The First Year Experience: Engineering for Social Change

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Abstract

The first-year transition period is a crucial phase in a student's university experience as it can significantly impact their academic performance and future career prospects. However, research indicates that approximately 30% of first-year students drop out due to academic expectations and newfound independence. In response to this concern, a Faculty of Engineering at a South African University of Technology has implemented a tailored First-Year Experience (FYE) programme to support students. This reflective paper examines a tailored First-Year Experience (FYE) programme implemented to support students' transition into university. The FYE programme is informed by Kolb's Experiential Learning Cycle (ELC).

Based on reflections from the four core team members and their unique perspectives from the various roles they bring with them to the FYE programme, the paper seeks to offer an in-depth practice based account and insights into the learning environment of the first-year student by reflecting on the programme's development and impact using the four phases of the ELC framework. The 'Concrete Experience' phase discusses the experimentation with technological platforms and software tools to facilitate the programme, highlighting insights, challenges, and student engagement. In the 'Reflective Observation' phase, student involvement is analysed, emphasising the importance of fostering student ownership of the programme. The 'Abstract Conceptualisation' phase identifies areas for programme improvement, including addressing social concerns specific to the university and it proposes developing a credit-bearing compulsory subject called "Engineering for Social Change." The 'Active Experimentation' phase provides insights into best practices for supporting first-year students' successful transition and engagement in engineering education.

Keywords: First Year Experience; Kolb's ELC; Student support

1 Introduction

The first year of university poses several challenges for students, especially those in technical fields like engineering. Universities worldwide, including the Cape Peninsula University of Technology (CPUT) in South Africa, are concerned about the high number of first-year students dropping out. To address this issue, the university's Faculty of Engineering has launched a customised First-Year Experience (FYE) programme to help students transition to university life.

In this paper, a group of lecturers who developed the FYE programme share their reflections. They drew inspiration from Kolb's (1984) Experiential Learning Cycle and described how they used its four phases to assess the programme's development and impact. The authors experimented with various technological platforms and software tools to facilitate the programme and measure student engagement to gauge the overall effectiveness of the programme. They also reflect on critical areas of improvement, such as addressing context-specific social concerns and food insecurity among first-year students.

Although this study is based on reflections from only four core team members, their roles as coordinators and designers of the Faculty's FYE programme afford them unique, embedded perspectives. The aim is not to generalise but to offer an in-depth, practice-based understanding of how the FYE programme evolved to meet the complex challenges of first-year transition. Drawing on collaborative autoethnography and Kolb's Experiential Learning Cycle, these reflections surface insights that are both context-specific and broadly relevant for informing more supportive learning environments in engineering education. Although we do not

claim to measure impact definitively, the study highlights critical adaptations and lessons that can guide similar interventions elsewhere.

This study highlights the importance of targeted FYE programmes and provides insights into best practices for supporting students' successful transition and engagement in engineering education. The authors' reflections will inform the future development of the FYE programme, which they propose calling "Engineering for Social Change." They suggest making it a credit-bearing compulsory subject for all first-year students. This paper provides useful insights for educational institutions looking to create effective FYE programmes that support students' academic success and well-being.

2 Conceptual framework

This study applies Kolb's (1984) Experiential Learning Cycle as a framework to analyse the researchers' reflections on the programme's development and impact. The framework consists of four phases: concrete experience, reflective observation, abstract conceptualization, and active experimentation. These phases will be discussed in the literature review and findings and discussion sections of the paper. The framework highlights specific practices for both lecturers and students within each phase. It is important to note that the steps can be entered at any point in the cycle but must follow the sequential order.

Furthermore, there are four learning styles: divergers, assimilators, convergers, and accommodators. It is essential to consider both the phases of the cycle and the learning styles together, as the learning styles can describe how students learn within the phases. This information is significant because the authors' reflections can provide reflective data on the learning processes in Kolb's cycle. The authors have considered the students when constructing the content, and they themselves have acted as learners or students while learning to create content in a specific way using technology.

3 Literature Review

The approach to learning designed by Kolb consists of three components which include the theory of experiential learning, the learning cycle model, and learning styles (Bergsteiner, Avery and Neumann, 2010:29). The experiential theory is described by Healy and Jenkins (2000:185; Fenwick, 2001) to structure a course or session by using a learning cycle, and where they further emphasise that Kolb's theory shows ways in which to do so through a learning process through knowledge and experience.

