996, 159–185). In order to gain an understanding of the human form and how it works, students learn to draw both nude and clothed figures (Lecanides-Arnott 2010, 4; 2012, 126).

My teaching approach reflects the principle of continuity and change and is based on two opposing approaches to 'learning to see' to which I was introduced as a student. This approach is based on the concepts put forward by Nicolaïdes (1969), which he named 'gesture' and 'contour'. I use these approaches as a basis for teaching the students to see. Although my approach has deep roots, it has evolved to fit the current context of teaching underprepared students in the Design Foundation Course. The learning experiences, and the teaching approach, are adjusted and changed to meet the needs of the foundation students. These vary from year to year depending on the individuals in the class (Bruner 1977, 40; Lecanides-Arnott 2010, 5).

Gesture drawing is done in quick energetic spurts, and is made up of many loose, broken lines, searching for form through movement (see Figure 3). Contour drawing is done slowly, in a carefully considered manner, focusing on eye-hand co-ordination, defining the edge of a form, and is made up of single, clean lines (see Figure 4) (Lecanides-Arnott 2010, 5; 2012, 128).



Figure 3: Object gesture drawing, compressed charcoal on paper (student work, Design Foundation Course, CPUT 2005)

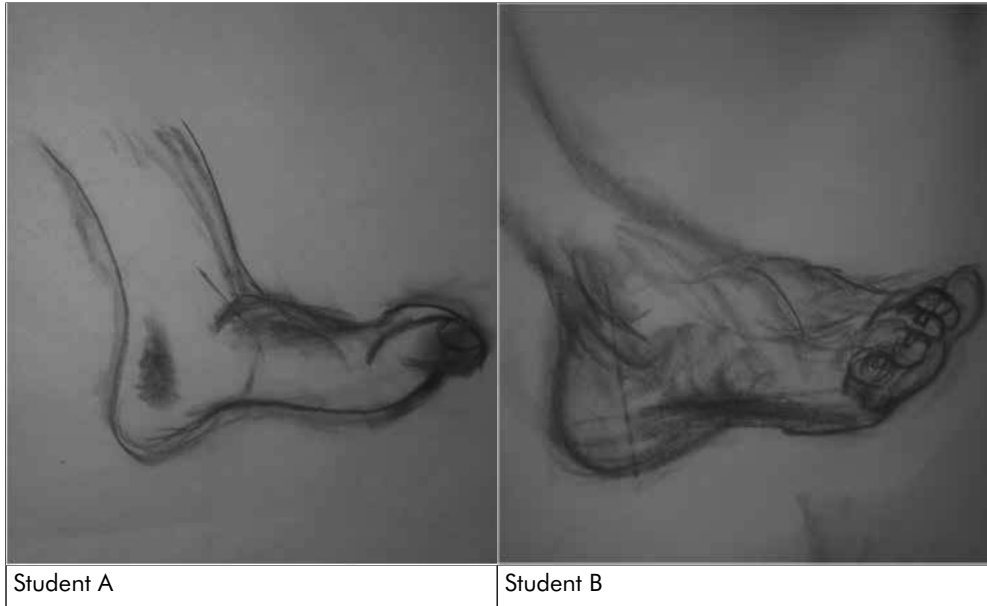


Figure 4: Figure contour drawing, black fine-liner pen on paper (student work, Design Foundation Course, CPUT 2008)>

‘Learning to see’ enables confidence

Initially there may be a lack of confidence and great uncertainty among the students, as the figure drawing classes are interactive and require the students to engage completely, in a very physical way. The students are often fearful (Nelson and Stolterman 2003, 2) as the process is direct and exposes their visual strengths and weaknesses. The time that it takes varies, but most of the students engage in the process and as soon as they can see that they are making progress, their fear diminishes and their confidence and self-awareness begin to grow. This in turn usually leads to exponential development in the way the students approach their work, which is reflected in the resultant drawings, as what it does is to ‘raise [the student’s] sights above the narrow channel through which he [/she] normally sees’ (Schön 1983, 314).

... I never knew that I could draw the form that I was seeing. But now I know that if I push myself, then I can do well, I can improve ('Iris', fashion design student: filmed interview, 2011 from 2008 foundation student group).



