

Perception of integration in the MBChB III programme at Walter Sisulu University

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Declaration

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Date: 14 March 2013

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Abstract

Since the SPICES (S: student centred; P: problem-based learning; I: integration; C: community based/hospital based; E: electives; and S: systematic apprenticeship based) model of medical curriculum was proposed by Harden, most medical schools worldwide have introduced curriculum changes toward a paradigm shift in teaching and learning. Walter Sisulu University (WSU) introduced such changes in 1992 when problem-based learning (PBL) was implemented in the medical school. This research assignment examines the level of horizontal integration within the WSU Bachelor of Medicine and Bachelor of Surgery (MBChB III) programme. The purpose of the study was to determine the students' and tutors' perceptions of integration in the curriculum.

A cross-sectional descriptive survey was designed and piloted in 2009 and the questionnaire was then administered to MBChB III students who agreed to form part of the study. The tutors' opinions on integration were also explored. A questionnaire on integration using a five-point Likert scale, was administered to both the students (12 questions) and the tutors (six questions). Six open-ended questions on integration were added to the students' instrument and one to the tutors' instrument, for qualitative analysis and to assist in triangulation. In addition, semi-structured interviews were conducted with the tutors individually.

As a result of the survey, it seemed that all the students were "satisfied" or "very satisfied" with the level of integration of content and learning. All the tutors were aware of the need for integration, but some were not familiar with how the learning environment could be modified to enhance students' approach to integration.

MBChB III students at WSU highly valued the integration of learning and teaching during tutorials. Thirty-three per cent of the tutors, though, believed that integration increased their workload. All the tutors thought that integration facilitated students' learning skills and promoted student engagement, learning and interaction with faculty.

Keywords: integration; curriculum; disciplines; MBChB

Opsomming

Sedert Harden die SPICES-model as mediese kurrikulum voorgestel het, het die meeste mediese skole in die wêreld kurrikulumveranderinge ingevoer as 'n paradigmaskuif in onderrig en leer. (S – studentgesentreerde; P – probleemgebaseerde leer; I – integrasie; C – gemeenskaps-/hospitaalgebaseer; E – keusevakke; en S – gebaseer op sistematiese vakleerlingskap.) Die Walter Sisulu-universiteit (WSU) het in 1992 sulke veranderinge aangebring toe probleemgebaseerde leer (PBL) in die mediese skool geïmplementeer is. Hierdie navorsingswerkstuk ondersoek die mate van integrasie in die Baccalaureus in Geneeskunde-program en Baccalaureus in Chirurgie-program (MBChB III) aan die WSU verder as die PBL-tutoriale kan vorder. Die doel van die studie was om te bepaal wat studente en studieleiers se persepsies oor die integrasie van die kurrikulum is.

'n Beskrywende deursnee-opname is in 2009 opgestel en 'n loodsstudie is gedoen. Die opname is weer gebruik met MBChB III-studente wat ingestem het om aan die studie deel te neem. Studieleiers se menings oor integrasie is ook ondersoek. 'n Vraelys oor integrasie volgens 'n vyfpunt Likert-skaal, is aan die studente (12 vrae) sowel as die studieleiers (ses vrae) gestel. Ses oop vrae oor integrasie is by die studente se instrument gevoeg en een by die vraelys vir die studieleiers ter wille van kwalitatiewe ontleding en triangulasie. Daarbenewens is 'n semigestruktureerde onderhoud met elke studieleier individueel gevoer.

Na afloop van die toepassing en ontleding van die opname was al die studente “tevrede” of “baie tevrede” met die vlak van integrasie van leer, met begrip en met die vlak van integrasie van inhoud. Al die studieleiers was bewus van die behoefte aan integrasie, maar sommige was nie vertrouwd met hoe die leeromgewing aangepas kan word om die studente se benadering tot integrasie te bevorder nie.

MBChB III-studente aan die WSU het 'n hoë waarde geheg aan die integrasie van leer en onderrig tydens tutoriale. Drie-en-dertig persent van die studieleiers het egter geglo dat integrasie hulle werkslading verhoog. Al die studieleiers was van mening dat integrasie die studente se leervaardighede fasiliteer en die studente se deelname, leer en interaksie met akademiese personeel bevorder.