As an alternative to traditional classroom approaches, several authors (Healey and Jenkins 2000; Holman, Pavlica and Thorpe 1997; Bergsteiner et al., 2010: 29) relate that Kolb’s experiential learning theory is a good approach as a learning cycle, as it allows students to develop themselves and change their personal method of learning. The approach allows for learning, as a holistic process, to be a cognitive process which includes engagement and adaption, and where students can create knowledge through experience (Bergsteiner et al., 2010: 30). In this way individuals can make their own decisions around engagement and learning (Kolb and Kolb, 2009).

The learning cycle model, seen in Figure 1 below, shows four phases of the cycle: concrete experience, reflective observation, abstract conceptualisation, and active experimentation. The individual can enter the cycle at any time, but they will have to follow into the next phase in the cycle (Healy and Jenkins, 2000:186).

Concrete experience refers to the place where learning is taking place, for example, the lecturers discussed content topics and brainstormed in a meeting as to how content will be delivered. Reflective observation is the second phase where the individuals reflect, analyse, and observe their experience from the first phase. In abstract conceptualization phase the participant attempt to make sense of their experience by developing concepts, theories, or generalizations, and then look for any patterns and connections between their experiences and their knowledge. In the last phase, active experimentation, the participant uses the concepts and theories developed in the third phase to form innovative ideas and actively experiment with different approaches.

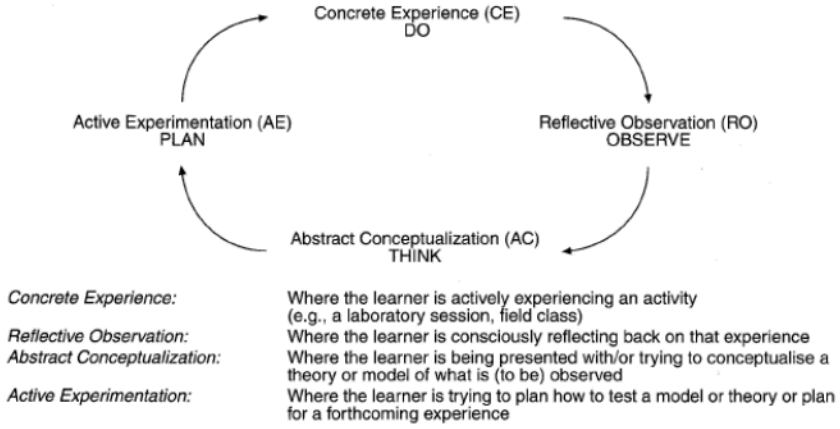


Figure 1: Kolb's Experiential Learning Cycle (based on [Jenkins, 1998:43])

Each of the phases in his framework has activities associated with them (Bergsteiner et al., 2010: 33). For example, concrete experience looks at a person's direct experience (including in-class experience), simulations and lecture examples. Reflective observation includes discussion and brainstorming. Abstract conceptualisation has activities such as project proposals, text reading and lecture descriptions, and lastly active experimentation includes fieldwork, homework, case studies, and simulations (Bergsteiner et al., 2010:36).

Kolb's work in management education was the basis for his work on learning styles and his learning model (Bergsteiner et al., 2010: 30). He suggested that students learn in particular ways and develop a preference over time (Kolb, 1984). The four learning styles he outlined are divergers, assimilators, convergers, and accommodators (Healy and Jenkins, 2000:187). Divergers perceivet a situation by considering numerous perspectives and rely mostly on brainstorming ideas. Assimilators use reasoning and can develop theoretical models of the information they are working with. Hypothetical thinking is used by those that are convergers, and lastly, accommodators are that can plan, carry out, and adapt to their situations (Healy and Jenkins, 2000:187). Each person uses their preferred learning style among these, including teachers, as they reflect and shape their teaching according to their learning style (Healy and Jenkins, 2000:189-190). This could lead to a mismatch with the students' learning style, which could affect the students learning (Fielding, 1994). Therefore, Kolb emphasizes that the teacher should use a mixture of various teaching methods to accommodate the styles of learning in the classroom (Healy and Jenkins, 2000:186). To accomplish this, FYE used the digital platforms to provide students with a range of learning material to support the learning styles of students and broaden that of the teachers who created the content.

