choice of approach to learning in Dentistry: A South African case study

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Abstract

The purpose of this article is to report on empirical work, related to a techniques module, undertaken with the dental students of the University of the Western Cape, South Africa. I will relate how a range of different active learning techniques (tutorials; question papers and mock tests) assisted students to adopt a deep approach to learning in this large diverse group of students. They then completed an adapted version of the revised study process questionnaire which focussed on the effects of these active learning techniques and how these learning techniques assisted with a change in approach to learning adopted by them. Results indicated that the active learning techniques led to a better understanding of the concepts covered within the module. It also showed how the new exercises guided them to adopt a deep approach to learning. It can be concluded that with this type of educational research, students' learning difficulties are not just emphasized and highlighted but that these problems are also understood. This research also guided the educator to search for practical solutions to these observed difficulties.

INTRODUCTION

Effective teaching ensures that all differences in one classroom be attended to, be it cultural, maturity levels, cognitive or learning styles of the students and that these differences be addressed so that deep learning (i.e. meaningful comprehension and retention of information) can occur (Vaughan and Baker 2001; Biggs 2004). When appropriate learning occurs and is encouraged, this is inferred to as deep learning occurring (Biggs 2001). Traditional teaching methods, for example, lecturing, tutorials and individual studying on their own do not sustain deep learning strategies. Successful teaching (including traditional and/or supplemented by active learning techniques) at tertiary level requires that students be sufficiently encouraged and positively motivated so that they can adopt a deep approach to learning (Border and Chism 1992; Paulson and Faust 1998; Biggs et al. 2001; Biggs 2004).

So what are these *active learning exercises*? Strategies promoting active learning are defined as 'instructional activities involving students in doing things and at the same time thinking about what they are doing' (Bonwell and Eison 1991). It is this active engagement of content that needs to be encouraged as this will ensure that students adopt effective learning strategies (Paulson and Faust 1998; Fathe 2002).

Research has indicated that by using *active learning techniques* to supplement didactic teaching, which are what lecturers would be responsible for, students' depth of knowledge and retention thereof will considerably improve (Fathe 2002; Paulson and Faust 1998; Mc Kinney 2009; Bonwell and Eison 1991).

The literature also suggests that encouraging students to adopt a deep approach to learning will ensure quality modular outcomes resulting in academic success (Biggs et al. 2001; Zeegers 2001; Biggs 2004). Thus, from the literature, it is suggested that a strong link exists between active learning exercises, that allows engagement of the module content and retention of information, and deep learning implying that successful learning will be allowed to occur consequently (Fathe 2002; Bonwell and Eison 1991).

Concerned lecturers would be very mindful of the many learning differences amongst university students when executing their duties as educators (Border and Chism 1992; Vaughn and Baker 2001). Effective teaching can only be accomplished by addressing these learning differences within the classroom setting (Border and Chism 1992; Vaughn and Baker 2001). The merging of institutions like elsewhere in the world has had a major impact on the heterogeneity of the new student population. With this comes a barrage of issues that needs to be redressed as different learning approaches are rooted within specific cultural communities (Blatchford et al. 2001; Zeegers 2001; Phan and Deo 2007).

This precarious situation described above is no different within the South African context and especially at this institution where my study was conducted. In fact, this study focuses on a diverse group of students following the merging of institutions. At this point it would be apposite to detail some of the outcomes of this module. In this *prosthetic techniques module*, students are expected to attend lectures, observe demonstrations but also complete practical procedures as part of the outcomes. But after exposing students to the traditional lecture on the prosthetic techniques module, it was decided to supplement these with more interactive forms of teaching as discussed later in the article. Being a very practically-oriented module, students are expected to know the theory but and be able to apply the knowledge for successful completion of the practical procedures. They need to complete these procedures until the second semester of their fourth year with the full understanding that this work will be the responsibility of the dental technicians after that.

In my study, I addressed a series of concerns observed in teaching this dental prosthetic techniques module including the following:

• Differences in learning styles with this diverse student population;
• Poor long term retention of information;
• Attitude of dental students towards this module; and
• Immaturity in their approach to studies.

This article will report on what was considered as practical solutions to some of these concerns linking the interactive exercises and the motivations for learning to

ensure that deep learning occurs. I will also briefly mention the theories relating to students' approaches to learning, the specific strategies chosen by dental students and the motivations for doing so. More importantly, I will focus on the active learning techniques introduced and their effects on the choice of approaches to learning of this diverse group of South African dental students. The study was intended to address the research gap in the knowledge related to student learning as no studies were conducted in South Africa, following the merging of institutions.

LITERATURE REVIEW

Approach to learning refers to how students are influenced by their teachers and the specific learning environment either positively or negatively. In comparison, deep approach (and surface approach for that matter) refers to how students typically go about their own learning, that is, their methods of learning, building on to previous knowledge and the different ways they learn for the different modules.