Figures 5 and 6: Comparison of two gesture drawings of feet done during the same drawing session in the second semester of the foundation year of study (Design Foundation Course student gesture drawing studies of feet, July 2009, compressed charcoal on newsprint)

However, approximately 10 per cent of the class each year struggle to 'learn to see' through drawing (see Figures 5 and 6), and for these students other means of gaining an understanding of the visual language are essential, such as exploring the use of colour, stylisation and simplification; working in 3D; visual analysis in the theory subjects; and using the formulaic drawing conventions of the different design disciplines (perspective and axonometric drawings, and sections and plans to scale in order to visualise ideas) (Lecanides-Arnott 2012, 131). Figures 5 and 6 compare two gesture drawings of feet done during the same drawing session in the second semester of the foundation year of study. Student A's drawing has not shown much progress from the first figure-drawing session of the year, whereas Student B, who started off drawing poorly, benefited through 'learning to see' from drawing. Student A was not receptive to the drawing process and avoided the risk of allowing herself to enter into the unknown without fear, unlike student B who engaged and became immersed in the drawing process from the very first drawing session.

'Learning to see' through criticism and analysis

According to Lecanides-Arnott (2010, 4):

Learning to 'see' does not only occur through the act of drawing, but also through students learning to discuss and analyse their own and each other's drawings. The physical act of learning to see through drawing is transferred to the cerebral act of 'seeing' by looking at the drawings critically. This is done through comparative analysis.

In order to understand something, a person must be able to compare it with something else, preferably its opposite (Bourdieu 1967, 346; Wölfflin 1950, 32–40).

Learning through comparative analysis is a means for students to develop critical thinking skills. According to *Bloom's Taxonomy of learning* (1956) (knowledge, comprehension, application, analysis and synthesis), the students engage in the lower levels of the cognitive domain. However, the highest level of cognition, that of evaluation, is introduced early on in the figure drawing through the studio group critique, and in 'learning to see' through comparative analysis of their own and others' work. Making use of the evaluative level of cognition (dealing with complex ideas at an appropriate level early on) is an approach that is supported in the teaching of architecture students (Arens, Hanus and Saliklis 2009, 1), and is reaffirmed by education theorists (Bruner 1977, 33, 40, 52; Lecanides-Arnott 2012, 76; Wiggins and McTighe 2005, 292, 314).

The students learn to critique and assess their own and each other's drawings with the guidance of the drawing teachers. The studio group critique as a method of assessment and learning, described as 'reflection in action' (Schön 1983, 276), was introduced by Josef Albers in the foundation course at the Bauhaus (Schmitz 2006b, 375), and continues to be used in drawing and in other design subjects in the Design Foundation Course. As the students' levels of visual literacy and their critical thinking abilities increase, they use comparative analysis incrementally, not only in drawing but in the theoretical and studio-based design subjects (Lecanides-Arnott 2012, 134).

Colour as 'learning to see' by bridging art and science

The complex and essential aspect of colour in design demonstrates very clearly that through transference of knowledge and skills and the repetition of fundamental principles ('core ideas') in different situations, new learning habits are successfully established (Boud 2001, 38).

'Similar to "learning to see" through drawing, which is not only about the physical act of drawing, colour cannot simply be regarded scientifically as an optical perception phenomenon, because colour has symbolic value' (Lecanides-Arnott 2012, 136). Like drawing, colour is an essential element in the 'critical visualisation' of ideas (Hall 2008, 120–131; Wiggins and McTighe 2005, 319).

Colour conveys meaning about specific cultures, and if we take the view that ‘designers create culture’ (McCoy 1990, 21), then, as artists have done for many centuries, designers should use colour (pigment) symbolically to express emotions, and luminance (colour values) to convey form, shape, pictorial depth and three-dimensionality in their designs (see Figure 7) (Gage 2006, 7; Livingstone 2002, 10, 37, 137).