4 Research Design

This study adopted a constructivist and interpretivist methodological approach. Cresswell and Clark (2018) argue that these philosophical frameworks emphasize the subjective and socially constructed nature of knowledge. Constructivism posits that individuals actively build their own understanding of the world through interactions and personal experience of their environment. Concomitantly, interpretivism underscores the significance of interpretation in comprehending human behaviour and social phenomena. Interpretivism contends that there is no objective reality outside the social and cultural contexts in which it is constructed. Thus, individuals create meaning through their experiences and interpretations of the world. The combination of these two perspectives forms the philosophical foundation of this study, emphasizing the importance of understanding individuals' perceptions and interpretations of their experiences to gain deeper insights into social phenomena.

Based on the views of Roy and Uekusa (2020), the strategy adopted to perform data collection and analysis is a collaborative autoethnography (CAE). Roy and Uekusa (2020) explain that CAE integrates the principles of autoethnography, where the researcher reflects on their individual experiences, with collaborative research, involving joint data collection and analysis with others. In this study, multiple collaborators engaged in reflection on our individual experiences, contributing to a collective narrative that delved into a shared topic or issue.

4.1 Participant Autoethnographers

The reflective data presented in this study was generated by four core members of the Faculty of Engineering's FYE programme team. These include three faculty-level coordinators responsible for Language, Learning and Teaching, and Student Engagement, as well as one departmental coordinator for Learning and Teaching based in the Department of Electrical, Electronic and Computer Engineering. All four team members contributed to the collaborative development and implementation of the FYE programme, and data was collected from each of them to inform the collaborative autoethnographic reflections discussed in this paper.

4.2 Data Collection Instrument

Kolb's (1984) Experiential Learning Theory served as the underpinning theoretical framework for the development of reflective questions in the data collection instrument of this study. These questions were crafted to prompt individual academics' reflections. Drawing on the work of Kolb (1984), three prompting questions were developed for each aspect of the framework, namely (1) Concrete Experience, (2) Reflective Observation, (3) Abstract Conceptualization and (4) Active Experimentation. The prompting questions can be seen in Table 1.

Table 1: Three prompting questions for each aspect

Concrete Experience	What were the specific tasks and activities involved in developing the FYE programme? How did you collaborate with your colleagues during the programme development process? What were the challenges and obstacles you encountered while working on the programme?

Reflective Observation	How did the use of different technologies (MS Teams, MS Excel, Blackboard Collaborate, H5P interactive software, LinkedIn Learn) impact programme development? What feedback or responses did you receive from colleagues or students during the development phase? How did your experiences during the development process influence your thoughts and perceptions?
Abstract Conceptualization	What were the key themes and patterns that emerged from your experiences and observations? How did the FYE programme align with the specific needs of first-year students in your faculty? In what ways did you envision the programme contributing to broader social impact and student success?
Active Experimentation	What lessons did you learn from developing the FYE programme, and how do you plan to apply them in the future? How will your experiences inform future programme enhancements or other educational initiatives? Describe your vision for the future development of the FYE programme, including its potential impact on student success and well-being.

4.3 Data Analysis

By engaging with the prompting questions in Table 1, we drew on our direct experiences and undertook a process of critical self-examination. We performed the initial thematic analyses of the dataset as individuals. The initial individual analysis enhanced the study's veracity by mitigating potential bias. Following this, we had group discussions to converge our findings collaboratively. Simultaneously, determinations were made regarding the inclusion or omission of specific themes and codes. A consensus-driven approach underscored the collaborative nature of code clustering and theme development in our study.

5 Findings and Discussion

This section presents the findings and discussion from the themes that emerged from the analysis in the four phases of Kolb's framework of the lecturer reflections.

5.1 Concrete Experience

There were various tasks and activities involved in the development of the FYE programme and during the development, the reflectors indicated that there was huge emphasis placed on conceptualising what the programme would look like. This became evident when respondent 1 indicated that "I was quite involved in drawing up possible timelines, following order of topics." This was later corroborated by respondent 3 who stated that "tasks involved in developing the FYE programme ranged from identifying the correct placement of the programme". R4 was supported by R1 and R3 when indicating that the planning of topics was a key component in developing the programme. R4 also stated that "To deploy the lessons, we needed to plan topics and then decide how to present each topic"

As the tasks grew, the programme called for collaboration with colleagues during the development process. Based on the responses received, it is evident that no roles were allocated. Collaborators on the project

performed any role they were confident in and contributed towards the success of the programme. R1 stated that “I was one of the core developers and also assisted those that were developing content material for the programme.” The collaboration between the developers was cited as supportive, inspirational, and constructive. R4 indicated that “I found the whole experience interacting with the core team was supportive and constructive.” R4 also reflected on her joining the project by stating that “I did not yet feel like I was part of the project. I Could not see my value.” After that, R4 also went on to say “However, seeing what they were doing - when it came to my turn to do something - I was inspired”

However, the programme was not without challenges and obstacles. Based on the responses provided, it became evident that departmental buy-in was a challenge in some cases. Not all departments had bought into the project at the planning and implementation stage. R2 stated that “I had to spend lots of time motivating people to support the project”. This was also evident from the response from R4 who stated that “We had to include people from all departments, but it was clear that not everyone “bought into” the programme.” This was supported by R3 who indicated that “Some departments continued to engage students in academic activities during the time set for developmental programmes outside of the classroom.”