Although Marton and Säljö published their findings regarding the approach to learning of students in 1976, several other researchers extended this research to address all the factors focussing on students' approaches to learning in tertiary institutions over the last 30 years (Biggs et al. 2001; Zeegers 2001; Biggs 2004; Phan and Deo 2007). These subsequent studies concluded that the teaching environment has an impact on students' choice of approach to learning (Biggs et al. 2001; Biggs 2004; Strayhorn 2004; Camalahan 2006; Kember et al. 2008). Research, related to the effects of motivation of students to learn, conducted in the US suggests that it is what happens within the classroom that influences students learning of module content (Strayhorn 2004). Students' learning strategies depend on the module taught and the different pedagogical techniques used by teachers that would motivate students to adopt a deep learning strategy (Strayhorn 2004). Teaching and pedagogy have evolved and there is a move towards using methodologies that specifically encourage a deep approach to learning such as problem-based learning (PBL) (Newble and Clarke 1986).

The literature illustrates that students learn and retain knowledge as they engage more with the material (Paulson and Faust 1998; Fathe 2002). Particular kinds of activities encourage students to engage in different ways: for example, if students only listen to the lectures or even just observe the demonstrations related to these practical procedures, which is what the lecturer would be responsible for, insufficient learning would occur. In fact, lecturing allows only 20 per cent learning, observing a procedure combined with lecturing allows 40 per cent of learning but more importantly, 75 per cent of learning occurs when students observe, listen and actively do procedures (Reisman and Carr (1991) cited in Anderson, Sharma and Taraban 2002). It is this active engagement in the form of listening, writing, peer-teaching and observing that is required of students as it is only then that deep learning can occur.

A theoretical viewpoint

'Approach to learning' in the works of Marton and Säljö refers only to the learner's perspective in approaching his/her studies prior to the outcome of learning and this is known as the *phenomenographic or phenomenological theory* (Biggs et al. 2001; Pintrich 2004; Biggs 2004; Phan and Deo 2007). The students' motive for learning affects the way they approach their work, their choice of strategy and this is observed in the interaction between the students, the context and the content of the module concerned (Phan and Deo 2007).

Biggs and Ramsden have extended this basic framework to include the motivations achieved by the teacher and the teaching methodologies employed within the classroom (Biggs 1996; Biggs et al. 2001; Biggs 2004; Phan and Deo 2007). According to Biggs' *constructivism and systems theory* of students approach to learning, two strategies that are vital to ensure that successful engagement of content occurs include that of student motivation and teacher actions (Biggs 1996; Biggs et al. 2001; Phan and Deo 2007). The strategy and motives of the student when approaching particular modules are significant on their own to motivate him/her to learn the content successfully (Biggs 1996; Biggs et al. 2001; Phan and Deo 2007). With regards to the teacher, his/her teaching approach (and the changes in methodology) can be encouraging to motivate students to adopt better learning approaches and so ensure that successful engagement of content occurs (Biggs 1996; Biggs et al. 2001; Phan and Deo 2007).

This *constructivist nature* of student learning thus involves construction of the learners' goals and strategies from available information (external influences) in addition to their own knowledge (internal nature) i.e. the learners learn from their own experiences (Biggs 1996; Dewey (1933) cited in Huitt 2003; Biggs (1993) cited in Pintrich 2004). If, however, the external influences (e.g. prior learning, assessment criteria and attitude of teachers) are greater than students own motivations, they the learners will adopt a more surface approach to learning and if the motivations are more intrinsic (e.g. self-motivated and mature students), a more deep approach to learning can be expected (Biggs 1993 cited in Pintrich 2004). Within this constructivist paradigm students are active in their own learning, but the teacher's role as guide and mediator in the classroom will facilitate improved learning (Biggs 1996; Biggs 1993 cited in Pintrich 2004). The effect of prior learning and methods of teaching clearly demonstrates the close link between motivation (for example in the form of active learning exercises) and strategies for learning that students adopt (Biggs 1996; Paulson and Faust 1998; Biggs 1993 cited in Pintrich 2004).

The *systems' theory* of student learning alludes to the class as an entity but also to the relationships between the individuals in that class when a holistic approach to learning is considered (Hetherington 2008). This holistic approach alludes to individual students motives and the encouragement within the class, be it the interaction between students or that between student and teacher (Hetherington 2008). This systems theory is also defined by a set of elements that interact and work

together in order to achieve an objective (Moise 2008). If any of these elements (for example, the inclusion of active learning exercises) have been changed, the entire learning process will be affected (Moise 2008). Thus understanding the dynamics of the class (and the students as such) will have an important influence on the teaching methodology per se. It will influence the type of active learning exercises utilized per class and per module.

