A case study on the challenges faced in the facilitation of a first year subject at a University of Technology and how they can be overcome using reflective practices

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The Universities of Technology (UoT's) are a recent addition to the South African higher educational structure. Formerly known as Technikons, their main aim was and is to produce technicians. In the new educational structure, their aim is to produce technicians as well as do active research which can positively contribute to the economic development of our growing nation. This makes the UoT's very unique and distinct from the traditional universities and as a result the challenges faced by the UoT's also differ.
Some of the challenges faced by lecturers are as follows, high volume of students, students with poor academic background, language barrier and students who are poorly motivated.
Reflection in an educational context is defined by Richert (1990) as *the ability to think about what one does and why - assessing past actions, current situations, and intended outcomes - is vital to intelligent practice, practice that is reflective rather than routine. As the time in the teaching process when teachers stop to think about their work and make sense of it, reflection influences how one grows as a professional by influencing how successfully one is able to learn from one's experiences*.
There are different types of reflective practices, reflection-for action, reflection-in action, reflection-on action, egocentrism, allocentrism, macrocentrism.
This paper looks at the challenges that are mentioned above in detail from my point of view as a lecturer, lecturing first year engineering students at the Central University of Technology, Free State and how I used some of the well defined methods of reflective practice to overcome these challenges.

Introduction

The Universities of Technology (UoT's) are a recent addition to the South African higher educational structure. Formerly known as Technikons, their main aim was and is to produce technicians. In the new educational structure their aim is to produce technicians as well as do active research which can positively contribute to the economic development of our growing nation. This makes the UoT's very unique and distinct from the traditional universities. As a result the challenges faced by the UoT's also differ.

This paper looks at the challenges that I as a lecturer face in lecturing first year engineering students at the Central University of Technology, Free State and how I used some of the well defined methods of reflective practice to overcome these challenges.
The challenges that I encountered while lecturing at the Central University of Technology in a first year engineering subject, Digital systems 1 are as follows;

- High volume of students
- Students with poor academic background
- Language barrier
- Students who are poorly motivated

High volume of students

The Electrical Engineering department at the Central University of technology, Free State

(CUT) registers up to three hundred students per semester in the electrical engineering department. It is compulsory that all first year electrical engineering students take Digital systems 1. There are two lecturers that facilitate this course, meaning that each lecturer has at least one hundred and fifty students in a class.
This often results in students cramming into a class room, loosing focus and not understanding the proceedings in the class. It also adds extra academic and administrative work to the lecturers and an inability to give prompt feedback to the students.

Students with poor academic background

The CUT caters mainly for students who could not get admission into traditional universities in South Africa. As a result, the majority of students have average academic records. This becomes a challenge especially in the first year students as students are not able to cope with this sudden shift from secondary level to tertiary and tend to fail in the subject(s) offered in the first semester.

Language barrier

The University recently amended its language policy and made English the official language for teaching/facilitation on all its campuses. Majority of the students who are admitted to CUT are from smaller towns and villages in the Free State and Northern Cape province where English might not have been a language for communication between students and teachers at secondary level. As a result, the students find it hard to understand the lecturer.

Poor motivation

Some students who come to CUT are not motivated to do the specific course that they have enrolled for. This is not due to a lack of talent or poor services rendered to them, but because their talents lie in a different discipline. Most students enroll for an engineering course because engineering firms provide a lot more bursaries as compared to firms in disciplines like finance, law and management. This means that the students, whose natural skills lie in some other field, pursue engineering on a wrong motivation.

These challenges tend to demoralize me as a lecturer. As a result I understand that there is a need for devising ways to address these challenges. In this paper the results of the application of well defined reflective practices, which I have utilized to improve the teaching and facilitation and the consequent improvement of the academic performance, of students is presented.

Reflection and reflective practice

The methodology used in arriving at the solutions is based on reflection and reflective practices. This section looks at what these terms mean in an academic context.
Richert (1990) has defined reflection follows;

"*The ability to think about what one does and why - assessing past actions, current situations, and intended outcomes - is vital to intelligent practice, practice that is reflective rather than routine. As the time in the teaching process when teachers stop to think about their work and make sense of it, reflection influences how one grows as a professional by influencing how successfully one is able to learn from one's experiences*."