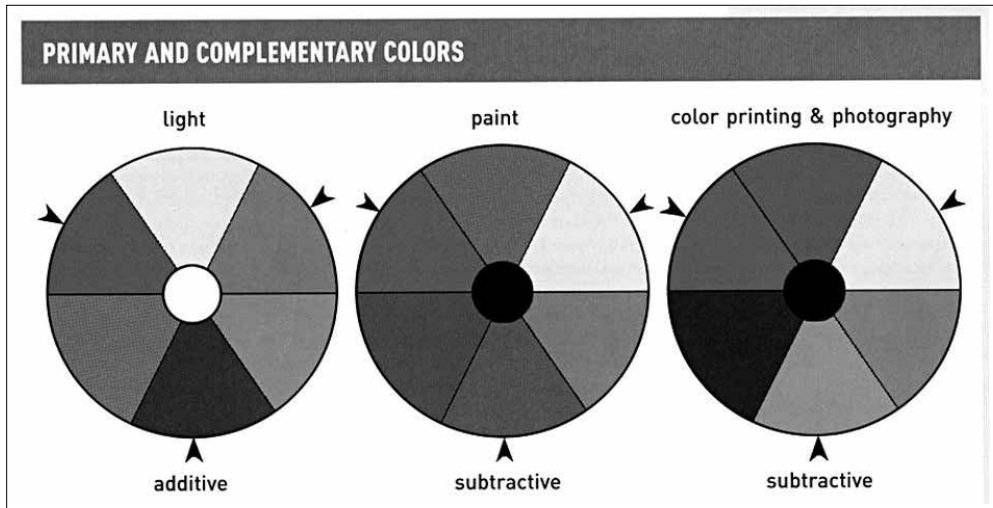


Figure 7: Luminance (colour values) and colour (pigment). Colour wheels: Primary and complementary colours. In the original illustration, which is in colour (Livingstone 2002, 171), the arrow heads indicate the three primary colours, with the complementary colours opposite the primary colours on each circle. The primaries and their complementary colours differ according to light or pigment colour.>

Past foundation students have identified the way colour has been taught as being a successful aspect of the curriculum for the Design Foundation Course. During a filmed interview with the 2008 foundation student focus group, ‘Peter’ (industrial design) and ‘Violet’ (surface design) highlighted different aspects regarding colour studies in the foundation course. ‘Peter’ said that learning to mix colours for use in the colour wheel helped with the surface design repeat pattern project and all other projects that needed colour during the rest of the year. ‘Violet’, who discovered how to use colour in the foundation course, spoke about its transformative power. Owing to the diagnostic function of the foundation course, she changed from fashion design to surface design, where the use of colour is emphasised (Lecanides-Arnott 2012, 136).

I thought fashion was the greatest thing in design ... I knew nothing about colour ... Surface design is a little easier because you can come up with a separate design and you use patterns, and then you just add colour and it becomes something else (‘Violet’, graduating surface design student 2011: filmed interview, 2008 foundation student focus group).

INTEGRATING THEORY WITH PRACTICE: 'THINKING THROUGH DOING'

In the studio-based design subjects, learning is encouraged through the development of self-research, through drawing and the hands-on 'thinking through doing' (Arens 2010; Illich 1973; Ranjan 2005; Schön 1983). The emphasis is on 'learning to see', and developing an understanding of the visual language through analysis and synthesis (Arens et al 2009, 6–7; Sonntag 1969, 393). To this end, lecturers in the theory subjects (which include language, numeracy, computer and life skills) and the studio-based staff work closely together so that 'key ideas' are reinforced in all areas of learning (Bruner 1977, 12, 52; Tyler 1949, 19, 157; Wiggins and McTighe 2005, 296). The teaching and learning approach is demanding on staff and students in the beginning, but as the year progresses the benefits are revealed in the outcomes of the students' work.

... you guys forced us to go through that design process, to go and get research, go and work with your ideas and get to an end product, and that was very hard for me at the beginning of the year. I struggled ('Clint', graduating architectural technology student 2011: filmed interview, 2008 foundation student focus group) (Lecanides-Arnett 2012, 123).

Through the continued application of the design process of 'thinking through doing', the students gain in confidence and with time they are able to work more independently.

THE DESIGN PROCESS AND THE TRANSFERENCE OF KNOWLEDGE AND SKILLS

What emerged was that, according to their different conceptual and perceptual abilities, the focus group as a whole understood and made use of the 'core idea' of the transference of knowledge and skills from one design discipline to the other. They were critically aware that transference made it easier to engage in the design process by applying what they had learned previously to different and new situations. 'Glenda', a graduating interior design student 2011, described the transference of what she had learnt in drawing to the design process as 'the key to opening the door to design' (filmed interview, 2008 foundation student focus group) (Lecanides-Arnett 2012, 149).