SLEUTELWOORDE: Integrasie; kurrikulum; dissiplines; MBChB

Table of contents:

INTRODUCTION	1
Background	1
Curriculum.....	1
Problem-based learning, integration and the tutorial process	4
The learning environment.....	7
THE RESEARCH PROBLEM.....	9
Problem formulation.....	9
Problem statements:.....	9
Main research questions:.....	10
Secondary research questions	10
The purpose of this study.....	11
METHODS	12
Research design	12
Population and sampling	12
Research instruments	12
Data collection and analysis.....	13
Quality assurance/rigour.....	14
RESULTS.....	16
Students’ perceptions of integration.....	16
Table 1 Frequency, average and mode of Likert levels for the semi-structured questionnaire:	16
Table 2: Topics identified by students in the open-ended questions	19
Table 3: Students’ perceptions of expectations and self-attainment regarding integration.....	20
Tutors’ perceptions of integration.....	23
Table 4: Quantitative analysis of tutors’ perception of integration.....	23
Table 5: Summary of the main answers obtained during the tutors’ interviews	26
DISCUSSION	28
CONCLUSIONS	37
RECOMMENDATIONS	38
ETHICAL CONSIDERATIONS.....	40
REFERENCES	41
APPENDICES.....	48

INTRODUCTION

The rapid growth of knowledge in the individual branches of science causes a great accumulation of content to be covered by the individual disciplines in the health sciences in general and in medicine in particular. Teaching and learning of the content are difficult and cumbersome; hence, the need to find a way to cope with these demands in order to keep the content updated arises in both faculty and students. Integration could be one way of helping students and teachers to cope, besides showing explicitly to the students the commonalities among the biological sciences (Barragan et al 2005). Integration was considered by Mennin (2010a) as a way to form new, complete models of teaching and learning. According to him, integration appears as a new pattern through interactions in the curriculum design. Most of the basic science and clinical educators recognize the need for greater integration in the health sciences curriculum (Bruekner & Gould, 2006). On the other hand, Harden, Sowden and Dunn (1984) SPICES model of curriculum emphasizes on the need for it to be Self-directed, Problem-based, integrated, Community-based, Core with Electives, and Systematic. Harden and Davies (1998) remarked the need for the continuum of the PBL in the Health Sciences Education through task-based learning.

The School of Medicine of the Faculty of Health Sciences at Walter Sisulu University (WSU; former UNITRA) adopted the SPICES model in 1992. Integration was implemented with the Problem-Based Learning (PBL) throughout all academic years of the curriculum; but only during tutorial sessions. No attempts to enhance interdisciplinary integration out of tutorials was officially planned and structured.

All these reasons were a source of motivation to select integration as the main topic of this research. Besides, the setting of this study on integration was a semi-rural medical school that has pioneered the implementation of problem-based learning (PBL) and the tutorial process since the end of the last century, but the geographic location of the faculty may influence the students' learning environment as well as the approach to teaching by some of the educators.

Background

Curriculum

The word 'curriculum' is Latin for 'racecourse' and originates from the word *currere*, which means 'to run' (Petrina, 2010; Su, 2012). At the beginning of the 20th century, a curriculum was considered as the body of knowledge to be transmitted to the student. The work of Bobbitt,

Boyce and Perkins (1913) and Tyler (1949, p52-59) reframed the original meaning to emphasise the objectives achieved through completion of the curriculum material by a student, with special stress on the formulation of behavioural objectives and the importance of a sequential order in the learning process. Clearly, the definition of a curriculum has changed over time, varying from narrow to broad interpretations and according to the philosophical context of the era in which the term was defined.

More specifically, medical curricula have undergone several reforms and modifications after the work of Bobbitt, Boyce and Perkins (1913) and Tyler (1949); and from Flexner (1910) to Harden, Sowden & Dunn (1984) (McKim, 2010a). The body of knowledge related to medicine grew exponentially during the second half of the past century (Ebert, 1992) as the biological sciences developed individually. First, the sciences to approach the study of the human being were developed, and from there, the disciplines to teach each science to students in simplified, understandable ways were refined (Rosse, 1973). At the end of the last century, the endless development of each specialised medical branch became overwhelming, and the need to understand the human being and its illnesses within the context of a particular society required a more holistic and integrated approach (Pratt, 1980 p 9; Hamlin, 2001).