The deep approach to learning refers to meaningful engagement of coursework and the need to comprehend and understand in comparison to the surface approach which alludes to the less challenging rote learning and memorisation of facts by highly unmotivated students (Fourie 2003; Biggs 2004). Special mention regarding the learning approach of science students (similar to the dental students) need to be revealed at this stage. Researchers discovered that they use surface strategies as a tool to assist with deep learning (Prosser and Trigwell (1999) cited in Zeegers 2001). Prosser and Trigwell (1999) called it the 'deep-memorising' approach of science students (cited in Zeegers 2001). Newble and Clarke (1986), on the other hand, referred to this approach as the 'operational' approach of science students referring to the logical step by step and orderly approach to memorise for understanding. They tried to distinguish this approach from the other approaches, such as deep and surface, mentioned earlier.

The proponents of active learning techniques state that these interactive exercises assist students with long-term retention of information and development of high – order thinking skills which are also characteristics specifically of deep learning, further specifying this relationship between the two concepts (Paulson and Faust 1998; Dogru and Kalender 2007).

Motivating and motivation of students

The literature alludes to the fact that students may use dissimilar learning strategies for different courses or modules and that their enthusiasm for the different modules will vary (Pintrich 2004). The motivational beliefs and strategies are thus domain or module specific (Pintrich 2004). This fact has also been observed in my teaching experience. From my empirical experience with dental students over the years, it has also been observed that they adopt a dissuasive attitude towards this prosthetics technique module, as they consider it to be the work of dental technicians rather than dentists. Attempts to regulate students' motivational beliefs with regards to a module have also been discussed in the literature (Pintrich and Schunk (2002); Wolters (1998) cited in Pintrich 2004). These include aspects such as the goals of the task, value of the module, personal interests and competencies of task performance (Pintrich and Schunk (2002); Wolters (1998) cited in Pintrich 2004).

The age of students has also been shown to have a great impact on the attitude towards learning and studying, for example, the older students have a more deep approach to learning and are more committed to their work (Zeegers 2001; Biggs 2004; Camalahan 2006). With regards to active learning and maturity, the more

mature students will find these techniques of great value as it would make learning easier and assist with better retention of knowledge (Zeegers 2001).

Interventions

Active learning is best described as activities that encourage students to think, critically analyse, question and at the same time obtain factual knowledge (Paulson and Faust 1998; Fathe 2002). In fact, it can be described as any other learning activity in class that students occupy themselves with other than passive listening to a lecture (Paulson and Faust 1998).

Active learning is derived from two basic assumptions:

1. *That learning is by nature an active process and*

2. *That different people learn differently (Phan and Deo 2007; Fathe 2002; Mc Kinney 20*09).

Active learning techniques serve only to supplement the traditional didactic form of teaching and these techniques should not be introduced without lecturing the content and objectives of the module (Mc Kinney 2009). According to Bonwell and Eison (1991), using these techniques is important as these tend to have a dominant impact on students' learning. They also state that these techniques encourage development of students' thinking and writing skills. The literature states that active learning exercises serve to motivate students to adopt a particular approach to learning and that greater learning occurs due to these interventions (Paulson and Faust 1998; Fathe 2002; Dogru and Kalender 2007). In fact, as stated earlier, some characteristics of active learning coincide with the features of deep learning (Paulson and Faust 1998; Fathe 2002; Dogru and Kalender 2007). These techniques allow students to engage with module content and make comprehension more meaningful (Paulson and Faust 1998; Fathe 2002). At the same time, successful learning is promoted and students become confident and take charge of their own learning. It is these aspects of active learning exercises that prompted the lecturer to implement these techniques as part of the teaching in this classroom (Paulson and Faust 1998; Fathe 2002).

It is important to bear in mind that the elements of active learning include talking; listening; reading; writing and reflecting (Paulson and Faust 1998; Fathe 2002; McKinney 2009). According to Fathe (2002), the characteristics of active learning techniques and the proven effects on student learning are to:

- engage students beyond listening and reading;
- promote learning, not just acquisition of facts;
- encourage interaction between students;
- develop high-order thinking skills;
- persuade students to take responsibility for their learning;
- help students build competencies;

- allow students to monitor their own learning and lastly;

- endorse deep learning.

Fathe's characteristics of active learning are in line with all the characteristics outlined by Bonwell and Eison years ago (1991).

The literature has shown that effective teaching requires flexibility and an understanding of learners' needs and learning styles (Vaughan and Baker 2001; Gravett and Geyser 2004). Research indicates that not just will the individual learners' diverse learning styles (reflecting the diversity of student population) be addressed, but learners will be positively encouraged to adapt to the different teaching styles if these active learning exercises are incorporated to supplement the didactic teaching (Paulson and Faust 1998; Vaughan and Baker 2001; Fathe 2002; Border and Chism 2002).