Jennifer Moon (1999) defines reflection as *"a form of mental processing that we use to fulfill a purpose or to achieve some anticipated outcome.* This point made by Moon is corroborated by Reynolds's (1965) model of developing competence which is described in Figure 1.

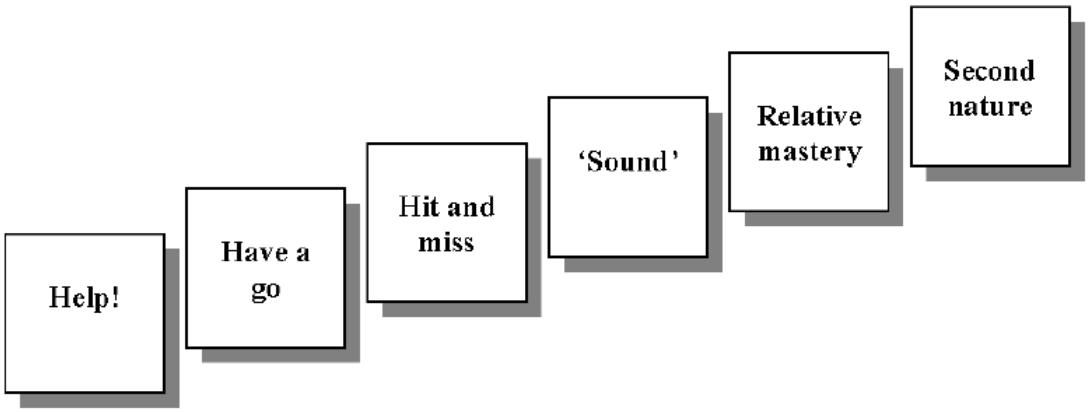


Figure 1: Reynolds's (1965) model of developing competence

Both Moon (2005) and Reynolds (1965) equate reflection as a growth process in lecturers much like any art that one attempts. An analogy can be made to that of attaining balance while learning to ride a bicycle. One does not climb on to a bicycle and start cycling straight away. There will be instances of trying, failing, gaining confidence and then finally a stage where it becomes an unconscious process.

The same process can be accomplished by a lecturer as he goes through the different stages in his/her career, provided they reflect on their work and are not complacent with the maturity developed over the years.

Lecturers who consistently reflect on their work are referred to as reflective practitioners. Dewey (1933) states that there are three important qualities reflective practitioners must possess. They are;

- Responsibility- to undertake a task and accomplish it.
- Whole heartedness- dedication to the task at hand.
- Open mindedness- an ability to bring about change in ones work, if they feel that the techniques they are using currently are not working.

Reflection can be combined with Centricism (Green 2006) which gives multiple perspectives into improving the performance of students. The centric reflection model developed by Saban, Killion and Green (1994) is one such model and is shown in Table 1.

	Type of Perspective →		
Types of Reflection ↓	Egocentric	Allocentric	Macrocentric
Reflection-For-Action			
Reflection-In-Action			
Reflection-On-Action			

Table 1: The Centric reflection model by Saban, Killion and Green (1994)

The Centric reflection model is described in detail here;

Reflection-For action

In this type of reflection, the lecturer plans ahead based on the reviews they have generated over the years teaching the same subject. This type of reflection is of little help to novice lectures (Green 2006:3).

Reflection-In action

Here the lecturer reflects during the course of a class. He/she is able to analyze that the students are not following the class and hence need to resort to other methods for explaining the material. (Schon: 1987). This kind of reflection is also executed better by veteran lectures as it takes experience and practice, but a novice lecturer can pick up this skill if he/she pays attention to the students during a class (Green 2006:3).

Reflection-On action

This is the most common type of reflection; here analysis is done after the class. Here lecturers can question themselves about the success of a class and how it can be improved at the next opportunity (Green 2006:4).

Egocentrism

Egocentrism means coming from the point of view of a person. The person in this case being the lecturer and the point of view being how he/she has executed the task at hand. All points of view in this type of reflection are from the lecturer (Green 2006:4).