The PBL and tutorials in the MBChB programme at WSU start during the second semester of MBChB I. This year, students cover basic sciences, namely anatomy, histology, embryology, biochemistry and physiology. The integration of different disciplines during the first three years of the MBChB programme; is presented to the students through the use of paper cases. The cases are designed specifically to cover the learning objectives of all of the disciplines taught during each year (phases 1A, 1B and 2). The cases also illustrate particular disorders, to open a way for the students to see the link between the normal and the abnormal structure and function. The connections among the four disciplines within the diseases illustrated by the cases, in MBChB III; serve as a bridge for the students to identify the learning objectives and the commonalities between the disciplines. Resource sessions for clarification of concepts are offered by the individual disciplines. A similar approach is used in the second year, for the same reason. The only differences are the content topics, the number of disciplines and the learning objectives. Also, non-integrated clinical skills and COBES are covered during the academic year: COBES teaching takes place during one week in the first year and two weeks (full time) in rural peripheral hospitals. Clinical skills are taught in the skills laboratory during the whole of Phase 1 (MBChB I and II).

Many factors beyond the type of curriculum, including other components of the learning and teaching process, affect students' performance and the quality of new doctors (Craig et al 2009). The ever-increasing volume of scientific information and today's marked technology-driven approach also constitute a challenge, not only to medical students but also to their educators (Dahle et al, 2002; Ranjay, Lawrence & Puranam, 2005). The need to comply with accreditation standards led to major curricular changes in medical education programmes, and as a result, a new pedagogy, that of the integrated curriculum emerged (Harden, Davis & Crosby 1997). Smith (2005), based on Harden's previous work (Harden, Davis, & Crosby 1997 and Harden et al 2000), effectively depicted the historical evolution of medical curricula and the trend to integrate various branches of science. This consequently created new links between the performance of medical students and their future professional role and duties (Gaufberg et al, 2008).

This continuous development and evolution poses several challenges to the educator.

Following the model proposed by Flexner in 1910, health sciences educators have unfolded the properties of the curriculum even further. Flexner believed that all education should be applied in practice and should prepare the individual for civic responsibilities and for a profession (Hebert, 1992). The bases for unfolding the medical curriculum were, among others, the ever-increasing development of knowledge, the changes in the delivery of care, the addition of new technologies in the fields of health and education, and the development of cognitive psychology and sociology (Cooke et al 2006).

To merge the elements of all the previously mentioned developing sciences with medical programmes and keep them updated in terms of skills, learning styles, learning approaches and discipline content to ensure that medical programmes remain updated is overwhelming. Besides trying to cope with all of the above, integrating content from various disciplines is expected. The struggle of health sciences educators to keep all knowledge updated leads to what is regarded by Cooke et al (2006) as "*the perpetual state of unrest of the medical education*" (p. 1339).

Benor (1982, page 355) defines integration within the medical curriculum, in the context of medical education as:

"The identification of common aspects of the content, concepts, applications or methods of the subjects to be learnt, and the utilization of these commonalities to organize both the learning process and the knowledge acquired."

Russell (1978) emphasises the advantages and disadvantages of integration within the medical curriculum. The concise definition of integration by Harden, Sowden and Dunn (1984) provides more clarity to the term: *“Integration is the organization of teaching matter to interrelate or unify subjects frequently taught in separate academic courses or departments”* (page 283). Integration includes numerous models, from full integration at one end of the spectrum to discipline-based teaching at the other, with multiple variations in between. Indeed, integration can be vertical or horizontal. Horizontal integration occurs at a specific point in a curriculum, for instance a specific year. Two or more of the subjects taught in that year could be integrated to a certain degree. By contrast, vertical integration extends across academic years.

Vertical integration resulted from relatively recent strategies to improve medical education and service delivery to areas with poorly met medical needs (Rosenthal et al, 2004). These authors regard vertical integration of medical education as: *“a grouping of curricular content and delivery mechanisms, traversing the traditional boundaries of undergraduate, postgraduate and continuing medical education, with the intent of enhancing the transfer of knowledge and skills between those involved in the learning-teaching process”* (page 2).