'Sophia' said that by working closely to the brief through the design process she learned to

think of ideas quicker, or use symbols ... I think that at this stage you have to think of where you're heading to, and something, like a symbol, something to [symbolise] what you want to do ('Sophia', interior design student 2011: filmed interview, 2008 foundation student focus group).

What was clear from this statement was that although the solution for the final outcome had not yet been found, ‘Sophia’ understood that she had to keep the ‘desired result’ in mind (Cross 2007, 57; Wiggins and McTighe 2005, 338), so she described the final outcome/design end product as a ‘symbol’.

When ‘Sophia’ was asked to explain her statement by giving an example from one of her design projects, she referred to a surface design project and gave the following explanation:

With surface there is a lot of planning. You have to think what shapes you’re going to use, what colours you’re going to use ... and it takes such a long time before you get to the final idea, and the closer we get to the end of this [foundation] year, it became much easier for me to think of something and to produce the end of it (‘Sophia’, graduating interior design student 2011: filmed interview 2008, foundation student focus group).

What ‘Sophia’ demonstrated was that she had grasped the complex concepts of ‘design thinking’ and ‘backward design’, of working with the ‘desired result’ in mind (Wiggins and McTighe 2005, 18–19). The sequential development of the curriculum, and the teaching approach with emphasis on the iterative nature of the design process, play key roles in helping the students develop the understanding that they have to keep the ‘desired result’ in mind, but at the same time allow for unexpected possibilities and creative solutions to occur in the process (Lecanides-Arnott 2012, 156).

Table 5: Knowledge versus understanding (Wiggins and McTighe 2005, 38)

Knowledge	Understanding
The facts	The meaning of the facts
A body of coherent facts	The ‘theory’ that provides coherence and meaning to those facts
Verifiable claims	Fallible, in-process theories
Right or wrong	A matter of degree or sophistication
I know something to be true	I understand why it is, what makes it knowledge
I respond on cue with what I know	I judge when to and when not to use what I know

The other aspect that should be recognised from Sophia’s experience is that designers often have a high visual quotient (VQ), resulting in a tendency for design students to develop theory from the practical design work with which they are engaged (Raein 2004, 163). This resonates with Sophia’s experience and the view that ‘what is significant about the Bauhaus foundation course is the close interplay of theory and skill’, that theory is developed from practice (Ranjan 2005, 3).

The design process and the development of a research framework to bridge art and science

The findings of the research endorsed the acknowledged view that design is a field of study that bridges art and science (see Table 3) with the need for designers to be confident and self-aware in order for creative action to take place (Buchanan 1989, 103; 2006, 15; Cross 2007, 123; Lecanides-Arnott 2012; Nelson and Stolterman 2003, 4).

Popper's scientific/creative method, which is open, iterative and evolutionary in nature, is appropriate as the basis of the research framework (Lecanides-Arnott 2012, 177–178).

$$P_1 \rightarrow TT \rightarrow EE \rightarrow P_2 \dots$$

Figure 8: Popper's method (problem (P1) → a tentative theory (TT) → error elimination (EE) → new problem (P2)) (Magee 1975, 65; Popper 1978, 132)

The scientific/creative method, synchronous with the iterative nature of the design process, encourages continuity and change, necessary in dealing with a complex world in flux. The method begins by addressing a problem; followed by finding a tentative solution to the problem through error elimination; and finally leads to the investigation of a new problem (Popper 1978, 132). It is the interpretations that we place on appearances that are meaningful, that 'seeing' is not only about observing but understanding, that our senses do not say anything 'only our interpretations of them do, and those are very fallible. But the real key to science is that our explanatory theories – which include those interpretations – can be *improved*, through conjecture, criticism and testing' (Deutsch 2012, 8).

SUMMING UP: GUIDELINES FOR A CONCEPTUAL FRAMEWORK TO ENABLE CRITICAL SELF-AWARENESS AND CONFIDENCE IN A DIVERSE STUDENT BODY

Analysis and interpretation of the data confirmed that, in order to enable critical awareness and confidence in a diverse student body, the following guidelines for the development of a conceptual framework in design education should be considered (Lecanides-Arnott 2012, 167):

- Higher education in design should begin at foundation level through a curriculum that is open, flexible, integrated and based on 'core ideas' (McCoy 1990; Ranjan 2005; Sonntag 1969).
- 'Core ideas' and 'core tasks' need to be addressed early, for meaningful understanding to occur (Bruner 1977, 3, 40, 52; Wiggins and McTighe 2005, 314).