Allocentrism

This is reflection coming from the point of view of the students and how the lecturer uses them to improve his teaching and facilitation (Green 2006:4). This point of view is important in the context of this discussion as it addresses three of the challenges (poor academic background, language barrier and poor motivation) mentioned in the introduction.

Macrocentrism

Macrocentrism is reflection coming from the needs of the institution and the professional bodies governing higher education. This perspective on reflection makes all lecturers feel part of a bigger picture trying to achieve the same goal. (Green 2006:4)

Further, pioneers in the field of education have defined various models for the exercising reflective practices. One such model for reflective practice is developed by Greenaway (1995). The model used by Greenaway called the plan-do-review approach is presented in Figure 2.

Figure 2: Greenaway's (1995) model for reflective practice.

Greenaway's reflective practice does not have a start and end point. It can be viewed as a constant cycle of self improvement. One way to look at the model is that the lecturer has to first ***plan*** his/her work in advance. Secondly ***do*** or execute the work that has been planned for and finally do a ***review*** of the work. Review means going back and analyzing the work that has been done. It can also be that another lecturer executes his/her work, reviews it afterwards and plans on improvements for the next session.

Implementing reflective practice in Digital Systems 1

I am lecturing a first year engineering subject called Digital systems 1. The subject is at an entry level which introduces students to the different types of number systems, with stress on binary number system, Boolean algebra and Karnaugh mapping. All which underline the fundamentals of data communication in digital devices. The pre-requisite for the subject is a good understanding of basic arithmetic. The subject does not allow the use of a calculator; hence students should also be able to do calculations by hand.
This section looks at how the challenges can be put into perspective using the centric reflection model. Then, as a possible solution, the Greenaway's model is used to overcome the challenges.

	Type of Perspective →		
Types of Reflection ↓	**Egocentric**	**Allocentric**	**Macrocentric**
Reflection-For-Action	How can I keep a class of 150 interested in the lecture for 80 minutes?	Will students sitting in the back row be able to hear me and more importantly understand me?	Will I be able to transfer the study content to all students, at the same time maintaining the set standards of the institution?
Reflection-In-Action	How can I put the students at ease after explaining a difficult concept like 5 variable Karnaugh maps?	Will it help if I move around the class, instead of being stationery at one point?	Will the students be able to answer questions based on the Intended Learning Outcomes (ILOs)
Reflection-On-Action	Will it be of assistance if I can ask a colleague to analyze next class to point the short comings?	The students can provide me feedback on the class in short anonymous letters	Am I adhering to the standards set by the Engineering Council of South Africa?

Table 2: The centric reflection model aligned with challenges faced in Digital systems 1

The centric reflection model shown in Table 2 addresses the concerns that I have mentioned in the introduction. Using the Greenaway's model (1995) I will elaborate on the plan I set out to overcome the challenges.

Planning for overcoming challenges

Challenge	Plans
High student volume	Split students into groups in the practical class- the curriculum does not allow for group assessments in a theoretical class hence practical classes were used in the case study.
Poor academic records	Provide students with online tests and tutorials- I stress on online tests as I made use of 'blackboard', the university's online study portal.
Language barriers	Academic Language Proficiency course-it was made mandatory that all students attend an English proficiency course and attain a certain degree of competence.
Poor motivation	Practical exposure- the plan here was to make students do more real life/ industrial assignments in their practical classes which will show engineering as fun.

Table 3: Plans to overcome challenges faced in Digital Systems 1.

The next step in the Greenaway's model is the execution of the plans mentioned in Table 3.

Execution of plans to overcome challenges

Challenge	Execution
High student volume	A class of 300 was split among two lecturers. My class of 150 was split into 5 practical sessions. The 30 students in a practical session were split into 6 groups of 5 students each. The students had to make preparations, literature review, conduct experiments and finally answer theoretical questions based on the given experiment.
Poor academic records	The online tests prepared on blackboard vary from multiple choice questions to essay questions. The main advantage is that the students can answer the test at any given time, provided they have access to a computer with internet.
Language barriers	The English proficiency course is conducted by the university. I as the lecturer provides for consultation times outside class hours to cater for students who are having difficulty in following during lectures.
Poor motivation	Most of the practical assignments were refined to include aspects that students would find in an electronics store or even on their way back home, thereby giving students a feeling that they can indeed make a difference if they understand the working.