Today, medical educators must cope with the challenge of preparing a new generation of physicians. One of the ways to achieve this is through integration (McKimm, 2010, b), within and among disciplines, both horizontally and vertically throughout the curriculum. Issues such as politics, economy, power and global health influence the graduate outcomes and preparedness of new doctors (Kennedy, 2006) because medical education cannot be considered in isolation. Notably, Harden, Sowden & Dunn (1984) went beyond integration when they proposed the SPICES (S: student centred; P: problem-based learning [PBL]; I: integration; C: community based/hospital based; E: electives; and S: systematic apprenticeship based) model for the medical curriculum. PBL is a well-known example of how medical disciplines are integrated and is part of the SPICES model (Iputo, 2005).

Problem-based learning, integration and the tutorial process

At the end of the last century, PBL was regarded as an innovative way to teach and learn (Chan, Hsu & Hong, 2008), and today, PBL is being used almost worldwide. The Faculty of Health Sciences at Walter Sisulu University (WSU) is one of the leading PBL schools in Africa (Kwizera, Igumbor &

Mazwai, 2005). The integrated PBL curriculum was implemented in the early 1990s, and the pioneering class taught using this method graduated in 1997. At WSU, the Bachelor of Medicine (MB) and the Bachelor of Surgery (ChB) programmes are covered together (MBChB) by those students registered for medicine. During the tutorial process in the first three years of the MBChB programme paper cases are used, a case per week, and in PBL sessions during clinical rotations, students learn from real patients. The number of cases varies depending on the number of weeks per block per calendar year. The tutorial sessions per case/week differs, depending on the phase or academic year (i.e. MBChB I and II students have three two-hour physical contact sessions and MBChB III students two three-hour sessions per week). The tutorial process is regarded as one of the most valuable tools in the learning process (Kwizera, Dambisya & Aguirre, 2001). The tutorial groups are comprised of eight to 10 students and one or two tutors, depending on the number of students per class and the size of the tutor pool.

The WSU MBChB curriculum is divided into three phases. Phase I addresses Normal Structure and Function, Phase II addresses Abnormal Structure and Function and Phase III addresses Clinical Medicine. Initially, MBChB III (Phase II) consisted of eight full-year independent courses; four of these courses feature vertical continuity, but no integration, along the MBChB programme (clinical skills, community medicine, community objective-based education and services [COBES] and forensic medicine), and the other four courses were, prior to 2005, discipline based, corresponding to the main subjects taught in the phase (anatomical and chemical pathology, pharmacology and medical microbiology). Integration among the disciplines for MBChB III was achieved only during the PBL tutorial sessions, because outside of the tutorial rooms each discipline delivered the content they considered more suitable. Similarly, assessment per discipline addressed the content covered by them, not necessarily in connection with the parallel disciplines. The only commonality shared among the disciplines by then was the Individual Process Assessment (IPA). The IPA was based on the discussion of a common case involving the different perspectives of the integrated disciplines.

Tutorial sessions were based on discussing medical cases that integrated topics from the four discipline-based courses. The students' tutorial performances were assessed continuously throughout the year and then examined in an individualised process assessment (IPA) exercise. The same assessment results for the tutorials and IPA were used for all four disciplines. The supportive practices and resource sessions were conducted by the individual disciplines in a

discipline-specific manner and examined as such, using modified essay questions (MEQs) and objective structured practical examinations (OSPEs).

Integration is defined as a “introduction, developing and mastery of certain material expected at various levels in preparation for building on that material for the next concepts at subsequent levels” (Fogarty, 2009, pages 9-10)

In 2005, the approach to the four main disciplines for Phase II was changed partially, but the remainder of the MBChB III courses were unchanged. The content of the four discipline-based courses was merged and restructured as four integrated thematic blocks of 10-week average duration. The four blocks were rearranged in a specific sequence, whereby each block concluded with final written integrated MEQs before proceeding to the next block. Each MEQ was scenario-based, including related questions from the four disciplines, instead of writing four different discipline-based MEQ. The same change was applied for the OSPEs, which shifted from discipline-based stations and paper to a single integrated stations and OSPE.