The introduction of active learning techniques serve to encourage students to learn as their different learning styles can be addressed and it is also an indicator that the lecturer has thus understood the diversity of students and their learning. By introducing different teaching styles and supplementing the traditional teaching with new styles, the teacher is taken out of his/her 'comfortable teaching styles' (Vaughan and Baker 2001). At the same time the learners' 'comfort zone' of preferred learning style, which has not really been effective, is also addressed (Vaughan and Baker 2001). The teacher can thus consciously motivate students by introducing different teaching styles and remove the boredom from learning and the learning environment without disturbing the progress of the class (Paulson and Faust 1998; Vaughan and Baker 2001; Fathe 2002; Fourie 2003). It is important to note how 'comfortable teaching and learning styles' do not by implication mean that effective teaching and learning has occurred. This is due to the fact that all students do not necessarily learn and cannot be taught in the same manner as the diversity of students will not be adequately addressed. Lecturers' comfortable teaching styles do not address students' diverse styles of learning, but this situation can be amended by supplementing the traditional lecturing with other teaching techniques for better outcomes.

Biggs et al. (2001) in their research in the areas of cognitive psychology relating to student learning concludes that students' learning can be improved by employing interactive and contextual approaches to learning. This is echoed in the work of Machemer and Crawford (2007). Love-Kitchi (1989) also speaks about using different teaching techniques appropriate for the different health science modules and their effectiveness (cited in Pintrich 2004). Camahalan (2006) in her research alludes to the responsibility of teachers as teaching not just the context and imparting knowledge. She says that efficient educators should rather be teaching students the methodology of engaging with this knowledge for better understanding and ultimately for better performance (Camahalan 2006).

Types of active learning techniques

A variety of active learning exercises are available and the use of these are dictated by the following factors: class size, allocated class time, type of module, individual or group learning, barriers related to teachers or students participation or attitude and lack of resources (Fathe 2002; Paulson; Faust 1998; Bonwell and Eison 1991). It is important that every effort should be made to overcome these barriers if any intention to improve the teaching and learning of students exist. The diverse range of techniques available can be utilized for almost any setting (Fathe 2002; Paulson and Faust 1998). The active learning exercises used should be simple, relate to the level of students' understanding and be incorporated as part of the teaching for that specific class and that specific module (Anderson et al. 2002).

These exercises can be classified into two broad categories (Fathe 2002; Paulson and Faust 1998; Bonwell and Eison 1991): Low-instructor risk and high-instructor risk activities.

(a)   Low-risk activities include:

- •clarification pause procedure;
- •short note writing – summarizing lectures or readings, journal entries;
- •surveys or questionnaires;
- •think-pair-share;
- •student pairs developing an outline of lectures and
- •structured group discussions/tutorials (Fathe 2002; Paulson and Faust 1998; Bonwell and Eison 1991).

(b)   High-risk activities include:

- •guided lectures;
- •individual or group presentations;
- •students writing test questions related to lecture material; and
- •students evaluating each others work (Fathe 2002; Paulson and Faust 1998; Bonwell and Eison 1991).

Significance of using active learning techniques in the classroom:

- •   Learning is an active process, but it is when students are able to apply what they have learnt that the learning truly makes a difference and matters (Fathe 2002).
- •   Active learning techniques thus teach students not just how to learn but it also teaches them the content (Fathe 2002).
- •   These active learning techniques allow: better retention of information; that students develop higher thinking-skills; application of theoretical knowledge

to practical procedures (Fathe 2002; Paulson and Faust 1998; Bonwell and Eison 1991).

The next phase in this discussion focuses on the utilisation of the range of active learning techniques as used in this prosthetics techniques module to encourage students to actively engage the coursework, to ensure understanding of the concepts and long term retention of information and to ultimately encourage deep learning (Paulson and Faust 1998; Vaughan and Baker 2001; Fathe 2002). The utilization of active learning exercises has been referred to in the literature as 'regulation of the context and classroom environment' to make learning easier, to create a non-threatening learning environment and ensure successful outcomes (Pintrich 2004). By using these active learning techniques in their teaching, teachers are provided with feedback concerning student' understanding of the course material (Paulson and Faust 1998; Fathe 2002).

In the study described in this article the introduction of active learning techniques and their effects on student learning amongst a class of second year South African dental students was examined. Following on to this, Bigg's Revised Study Process Questionnaire (R-SPQ-2F) which was used as the tool for this study, was adapted to suite the needs and requirements for this research.

This adapted version of the questionnaire addressed the following two important issues:

• Effects of introducing active learning techniques as part of the teaching; and

• Whether these active learning techniques assisted students to adopt a deep approach to learning.