Table 4: Execution of plans to overcome challenges in Digital systems 1

Feedback and results

The Central University of technology conducts two theoretical and one practical evaluation to determine the course mark for each student. A course mark above 40 and a practical mark above 50 will qualify a student to write the final evaluation.

The theoretical evaluations are the class test and the main Test. The practical assessment is an average mark generated after completing four practical assignments and two practical tests.

The plans shown in Table 3 were executed after the class test. The success/failure of the execution was measured after the main test with a review to be done after the final evaluation. Leading up to the main test, the students were asked to give an anonymous feedback on how their preparations for the main test were proceeding as compared to preparations for the class test and if they felt any difference in my approach to teaching before and after the class test.

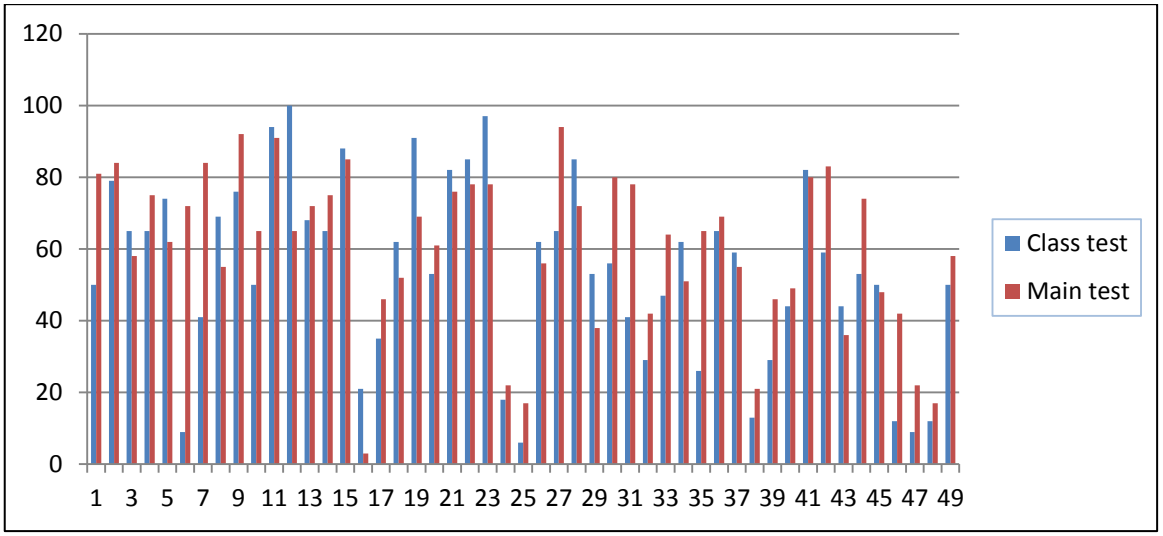
The results of the anonymous feedback from the students did not shed a lot of light to my case study as very few students gave critical feedback on the methodology. Most students felt that working in groups and doing practical experiments which bore close resemblance to everyday sights did assist them to an extent in awakening their interests in the subject.

The one-on-one consultation was helpful to most students who utilized it as they felt they understood the concepts better. This interaction also taught me that not all that I say in class is grasped by the students and the pace with which I teach must be slowed down.

The students were excited about the online assessments as they felt it made them more tech savvy and without the pressure of a classroom environment or the eyes of the invigilators monitoring their every movement they felt they were able to better express themselves. The students also liked the idea of getting theirs marks within minutes of completion of the test.

All this was good, but the real question for me was what impact the change in teaching and facilitation will have on the marks of the students in the main test. This question was answered when I examined the results of the main test. It was seen that 30% of the class had made an improvement of almost 20 percent from their first test marks. I felt that a 20 percent or more difference in marks between the class test and main test showed an improvement in the performance of the students.