- Analysis and synthesis are necessary for the development of confident self-awareness and ‘optimistic’ self-criticism (Arens et al 2009; Deutsch 2012; Sonntag 1969).
- The need for continuity and change, and the recognition that memory is reality (Goldstein 1996, 299; Hughes 1980, 21; Illich 1973, 24–25; Tyler 1949, 90).
- A student-centred approach that emphasises reflective practice and constructivism through ‘learning by doing’ is confirmed as being crucial to the understanding of subject content (Illich 1973, 9–31; Wiggins and McTighe 2005, 292).
- In educating the designer, careful attention should be given to both the ‘artist’ (designer) and the ‘object’ (design outcomes) (Leifer 2010; Sonntag 1969, 392).

CONCLUSION

This longitudinal, interpretive study of design foundation education confirmed the need for further research, particularly with regard to curriculum development beyond an integrated, multidisciplinary foundation course in design. A one-year multidisciplinary foundation course provides breadth in the critical awareness of design and in how the different design disciplines relate and fit together, but it does not provide the necessary depth for specialisation in a specific design discipline (Lecanides-Arnott 2012, 176).

What is essential is the integration of theory (‘brainwork’) and practice (‘handiwork’) to develop confident self-criticism in students to enable creative thinking and design action (Ranjan 2005, 1–5; Yorke 2003, 481–485).

‘Design thinking’ and ‘creative action’ develop critical self-awareness and confidence in students. The scientific/creative method is based on the advancement of knowledge through criticism (Magee 1975, 67), which is integral to the design process. Knowledge and criticism are central to teaching and learning in design education. Generative self-criticism (‘design thinking’ and ‘creative action’) in students provides the most appropriate benchmarking instrument for assessment of practical design outputs – confirming from a position of critical awareness, ‘the place of values in a world of facts’ (Popper 1978, 193).

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REFERENCES

- Arens, R. M. 2010. White space: Taking beginning students from the abstract to the architectural. In *Proceedings of ConnectED 2010: 2nd International Conference on Design Education, 28 June to 1 July 2010*, ed. G. Forsyth. Sydney: University of New South Wales.
- Arens, R. M., J. P. Hanus and E. Saliklis. 2009. Teaching architects and engineers – Up and down Bloom’s Taxonomy. *National Conference of the American Society of Engineering Education*, Austin, Texas, 14–17 June 2009.
- Babbie, E. 2010. *The practice of social research*. 12th ed. Belmont, CA: Wadsworth, Cengage Learning.
- Berger, J. 1972. *Ways of seeing*. London: British Broadcasting Corporation, Harmondsworth: Penguin.
- Bernstein, B. 1999. Vertical and horizontal discourse: An essay. *British Journal of Sociology of Education* 20(2): 157–173.
- Blair, B. 2010. Lost in translation? – An examination of the perception, interpretation and impact of verbal feedback on international design students in the UK. In *Proceedings of ConnectED 2010: 2nd International Conference on Design Education, 28 June to 1 July 2010*, ed. G. Forsyth. Sydney: University of New South Wales.
- Bloom, B. S., M. D. Engelhart, E. J. Furst, W. H. Hill, and D. R. Krathwohl, eds. 1956. *Taxonomy of educational objectives: The classification of educational goals; Handbook 1: Cognitive domain*. New York: Longman Green.
- Boud, D. 2001. Knowledge at work: Issues of learning. In *Work-based learning: A new higher education?*, ed. D. Boud and N. Solomon, 34–43. Buckingham: Open University Press.
- Boughey, C. 2005. ‘Epistemological’ access to the university: An alternative perspective. *South African Journal of Higher Education* 19(4): 230–242.
- Bourdieu, P. 1967. Systems of education and systems of thought. *International Social Science Journal* 19(3): 338–358.
- Bruner, J. S. 1977. *The process of education*. 2nd ed. Cambridge, MA: Harvard University Press.
- Buchanan, R. 1989. Declaration by design: Rhetoric, argument, and demonstration in design practice. In *Design discourse: History, theory, criticism*, ed. V. Margolin, 91–110. Chicago, IL: University of Chicago Press.
- . 2006. Anxiety, wonder and astonishment: The communion of art and design. In *Enhancing curricula: Contributing to the future, meeting the challenges of the 21st century in the disciplines of art, design and communication: 2006 3rd International conference*, ed. A. Davies, 13–22. London: Centre for Learning and Teaching in Art & Design.
- Cronjé, J. C. 2006. Paradigms regained: Towards integrating objectivism and constructivism in instructional design and the learning sciences. *Educational Technology Research and Development* 54(4): 387–416.
- Cross, N. 2007. *Designerly ways of knowing*. Basel: Birkhäuser.
- Denzin, N. K. 2002. The interpretive process. In *The qualitative researcher’s companion*, ed. A. M. Huberman and M. B. Miles, 349–365. Thousand Oaks, CA: Sage.
- Department of Education. 2006. *Funding for foundational provision in formally approved programmes: 2007/8 to 2009/10*. Pretoria: DoE.
- Department of Higher Education and Training. 2012. *Foundation provision in ministerially approved programmes: 15 May 2012*. Pretoria: DHET.
- Deutsch, D. 2012. *The beginning of infinity: Explanations that transform the world*. London: Penguin.