Questionnaire (R-SPQ-2F)

Many tools were developed over the years to evaluate the specific learning strategies adopted by students and the teaching styles of lecturers (Biggs et al. 2001; Zeegers 2001; Phan and Deo 2007). Cognitive psychology tools were developed to evaluate personality problems only. These were, however, generally found to be inappropriate to establish learning and teaching problems as they did not address the context-dependent issues related to student learning and teaching (Biggs et al. 2001).

The original study process questionnaire (SPQ) developed to evaluate students' learning problems, was revised by Biggs et al. (2001) to the R-SPQ-2F and this to address the changes that were occurring in academic institutions across the world at that time (Phan and Deo 2007). These changes in the academic institutions were:

• institutional norms: administration and structure;

• student population: diversity and internationalisation of students;

• curriculum changes: modularisation and depth of courses; and lastly

• merging of institutions (Biggs et al. 2001; Phan and Deo 2007).

The questions on the R-SPQ-2F questionnaire were adapted to this prosthetic techniques module to address the implemented changes in my teaching without affecting the psychometric properties of Bigg's revised questionnaire. This study was intended to address the cultural diversity exposed to as a result of the different groups of students and those coming from dissimilar educational systems with obvious contradictory approaches to learning. The reason this study was initiated was because research findings obtained in other western or Asian countries do not routinely apply to the South African situation as there are many variables that will be different. Researchers from third world countries, such as South Africa, should rather conduct studies to fill the gap in their research regarding student learning and present findings purely from their own experiences and perspectives.

Drawing on the literature, a study was designed to address the concerns, expressed earlier, regarding the learning approach of students for this prosthetic techniques module. The main purpose of this article is to report on the descriptive statistics obtained from this study and my views relating to its effectiveness centring on this group of dental students. I will also express the limitations of this particular study that affected the usefulness of its outcome.

METHOD

This was an experimental study conducted with the undergraduate dental students focusing on their learning for this prosthetic techniques module at the University of the Western Cape, South Africa.

Participants

The sample consisted of male and female dental students (N= 80) of the second year class of 2007 at the University. All the participating students were in second year for the first time and their participation was voluntarily. They had to complete an ethical clearance and permission form which is a requirement of the University's Ethics Committee. The inclusion criteria for the study were that:

- the students had to be part of the active learning exercises, and
- only the students who drew up the question paper and memorandum and who wrote the mock tests were allowed to complete the questionnaire.

Tool

It was decided to use and adapt Biggs' R-SPQ-2F to my prosthetic techniques module as his questionnaire was statistically reliable and easy to use. Each question from Biggs' R-SPQ-2F questionnaire was tested for reliability using the Cronbach alpha scales and Confirmatory factor analysis tests and they publicized what good psychometric properties the questionnaire possessed (Biggs et al. 2001; Phan and Deo 2007). The SPQ measured 43 items with 3 different subsets whereas the R-SPQ-2F measured 22 items with 4 subscales for deep and surface approaches. For

example, the deep motive and strategy and surface motive and strategy items, with each of the items having 8 subcomponents.

The adapted R-SPQ-2F questionnaire used for my study was user-friendly and it allowed me to reflect on my own teaching and monitor the innovations introduced. In addition to this, the questions did not have to be statistically validated again for this particular study as the designers had already done this. This adapted questionnaire for this study included questions that were divided into three sections: firstly, the questions focused on the active learning exercises introduced, secondly on the questions from Biggs' revised questionnaire that were modified to cover deep learning and lastly questions that covered surface learning. The questions were specifically worded to focus on this prosthetic module and covered the attitudes towards the active learning exercises used (i.e. structured tutorials; setting up of a question paper; preparation of a memorandum; writing of a mock test; evaluating of the test written and lastly marking of the test) and the module per se.

Responses were rated on a 5-point Likert scale with:

> A = Never True; B = Sometimes True; C = True half the time; D = Frequently True and E = Always True.

Procedure

The first interactive session included dividing the class randomly into groups and structured tutorials were conducted with them. Each group had a section of the module to complete. They were given questions as these questions helped them retrieve what they knew and then to apply it appropriately in context. The questions mainly focussed on the theoretical and practical aspects of that particular section as well as the application of the theory. Thereafter the groups had to present their tutorial findings to the broader class and questions related to the work were asked to the respective groups and answered by the group, the lecturer and the other students. The questioning was to clarify any problem areas that students were unable to comprehend. For the presentations, students were not restricted regarding format, materials or resources and demonstrations to illustrate their answers.