With this new level of integrated assessment, the previously discipline-specific assessments (MEQs and OSPEs) were discontinued. Practical classes and resource sessions remained discipline based for individual clarification from the experts. The rationale behind integrating assessments followed, originally, recommendations of the Health Professions Council of South Africa when the School of Medicine was visited for accreditation in 2003 (HPCSA, 2003). Accrediting body noted the inconsistency of discipline-based assessments within an integrated PBL system. The school was given a further period of three years to sort out this and some other issues and has enjoyed full accreditation since 2006 to date. After integrating the MEQs, the spare time was used to add two more new cases to the programme and implement multidisciplinary extra sessions, including a higher number of combined practical sessions and addition of continuous assessment. The change required making available more time for students to engage in self-directed learning. Previously, students had to write four MEQ papers, one per discipline at the end of the block. The content of each discipline was explored deeper than necessary related to the core objectives. This was the second step towards integration after it had initially been implemented within the PBL sessions early in the 1990s. Currently only the practical classes and resource sessions are still conducted in the disciplines.

The coexistence of the four non-integrated, vertically continuous courses previously mentioned, each taught independently, and the four integrated courses (blocks) results in diverse content covered during the academic year. MBChB III educators are currently striving to extend the current integration to the still 'stand-alone' disciplines; hence, the need to explore students' perceptions regarding integration in the MBChB III programme.

The learning environment

The learning environment typically includes four components: an enabling context, resources, a set of tools and scaffolds (Hannafin, Land & Oliver, 1999, 115-140). Genn (2001) published research regarding the importance of the educational climate to enhance students' learning. He considered the curriculum, environment, climate, quality and change in a unifying perspective. According to his study, the learning environment is regarded as a determining factor in students' behaviour. Further studies on the learning environment were conducted by Al-Hazimi et al (2004), in traditional and innovative medical schools. The influence of the learning environment on students' learning styles was also studied by Cano-Garcia and Hughes (2000) and also emphasized by Attwell- Pontydysgu (2007). The authors regard learning and teaching strategies and the need to modify them as part of students' learning environment in the 21st century.

Roff (2005) reported on a generic instrument known as the Dundee Ready Education Environment Measure (DREEM) that could be useful in measuring students' perceptions of the academic learning environment. The survey was later validated by Whittle, Whelan, & Murdoch-Eaton, (2007). In this study, the authors explored students' perceptions of learning, perceptions of teachers, academic self-perception, perceptions of atmosphere and social self-perceptions. Since Roff's report (2005), the learning environment has been regarded as an important factor that enhances the quality of learning. The importance of the learning environment was supported subsequently by Brown, William and Lynch (2011) and Mahyuddin et al (2011).

The characteristics of learners play an important role in students' perceptions of learning, including learning styles, cognitive preferences and other factors (Cano-Garcia & Hughes, 2000). The learning environment is defined more broadly by Jamaiah (2008) as "the 'climate', 'ethos', 'ambiance' and 'atmosphere' of an institution; it is the environment experienced or perceived by students and teachers". In his 2008 study, Jamaiah revised the definition of the learning environment and proposed that it be divided into three categories:

- The physical environment, which includes facilities, comfort, safety, food and accommodations.
- The emotional ambience, such as security, reinforcement and positive methods.
- The intellectual climate, which is characterized by up-to-date knowledge and skills, evidence-based learning and follow-through.

The latter is the most influenced by students and tutors. It may be modified, either positively or negatively, by actions and interactions from both sides.

Investigations into the learning environment resulted in various recommendations, including that teachers should work towards creating a nonthreatening learning environment in which students are supported by others (Koka & Hein, 2003). Baldo, Al Obaid and Dadr (2010) established the need to strengthen and promote certain behaviour among the staff, reported by a student survey, including increased support during periods of distress for students, such as assessments (95% of student respondents), and when students are being ridiculed or irritated by other students. Other factors such as very high expectations, conflicting information, late arrival or early departure, failure to show up, display of anger, a patronising attitude and either favouritism or ridicule may interact with the learning environment to influence students' confidence and achievements (Lai et al, 2009).