- DHET see Department of Higher Education and Training.
- DoE see Department of Education.
- Dorst, K. 2010. Design thinking at large. In *Proceedings of ConnectED 2010: 2nd International Conference on Design Education, 28 June to 1 July 2010*, ed. G. Forsyth, Sydney: University of New South Wales.
- Ellis, G. F. R. 2013. Personal communication, 9 May 2013.
- Gage, J. 2006. *Colour in art*. London: Thames and Hudson.
- Garraway, J. 2010. Field knowledge and learning on foundation programmes. In *Beyond the university gates: Provision of extended curriculum programmes in South Africa*, ed. C. Hutchings and J. Garraway, 31–39. Grahamstown: Rhodes University.
- Goldstein, C. 1996. *Teaching art: Academies and schools from Vasari to Albers*. New York: Cambridge University Press.
- Gombrich, E. H. 1984. *The story of art*. 14th ed. Oxford: Phaidon.
- Hall, P. 2008. Critical visualization. In *Design and the elastic mind*, ed. P. Antonelli and P. J. Vecchierini, 120–131. New York: Museum of Modern Art.
- Huberman, A. M. and M. B. Miles, eds. 2002. *The qualitative researcher's companion*. Thousand Oaks, CA: Sage.
- Hughes, R. 1980. *The shock of the new: Art and the century of change*. London: British Broadcasting Corporation.
- Illich, I. D. 1973. *Deschooling society*. Harmondsworth: Penguin.
- Kloot, B., J. M. Case and D. Marshall. 2009. A critical review of the educational philosophies underpinning science and engineering foundation programmes. *South African Journal of Higher Education* 22(4): 799–816.
- Lecanides-Arnott, M. 2009. Assessment of student work. Presentation for Staff Teaching and Learning Day, Faculty of Informatics and Design, 25 August, Cape Peninsula University of Technology, Cape Town.
- . 2010. Grounding for aware and versatile designers: Towards a conceptual framework in an integrated multidisciplinary foundation programme in South Africa. In *Proceedings of ConnectED 2010: 2nd International Conference on Design Education, 28 June to 1 July 2010*, ed. G. Forsyth, Sydney: University of New South Wales.
- . 2012. Towards a conceptual framework for an integrated, multidisciplinary foundation programme to educate critically aware and skilled designers in South Africa. MTech dissertation, Cape Peninsula University of Technology, Cape Town.
- Leifer, L. 2010. Dancing with ambiguity: Design thinking in theory and practice. In *Proceedings of ConnectED 2010: 2nd International Conference on Design Education, 28 June to 1 July 2010*, ed. G. Forsyth, Sydney: University of New South Wales.
- Livingstone, M. 2002. *Vision and art: The biology of seeing*. New York: Abrams.
- Magee, B. 1975. *Popper*. 2nd ed. Glasgow: Fontana/Collins.
- Manzini, E. 2009. A cosmopolitan localism: Prospects for a sustainable local development and the possible role of design. In *Design studies: A reader*, ed. H. Clark and D. Brody, 448–453. Oxford: Berg.
- McCoy, K. 1990. Educating the designer. *Design Issues* 7(1): 20–22.
- M'Rithaa, M. K. 2009. Mainstreaming universal design in Cape Town: FIFA 2010 World Cup™ related activities for social change. DTech thesis, Cape Peninsula University of Technology, Cape Town.
- Nelson, H. G. and E. Stolterman, 2003. *The design way. Intentional change in an unpredictable world: Foundations and fundamentals of design competence*. Englewood Cliffs, NJ: Educational Technology.
- Nicolaides, K. 1969. *The natural way to draw: A working plan for art study*. 2nd ed. Boston, MA: Houghton Mifflin.