With the second individual active learning exercise, students had to set up a question paper covering the content of the entire module and a memorandum (including the theoretical and practical sections). According to Paulson and Faust (1998), students learn what they think they will be asked in a test or examination and with this exercise they had a chance to play the role of teacher and student. This question paper and memorandum then had to be typed and printed by them in duplicate. The students had the freedom to decide what type of question paper (multiple choice; short or long questions or even a combination of questions) to set up but it had to be appropriate for their second year level. This question paper with a memorandum had to be handed in to the lecturer who then checked the individual question papers for levels of appropriateness for second year.

As a third interactive exercise, a mock test was advised and the students and the lecturer negotiated a date for this. It is has been noted that assessment drives learning, thus this exercise allowed deep learning to occur. Students prepared for this test and the proper protocol for a test was followed. Instructions were given with regards to completion of an evaluation of the test that was written by each student. Immediately after writing the test, students were handed their memoranda prepared by them and the test book of the student who wrote their test in order for them to proceed with the marking thereof.

Following the completion of these active learning exercises, students went into their final examination at the end of 2007. The examinations consisted of a written paper and a practical examination. The students had an 8 week vacation break before they continued with the evaluation of the active learning exercises that they participated in at the end of 2007.

At the start of their third year in 2008, I distributed the questionnaire that enquired about the effects of the active learning exercises completed in 2007 as well as the learning approach chosen by the students. On the day I distributed the questionnaire to the class, I re-iterated the purpose and the rules with regards to answering the questionnaire as mentioned earlier. I also distributed the consent forms and assured participants that anonymity was vital to ensure their protection and the reliability of the study. I did this in one of my lectures where the completed questionnaires were returned by those students who wanted to be part of the study.

Analysis of data

Quantitative statistical analyses of data collected from all the participating students were completed using Excel to provide descriptive statistics. Pearson product correlation tests were used to determine the relationship of the different learning styles of the students. Spearman Rank correlation test predictor values were determined for all questions.

RESULTS

The preliminary results obtained from this empirical study will now be discussed. It can be divided into 2 parts. Part 1 refers to the descriptive statistics and part 2 to the questionnaire results where questions 1–5 focus on the value of the active learning exercises and questions 5–15 on the learning approaches adopted by the students.

Descriptive statistics

The third year class of 2008 consisted of 88 students and 78 were allowed to answer the questionnaire, as they were part of the active learning exercises introduced in their second year. Two students from the class of 2007 were excluded from the study as they had discussed their question paper and memorandum and handed in identical question papers. The other 8 students were repeating their third year and were thus not part of the supplementary active learning exercises. Of the 78 questionnaires that

we used in the research, one had to be excluded as he/she did not use the answering grid correctly and used different terminology (yes/no) to answer.

With regards to the responses for the first five questions which focused on the value and effectiveness of the active learning techniques introduced to the class the following results were obtained: 44 per cent said they valued the different active learning exercises that supplemented the didactic teaching; 42 per cent said it assisted with learning the content of the module and 45 per cent said it helped with preparation for the final examinations. It is important to note the questions relating to the active learning exercises are strongly correlated.

According to the Spearman Rank Correlation test predictor, questions 6, 8, 9, 12, 13, 14 and 15 referred to the deep approach to learning of students. The total score for the deep approach includes those questions referring to deep strategy and motive. Questions 6, 8 and 9 assisted students with deep learning and refers to how the active learning exercises motivated them; assisted them to cover the content and how it helped with a better understanding of the content of the module. Question 9 refers to the opinions of students related to the active learning exercises and its implications for a better understanding of the content of the module. It was the strongest predictor of a deep approach ($r = 0.759$) as expected, with students scoring high for this question. Questions 7, 10 and 11 on the other hand refers to doing as little work as possible and memorising the work rather than understanding (i.e. surface learning) and of these, question 7 was the strongest predictor of a surface approach.

Relating to the individual scores for deep and surface approaches, motives and strategies, the results reflected very positively. Very few people (n=12) had a low score for a deep approach following the active learning exercises given to the class that allowed active engagement of the work (Figure 1). Only one person had a high score for a surface approach indicating that he/she was obviously not motivated at all for this module even though he/she was exposed to the active learning exercises (Figure 1).

Table 1 represents Pearson's correlation values of the counts of the learning styles. Pearson's correlation is a scaleless quantity varying between +1 and –1. It is symmetrical around the diagonal represented by the value of 1. Correlation coefficient indicates that the Pearson correlation values are greater than 0.8 for deep motive and strategy and surface motive (Table 1). Two of the Pearson's correlation values are between 0.6 and 0.7 for surface and deep strategy (Table 1).