The learning environment is regarded currently as an important factor that facilitates contemporary learning and provides the necessary resources to facilitate both lifelong learning and professionalism (education and technology) (Atwell-Pondysgu, 2007). The learning environment has been modified gradually from the conventional classroom with the development of advanced technologies, to include also small rooms for tutorials and the concept of teaching and learning 'without walls' (Elison-Bowers et al, 2008; Atwell-Pondysgu, 2007) or 'virtual classrooms'. In fact, technology is contributing to reshaping the concept of the learning environment to extend beyond the classroom, to free up time, space and facilities for both students and lecturers. The concept of the learning environment has undergone so many modifications that it is also linked with e-learning (King et al 2010). Researchers within the field must consider the personal e-learning environment, such as systems that allow students to control and manage their own learning. In its broadest sense, this term refers to "*any online environment for use by an individual in the e-learning domain*" (Van Harmelen, 2006, page 1). These systems must include support for learners to set their own learning goals, manage their

learning (including process and content), communicate with others during the process of learning and achieve learning goals.

The broad scientific literature published on the learning environment by health sciences educators is proof of its influence on students' academic achievement. One of the main advantages of an e-learning environment from the researcher's point of view is the flexibility with regard to time management, depending on different students' needs.

THE RESEARCH PROBLEM

Problem formulation

The overloaded curriculum within the phase 2 or Abnormal Structure and Function (MBChB III), affects students and staff of the phase, since some departments have only one or two lecturers; most of them with another commitments at hospital. The boundaries are partly due to the semi-rural geographic location of the WSU, which attracts few staff and recruits mostly disadvantages students from academic and economic background. This results in the delay of the new staff to get used to the workload, as well as to the students' success when trying to cope with the workload. The problem started when integrated assessment was implemented in 2005; yet the situation is similar, sometimes worse either with the increment of students number or permanent leave of some faculty members. Understanding students' needs and concern with integration, as well as staff points of view, would help to identify the problems which have to be sorted out; to improve and facilitate learning and teaching.

The facts previously mentioned caused the researcher to formulate the problem statements:

Problem statements:

The overloaded MBChB III curricular content; integrating four large disciplines besides Clinical Skills, COBES and Forensic Medicine; needs to be adjusted to fit with students' needs. The pedagogical method used to support integration among the four main disciplines is the Problem-Based integrated tutorials. Each discipline besides includes, separated classes (resource sessions by experts) and practices. Some staffs perceive integration as the mere connection among the disciplines within a tutorial case, whereas some others struggle to find the commonalities of the four disciplines also during the rest of the classes. Students do not know how to integrate altogether the separated content of four disciplines, far less how to cope with the overloaded

content; hence, the need to formally get feedback on perceptions from both: staff and students; in order to get clarity on the current impediments for horizontal integration within the phase and the way whereby the curriculum can be adjusted to students requirements.

The four integrated disciplines covered by students during the MBChB III programme at WSU interconnect the threads of comparing the complex concepts of human health, from the basic sciences to the understanding of pathological mechanisms of diseases and their treatment. In 2005, attempts were made to reduce the content of each discipline to a core curriculum to decrease the content overload in all of the disciplines and to add a number of new cases to cover some core content that was previously shallow. These attempts were not all equally successful and the content remained similar to that of the 2005 curriculum, with a few exceptions of scarce topics removed partially, to be fully covered in Phase 3 (clinical years). Besides, learning objectives were reformulated, yet they are not totally clear to the students. In addition, some of the topics are still unlikely to be encountered in clinical practice by general physicians, due to their extreme rarity. The need to evaluate the 2005 intervention and modification in the assessment since then; as an indirect attempt to decrease redundant content - sometimes extremely detailed- is necessary. The students and tutors perceptions on integration at the MBChB III course have not yet been evaluated formally; hence, the motivation for the current study.

Main research questions:

What are the current impediments for horizontal integration within the phase and how the curriculum could be adjusted to students' requirements?

How do students' and tutors' perceive integration during tutorials?

What are students' and tutors' perceptions on integration in the rest of the classes during the MBChB III programme at the Faculty of Health Sciences at WSU?

Secondary research questions

Does integration help students to understand the topics covered during tutorials?

How do students perceive integration?

How do tutors perceive integration?

Should the integrated core content involving all disciplines be modified?