Based on Kolb’s (1984) Experiential Learning Cycle, the reflectors underwent a first-time experience through the implementation of this programme. It is evident in the reflection that at this stage of the cycle, neither of the reflectors was certain of the outcome nor the learning to be taken from this programme. However, as the stages progress, a certain level of cognitive understanding was to be expected as revealed by Kolb (1984).

5.2 Reflective Observation

To implement the programme, we experimented with and used various technologies including MS Teams, MS Excel, Blackboard Collaborate, H5P interactive software, and LinkedIn Learning. Using these positively impacted the programme development. This became evident in the reflection by R1 who indicated that “As the team had had some online sessions that were not pre-recorded, it became easier to use MS Teams to hold the session as it allowed for more control with access for the students and the relevant presenters”. This control became crucial after the first session was derailed by students as stated by R1.

Pre-recorded sessions were also made possible with the use of technology. R1 stated that “I would use Zoom Meetings to do a video and audio recording as I found it was a simpler option to use to create a recording for free and at a fraction of the file size.” As can be seen from the response from R1, technology allowed the programme to be developed at a cost-effective rate due to the compressed size of pre-recorded. R3 supported this indicating that “The use of virtual platforms to deliver content meant that students could attend the programme from wherever they are,” meaning that they would not incur any travel costs solely to come and attend the sessions. R4 indicated that “We could not have presented the programme without technology (the Learner Management System (LMS) - Blackboard and then MS Teams) because of the size of the class (the number of first years in the faculty). It would have been impossible to put them all in one physical venue.

Some of the feedback that was received from colleagues and students during the development phase which was indicated, and reiterated in the reflection, centred around the volume of work. R1 indicated that “there were some issues in terms of the volume of work students or items students were expected to go through in one afternoon”.

The experiences during the development process also influenced the thoughts and perceptions of the team. The responses provided indicated the realisation that a programme of this nature could not be successfully implemented as individuals due to the wideness of their reach. This was evident in R4's response where they indicated how intimidating the project came across at first because of its magnitude. R4 stated that "During the development, I realised the importance of the work – developing this programme as in – it was for all the first years. Not just my small class in one department. It was for all the first years across that faculty." R3 also reflects on the intimidating nature of the programme due to its size by stating that "During this phase, it became very clear that a project of this magnitude, no matter how important it is for the development of students; it would not be possible without the buy-in of every stakeholder."

R4 reflects on the project after implementation and teamwork by stating that "On the whole though, after the delivery of the programme, my work and everyone else's combined I feel pretty darn proud of us." Based on R4 responses, it is evident that the teamwork and partnership from the core team of the programme led to the successful implementation of the initiative. R1 supports R4 on the positive experience gained from the collaboration by stating that "It was overall a great experience as I was able to learn from my colleagues about their technological use, their thought processes and provide input from my thoughts as well." R1 also goes on to say, "It became an innovative space that broadened my thinking and allowed me to consider situations in advance."

As can be seen from the findings, the core team reflected on each session that passes to improve on the next session. R1 stated earlier in the findings that a session was derailed by students due to the students having equal rights on the online delivery platform as the presenters. This allowed them to unmute themselves at any point, not allowing the presenter to continue without disrupting them. This became more of a joke for the class as others would then unmute themselves to laugh at the joke.

Upon reflecting on this, we realised that this was the students' first online session of this nature, where all engineering students were in the same virtual class. With many of them attending an online session for the first time.

Kolb (1984) alludes to the notion that these reflections taking place in the reflective observation phase are the ones that form the basis for learning and improvement in the reflectors' understanding of a situation. For this project, the various changes that took place to improve the development and delivery of the programme were all determined during this phase after each session was held.