- Popper, K. 1978. *Unended quest: An intellectual autobiography*. 2nd impression with corrections. Glasgow: Fontana/Collins.
- Raein, M. 2004. Integration of studio and theory in the teaching of graphic design. *Art, Design and Communication in Higher Education* 3(3): 163–174.
- Ranjan, M. P. 1999. Design before technology: The emerging imperative. Proceedings of the Asia Pacific Design Conference, 12 October, Osaka, Japan.
- . 2005. Lessons from Bauhaus, Ulm and NID: Role of basic design in post-graduate education. *Proceedings of Design Education: Tradition and Modernity International Conference, DETM 05*, Ahmedabad: National Institute of Design, 2–4 March 2005.
- Rose, D. 2008. Redesigning foundations: Integrating academic skills with academic learning. In *Conversations about Foundation and Extended Curriculum Provision: Conference Proceedings*, ed. J. Garraway, 15–36, Granger Bay, Cape Town. Fundani CHED, Bellville: Cape Peninsula University of Technology.
- Schmitz, N. M. 2006a. The preliminary course under Johannes Itten – Human Education. In *Bauhaus*, ed. J. Fiedler, 360–367. Cologne: Könemann.
- . 2006b. The preliminary course under Josef Albers – Creativity School. In *Bauhaus*, ed. J. Fiedler, 374–381. Cologne: Könemann.
- Schön, D. A. 1983. *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- . 2009. Designing: Rules, types and worlds. In *Design studies: A reader*, ed. H. Clark and D. Brody, 110–114. Oxford: Berg.
- Scott, I. 2000. *Undergraduate degree structures. Critical issues: Comments on CHE Size and Shape Task Team Discussion Document*. http://www.commerce.uct.ac.za/Organisations/Academics_Union/critical_issues/Issues/scott.php (accessed 12 May 2012).
- Scott, I., N. Yeld and J. Hendry. 2007. A case for improving teaching and learning in South African higher education. CHE – Higher Education Monitor 6 October. <http://www.che.ac.za/documents/d000155/> (accessed 25 May 2012).
- Sims, E. 2008. *Teaching landscapes in creative arts subjects*. London: University of the Arts.
- Sonntag, E. 1969. Foundation studies in art today. *Leonardo* 2(4): 387–397.
- Trowler, V. and P. Trowler. 2010. Case study 3: Using ‘Creative Space’ at Bridges CETL, University of Bedfordshire, UK. Student Engagement Case Studies. *Deliverable 3 for the Higher Education Academy Student Engagement Project*. Department of Research, University of Lancaster.
- Tyler, R. W. 1949. *Basic principles of curriculum and instruction*. Chicago, IL: University of Chicago Press.
- Tynan, J. 2006. Access and participation: Rethinking work-based learning on the foundation degree in art and design. *Art, Design & Communication in Higher Education* 5(1): 39–53.
- Tzonis, A. 2001. *Le Corbusier: The poetics of machine and metaphor*. New York: Universe.
- Volbrecht, T. and C. Boughey. 2004. Curriculum responsiveness from the margins? A reappraisal of academic development in South Africa. In *Curriculum responsiveness: Case studies in higher education*, ed. H. Griesel, 57–79. Pretoria: South African Universities Vice-Chancellors Association.
- Wiggins, G. and J. McTighe. 2005. *Understanding by design*. 2nd ed. Alexandria VA: Association for Supervision and Curriculum Development.
- Wölfflin, H. 1950. *Principles of art history: The problem of the development of style in later art*. New York: Dover.
- Yorke, M. 2003. Formative assessment in higher education: Moves towards theory and the enhancement of pedagogic practice. *Higher Education* 45: 477–501.