The purpose of this study

The purpose of this study was to investigate the perceived advantages and disadvantages of horizontal integration in the MBChB III programme. It also intended to explore students' and tutors' perceptions of integration in tutorials, also during the resource sessions and practical classes addressed by the experts of the four integrated disciplines in the MBChB III programme in the Faculty of Health Sciences at WSU, based on the need to explore the students' and tutors' perceptions of integration in tutorials and in the rest of the classes of the MBChB III programme in the faculty of Health Sciences at WSU.

Main objectives

To determine whether the integrated core content involving all disciplines should be modified in the MBChB III programme in the School of Medicine, Faculty of Health Sciences at WSU.

To determine whether horizontal integration should be extended to the non-tutorial-based courses taught during the academic year in the MBChB III programme in the School of Medicine, Faculty of Health Sciences at WSU.

To gain clarity on the perceptions of the staff and students in MBChB III on integration and main disadvantages reported by both; to change the curriculum accordingly.

METHODS

Research design

A cross-sectional study, based on both qualitative and quantitative methods, was conducted.

Population and sampling

All MBChB III students and tutors in 2010 were invited to participate in this research (appendixes 4 and 5). Participation was voluntary and written informed consent was obtained from each participant. Anonymity was guaranteed to both groups of respondents.

Research instruments

The instruments administered to students and tutors are presented in appendices 1 to 3 and are as follows:

A questionnaire; specifically prepared for the study; including 12 questions to be answered using a five-point Likert scale related to students' perceptions of integration in the MBChB III course (Appendix 1) was administered to the students respondents during the second block in 2010. The information of this section of the questionnaire was handled as quantitative. The questionnaire also included seven open-ended questions. Four of these questions intended to gather more detailed information, in the students' own words, about the areas they liked and disliked, as well as their proposed changes to improve the horizontal integration of subjects and the overall impact of the integrated course. The other three open-ended questions were included to explore students' perception on self-attainment and overall satisfaction with the integration in the course. The data generated from this section were treated only qualitatively (Maree & Pietersen 2007, p99-102).

The questionnaire was piloted, using the class of 2009 during the first block for validation, but included only four open-ended questions. There was no need to reformulate any topic on this part. The open-ended questions were read by three different researchers (the author and two other tutors from different disciplines), to identify the main codes for compilation of the qualitative data collected. Students participating in the survey did their consent to be enrolled in the research; by voluntarily filling in the questionnaire; after explaining them verbally the purpose of it. Questions on learning environment as such were left out on purpose from the

current study on the students tool, due to time restraint and for future study; however, three additional open-ended questions were added to the students' survey after the pilot study.

A tutor survey was conducted using a pretested and piloted questionnaire comprising of six questions, answered by selecting the preferred category on a five-point Likert scale. The questionnaire was prepared specifically for the study. It was answered by the author and two other lecturers not involved in the study for validation.

The questions were intended to probe the tutors' perceptions of the effects of integration. An open-ended question was provided to elicit additional information and recommendations related to the semi-structured items (Maree & Pietersen 2007 p155-170). The survey was piloted by distributing it among educators of the phase, some tutors from basic sciences and clinical years, and some educators of other health sciences schools (Havana, Stellenbosch and Lagos, among others) who volunteered to answer the questionnaire via email to ensure understanding of the formulated questions (Appendix 2) (Schuwirth & Van der Vleuten, 2011). No particular selection procedure was used to validate the tutors' questionnaire which was sent abroad to some colleagues for external validation as well. There was no need to modify any question after the pilot study.

Semi-structured interviews (Appendix 3) with individual tutors were performed to gain a deeper insight regarding their views on integration and the learning outcomes in the MBChB III programme. The participants were tutors of all four integrated disciplines, and community medicine; all of them tutoring MBChB III class. All the tutors were from the medical school and volunteered to be enrolled in the research by filling in the questionnaire.

The interviews were conducted using a pre-elaborated interview protocol (termed a guided conversation by Rubin and Rubin, 1995, p128). Each interview lasted for approximately one hour. The Appendix 4 reflects a consent form signed by tutors' respondents.