5.3 Abstract Conceptualisation

Several key themes and patterns emerged in the programme, R4 reflected on the uncertainty fuelled by a determination to succeed. This brought about the remerging of a concept presented at a conference referring to the experience as "building a plane while flying it". R4 also indicated a sense of "pride and closeness" that developed among the core team of coordinators. This is supported by R3 who states that "having been tasked with student development in the faculty, certain projects were not successful because of the lack of deliberate collaboration and partnerships with colleagues who had the necessary passion and reach to garner support for similar student development projects."

The programme aligned with some specific needs of the first-year students as R1 stated that “The themes focused on more humanistic elements that were quite noticeably missing in the student's development or socialization into the tertiary education space.” This was supported by R3 who stated that “first-year students in the engineering faculty are expected to be experts in mathematics and science; if they can master the scientific part of their studies, they will be regarded as good students” R3 and R1 both advocate for the wholistic development of the students for them to understand the diversity of the environment they are in.

As stated in the literature reviews, Kolb (1984) states that abstract Conceptualization is the phase where the participant attempts to make sense of their experience by developing concepts, theories, or generalizations. During this phase, the reflector started developing theories and generalisations not initially realised as pertinent within the faculty. These theories and generalisations emerged due to the unpredicted environmental changes that took place on campus; realising that students are less equipped to deal with various elements such as peer pressure, stress, on-campus protests, and decision-making skills among others; leading to actions of violence that have become one of the biggest concerns of the institution.

The programme, therefore, envisioned contributing to this broader social concern among others and student success. All respondents reflecting on the programme indicated the need to develop a module to address the socialisation of first-year students in the higher education space. This was seen from statements including that of R1, who stated that “I envisioned that the programme would assist the students in the process of socialization into the university space and introduce them to issues they might not have taken into account at the school level”. R3 indicated that “the programme may not have immediate results or impact the students to a great extent at the beginning. However, with the discussion and presentations, the students are expected to display more awareness of societal differences.” R4 indicated that this programme needs to be evaluated as a longitudinal study over 3 years to determine its true impact.

5.4 Active Experimentation

This phase allowed for learning in the programme as it showed ways in which the programme can be improved in the future. It highlighted the value of teamwork as a clear lesson learnt by the core team. This was seen from a statement by R1 who stated that “I learnt that team members that take on equal weighting in their respective duties makes for a smooth and great team.” This was supported by R4 who stated that “I think for starters get the right people on board if you want it to be successful. It is ok to ‘build a plane while flying it’ if you have the right team.” R4 alluded to the value of all stakeholders forming part of the team by indicating that “we should make the students our partners in this.” This means that students should be involved in the development of the modules. Involving students as stakeholders were supported by R3 when he alluded to ‘full participation’ by students to ensure engagement with these sessions for them to not become information dissemination sessions only, but fully engaging sessions that spark thoughts, ideas and change in the students.

The active experimentation phase by Kolb (1984) requires the participants to use the concepts and theories developed because of the previous phase. R2 indicated that the feedback received cited that “the programme was moving too quickly for students”. R3 also indicated the need to incorporate more activities during the delivery and leave all content that can be studied outside of the session. This is to increase the interaction of students with the content via exercises. In the second semester, the core team reduced contact time and involved more outsourced experts for facilitating workshops around the development of the students as ‘social’ beings. The use of external parties was cited by R1 who stated that “the careful scaffolding of the

programme and bringing in speakers could be a point of consideration for the development of the programme".

Upon looking at the need to monitor this project, R4 indicated the need for developing a similar programme for the Final Year Experience. The success of this programme warrants the core team to explore further than just the first-year experience. With the experience gained, developing future programmes of this nature will become much easier. To support this, R1 states that "This entire experience has been much better than there was bad and will make any future projects easier to handle and develop."

The core team has envisioned the future development of the programme and its potential impact on student success and well-being. R4 indicated the need to convert this into a formal module linking to the Dean's vision for a module called "Engineering for Social Change". This module aligns with the institution's Vision 2030 and the Graduate Attributes. R4 and R3 agree that content from this envisaged module would provide students with the "critical and soft skills" that they need to be "good citizens" and to be "successful and socially aware" in the world.

6 Conclusion

Kolb's (1984) framework allowed the authors to reflect on their practices using the four phases. It provided a holistic questioning of the content, technological use, collaboration, and future improvements. In this way it considered the lecturers as both learners and teachers of the content as each individual played crucial roles, as well as multiple roles in the programme's development and deployment. It was also agreed that using the digital space in various innovative ways allowed for creativity from the lecturers and engaged the first-year students in the delivery and engagement of the content in the online space.

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