It is important to point out that the main test covered questions from two additional chapters than the class test with very little or no repetition in question formats. I have created a bar graph with a random sample of fifty students from my class showing a comparison between their class test and main test marks. This is presented in graph 1. The graph substantiates the result mentioned in the previous paragraph.



Graph 1: Comparison between class test and main test marks of students for Digital systems 1.

Based on the techniques that I have used to arrive at my results, I have summarized what I believe are some of the positive feedback as well as the limitations from the execution of plans. They are presented in Table 5.

Execution	**Positive feedback**	**Limitations**
Splitting students in groups	The students liked the individual attention given to the students during the practical session and the felt they learned more from their peers than studying alone	Some students were not able to contribute to the practical assignments as much as the others.
Online tests	Students liked the idea of doing assignments outside the class environment and the immediate feedback given by the tests.	Monitoring students becomes difficult as they work outside the class environment. Online tests are not included as official assessments hence students do not take them as seriously as other conventional forms of assessments.
Consultation and English courses	Students understood concepts better when directly conversing with me the lecturer. There were no inhibitions due to fear of asking questions in a class. The English proficiency courses also helped in bridging the language barrier.	Not all students make use of the consultation times owing to the timings and fear of communication.
Practical exposure	Most students like the idea of 'doing' what they study in theory. It made them more inquisitive and hands on.	Theory and practical are not two different aspects; some students fail to understand the basics resulting in minimal success with the practical assignments.

Table 5: Positive feedbacks and limitations from the execution of plans to overcome challenges in Digital system 1

Future work

The results shown in the last section are the first of its kind that has been generated from this case study. As a result it is too early to determine if the results were a mere coincidence or a direct result of the change in teaching/facilitation plans. In order to ascertain the validity of the case study, the first thing to be done is to review the results of the final evaluation.

Based on the review of the results, a plan has to be made on what needs to be changed for the coming semester. The limitations mentioned in Table 5 will be the starting point for the design of new plan. It is my presumption that three cycles of the planning and execution with constant remodeling at each review stage will define a trend in the improvement of marks of students.

Conclusion

Like any work environment there will always be challenges. As a lecturer, the academic environment is no different. There are two ways to look at your job. The negative approach is to blame someone or something and continue with the work as if it is not our concern. The positive approach is to analyze the challenges, find solutions to them using different techniques and implement these solutions.

The challenges that I looked at in this case study are only four of the many that an academic faces. They might also be synonymous with challenges faced by other academics in different disciplines. I have used some well defined techniques in reflection and reflective practices set forth by pioneers in the field of teaching and learning like Greeaway, Richert, Moon, Green and Reynolds and applied them to the challenges that I saw as needing attention.

The Greenaway's model, which is the fulcrum of my paper, allows for constant reflection on what I did and what I can do better as a lecturer. I have only a single set of result that I can share in this paper and that might not be enough to either prove or disprove the success of the technique that I have used. I will be the first to acknowledge that 30% improvement is not a major breakthrough, but, it does set a path for improvement in the final examination this semester and in the coming semesters.

REFERENCES

Dewey, J. (1990). Discovering reflective practice
http://firstclass.ultraversity.net/~ian.tindal/rm/modeloverview.html
Downloaded on 10th April 2013
Greenaway, R. (1988). Powerful Learning Experiences in Management Learning and Development
http://reviewing.co.uk/research/learning.cycles.htm
Downloaded on 10th April 2013
Green, K. (2006). No novice teacher left behind: Guiding novice teachers to improve decision making through structures questioning. *Volume 4, Issue1. Penn GSE Perspectives on Urban education*
Jennifer, M. (1999). Learning Journals: A handbook for academics, students and professional development. *ISBN 0-7494-3045-1,* pp23. Stylus publishing
Reynolds (1965). The reflective teacher.
http://www.mcgraw-hill.co.uk/openup/chapters/9780335222407.pdf pp9
Downloaded on 15th April 2013
Richert,A E. (1990). Teaching teachers to reflect: A consideration of program structure. *Journal of curriculum studies ISSN 0022-0272. Volume 22,* pp525
Schon, D. (1987). A review of Educating the Reflective Practitioner. *Jossey –Bass publications. ISBN 1-55542-220-9*