DISCUSSION AND CONCLUSIONS

The purpose of this study was to assess the intervention that is, the active learning exercises introduced to the class and their effect on the preference of approach to learning by undergraduate dental students in their second year of study. At the outset, it should be noted that there were understandable limitations as no control group was
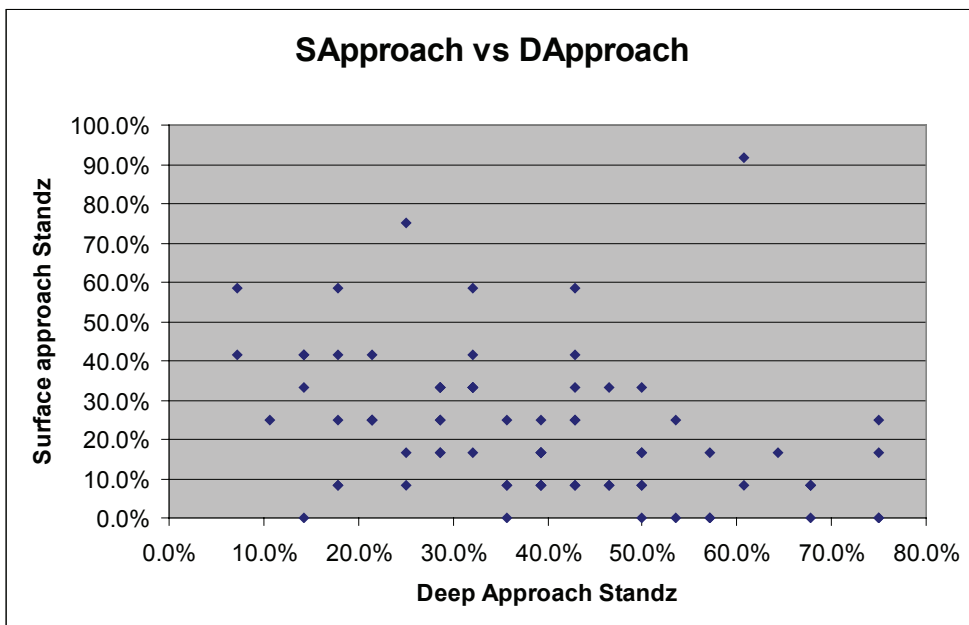
Figure 1:   Scatter plot depicting Surface versus Deep Approach to Learning Scores

Table 1:   Pearson's Correlation Values for the Learning Approaches

Pearson Correlation	Deep App	Surface App	Deep Moti	Deep Strat	Surface Moti	Surface Strat
Deep Approach	1	-0.38	0.944	0.889	-0.36	-0.18
Surface Approach	-0.38	1	-0.44	-0.22	0.893	0.605
Deep Motive	0.944	-0.44	1	0.688	-0.40	-0.25
Deep Strategy	0.889	-0.22	0.688	1	-0.24	-0.06
Surface Motive	-0.36	0.893	-0.40	-0.24	1	0.18
Surface Strategy	-0.18	0.605	-0.25	-0.06	0.18	1

in place. It is thus not possible to know if the active learning exercises introduced were exclusively responsible for the deep approach scores obtained. If the grades of the previous classes, where no active learning exercises were used in the teaching, were compared to this class a clearer picture of the effects of these exercises might have been obtained. Therefore only the descriptive statistics obtained from my study,

related to the completed active learning exercises and what was accomplished with these, will be shared with the readers.

The R-SPQ-2F consisted of 22 questions each referring to either deep or surface approaches, but the adapted version, used as part of this study, only had 15 questions alluding to either of the two approaches. Ten of the questions referred to the different approaches and 5 to the active learning exercises introduced. This shortened questionnaire is itself a limiting factor, as questions that would have focused on deep or surface learning were excluded and this could possibly have influenced the results, but it adds to the uniqueness of this particular study. The questions used, even though the wording was changed to suite the particular module, were reliable as it was statistically proven to be so (Biggs et al. 2001). According to Biggs et al. (2001), the change in wording makes the questions more sensitive for a particular module when evaluating the teaching and learning environment. Some would however argue that the reliability of the questions were affected when the wording of these questions were changed to refer to this specific module.

The fact that major differences between deep and surface learning were not noted may be an indication regarding the value these science (or dental) students placed on memorising for understanding. This memorising is in line with the works of Prosser and Trigwell (1999) and that of Newble and Clarke (1989) and can be regarded as an appropriate strategy with this specific techniques module which largely contains factual and procedural detail. The fact that both knowledge and interest is low at this initial stage for these novices, their preference of learning approach would consequently be more of a surface or memorising style. It is also important to note that the nature of assessment and the demands of modules at first and second year levels in dentistry influences the learning approach (memorising or understanding) chosen by students (Fourie 2002). Most of the modules at this level cover factual and procedural detail (as stated earlier) rather than the application of the knowledge obtained.

The scores obtained, following the use of this structure of questionnaire, is an indication that the students differed with regard to their selection of learning approach in the same cohort and that they dealt with the tasks differently (Biggs et al. 2001; Biggs 2004). This was observed in this particular study as well, particularly when reflecting on the one student's performance who was not at all encouraged despite all the efforts to include active learning exercises in the class. The clinical significance regarding this is that, even though the majority of students benefitted from the active learning exercises, there are still students who might presently require more than the interventions introduced. It could be that something was amiss with the active learning exercises or that the student just could not adjust to the different teaching styles or that the student was totally disinterested (Biggs et al. 2001; Vaughn and Baker 2001).

Research studies reported in the literature referred to how the active learning exercises influenced students' approach to learning and this was undoubtedly indicated in this study (Biggs et al. 2001; Vaughn and Baker 2001). The contribution

this research makes is supplementing of the didactic teaching with active learning techniques and the effects thereof on the learning approach adopted by students, even with the reported limitations for this study.

The strength of this study is observed in that the students do not have full scale tests covering the module content prior to the final examinations and that the active learning exercises forced them to engage with the content of the module, such as studying for the mock test. Even though a before and after questionnaire for the exercises were not formulated, the students had an opportunity to study for the mock test which allowed them to prepare long before they had to write the actual final exams. By doing these active learning exercises, the students were motivated to engage the concepts and revise the work, an opportunity which other students previously did not have. Thus they were able to comprehend any concepts that were not understood and had a further opportunity to revise the work.

Equally significant is the fact that had the active learning exercises not been completed under direction and contribution from the lecturer, it would not have been apparent that the work was that of the students. Thus a certain amount of scepticism related to the value of these active learning exercises could still have been expected to be expressed. What is equally meaningful with this research is that the teacher acted as a reflective practitioner which had an encouraging consequence on the students' learning.

The active learning exercises were intended to assist students with long term retention of information. But as stated earlier, it cannot emphatically be stated that this actually happened in this study as a consequence of using these active learning exercises. According to the literature, learning following the constructivist methods and using active learning techniques ensured better retention of information than only having the traditional didactic teaching methods (Paulson and Faust 1998; Vaughan and Baker 2001; Fathe 2002; Dogru and Kalender 2007).

A clear inference of the current results is that educators should find practical solutions, such as introducing active learning techniques in their teaching, to help students implement good learning strategies (Paulson and Faust 1998; Biggs et al. 2001; Fathe 2002). These categories of active learning exercises can also prompt students to approach other practical modules in a similar manner resulting in successful academic outcomes.

More rigorous studies have revealed that students do better when studying their specialist modules (Biggs et al. 2001). This can be inferred from the students' encounters in this study as well, as it is their first encounter with actual dental work. Studies have observed how these specialist modules itself are an inspiration for students to learn more deeply (Biggs et al. 2001). These studies alluded to how students become more deep in their approach to learning when undertaking graduate studies (Biggs et al. 2001).

The surface learning or low responses and ratings by students are reasonably in line with what was empirically expected of dental students as they are unmotivated

and have a negative attitude towards this techniques module (as stated earlier). This problem has been observed over the years by the researcher and this led to the decision to include a debate as part of the instruction with the subsequent class. The debate focussed on the relevance of teaching this module (the work of dental technicians) to dental students to gauge their opinions and understanding with regards to its inclusion in the undergraduate dental programme.

These results therefore mainly reflect what was expected following the utilization of the active learning exercises to supplement the didactic teaching. It can be concluded that students were motivated to learn and that these implemented active learning exercises assisted with this. It was observed within this study that these exercises aided students to understand the concepts with better final outcomes as seen in the works of other researchers as well (Zeegers 2001). But the successful final outcomes cannot essentially be due to the implemented exercises only as many other aspects (age, confidence levels and competence) do add to the academic success of students (Zeegers 2001).

This particular research thus emphasized two key factors:

- the understanding of students' learning difficulties and
- searching for easily implementable practical solutions to address these difficulties.

Reflective teachers must be sensitive to the many learning differences in the classroom and must ensure that successful teaching occurs in this environment (Border and Chism 1992; Biggs et al. 2001; Biggs 2004). According to other researchers, it is what happens within the classroom setting that will affect the learning of students either negatively or positively (Biggs et al. 2001; Strayhorn 2004). A series of actively learning exercises, that can be used to supplement the didactic teaching, is available to adequately address these learning differences (Paulson and Faust 1998; Fathe 2002). These exercises can assist students to adopt a deep approach to learning and to thus regulate their own learning with successful academic outcomes (Biggs 1996; Paulson and Faust 1998; Fathe 2002).

It is important for lecturers to understand students' approach to learning when dealing with such a heterogeneous group of students particularly following the merging of institutions as happened at this university. They should also be cognisant of the positive motivations to learn and what can be organized to improve these if it is deficient.

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