Data collection and analysis

Quantitative data

The data resulting from the questionnaires were handled as quantitative data; with exception of the open-ended questions; whose answers were analysed as qualitative. The frequencies of the Likert categories registered for each question were calculated as percentages to identify the

overall pattern of occurrence in the sample. The absolute value for the observed Likert categories per question was also used to obtain their arithmetic mean and mode. The mode was determined and used as a representation of the most common value assigned to the question. The guide to the interpretation of the means was as follows:

0–0.80 very dissatisfied

0.81–1.60 dissatisfied

1.61–2.40 neutral

2.41–3.20 satisfied

3.21–4.00 very satisfied

To describe the general pattern of satisfaction during the analysis the sum of percentages for the Likert levels 1+2 was considered as total frequency of dissatisfied and the sum of 3+4 was considered.

Qualitative data

All the answers to the open-ended questions were literally transferred into a text database. The answers to the open-ended questions from each survey (students and tutors); interviews were audio-recorded and later also transcribed verbatim. The text data were then analyzed to extract the main codes by comparing and contrasting the actual words used, establishing their meaning and frequency, and searching for the patterns and common threads amongst the participants (Babbie et al 2006) and the Quick scan audit methodology (QSAM) (Böhme et al 2012).

Categories of data were developed based on the research purpose, and a description of the resulting codes was then made. Comparison between the quantitative and qualitative responses from both, students and tutors was done among both groups of respondents for triangulation of the data collected.

Quality assurance/rigour

Qualitative analysis was performed by sifting through the data, looking for patterns and connections using a constant comparative methodology and repeating this process at least three times by three different researchers: the author and two colleagues from the departments of anatomy and chemical pathology respectively (Seale & Silverman, 1997).

The text analysis for the coding of transcripts was carried out independently by the three raters. The multiple coding strategies and interpretation of data were crosschecked by the raters. Only

minor rater disagreements were found which were then discussed and fine-tuned according to the coding frames relevant to this study as recommended by Maree and Pietersen (2007:113).

During the qualitative data analysis, supportive information for the emerging ideas and perceptions was identified in terms of contextual meaning, frequency, intensity and consistency of the related comments to ensure the validity of the emerging information. All the steps of the qualitative data handling were documented, and the resulting body of evidence was used to compare and ensure agreement in the continuum, from the raw data to the extracted codes and their descriptions, to ensure reliability (Barbour, 2001; Niewenhuis, 2007, 47-122).

RESULTS

Although the data collected from each participant was kept together under individual research codes corresponding to the original sampling criteria, they were not indicated in the reporting process because during the analysis no specific trends were observed to make it necessary.

Students' perceptions of integration

Eighty-eight students (87.1%) out of 101 registered for the class of 2010 consented to answer the survey. The results of the instrument administered to the students are shown in tables 1 and 2.

Students' responses to the questionnaire

The quantitative analysis of the students' responses to the questionnaire is presented in Table 1. All respondents (n = 88) were satisfied or very satisfied with the multidisciplinary integration (mode ranged from 3 to 5). The majority of the respondents (58%) agreed that integration facilitated their analytical thinking. However, only 41% found clear goals and objectives for the integrated pathology content.

Table 1 Frequency, average and mode of Likert levels for the semi-structured questionnaire:

QUESTIONS	Likert level 1 (%)	Likert level 2 (%)	Likert level 3 (%)	Likert level 4 (%)	Likert level 5 (%)	Average score	Mode
The Integrated pathology content in this block has facilitated enhancement of my analytical thinking skills.	1.1	10.2	30.7	47.7	10.2	3.56	4
There were clear goals and objectives for the Integrated Pathology content in this block.	3.4	26.1	29.5	37.5	3.4	3.11	4
I found the Integrated Pathology block being reasoning learning centered rather than being reproductive content centered.	2.3	6.1	33.0	39.8	18.8	3.65	4
The exam questions for the Block were matched to their goals and objectives.	1.1	13.6	33.0	40.9	11.4	3.48	4

The content of this block of Integrated Pathology facilitated active learning opportunities (in class questions, discussion, group activities).	0	15.9	22.7	51.5	10.2	3.56	4
Multidisciplinary integration encouraged me to reflect on how I am learning.	1.1	11.4	14.8	47.7	20.0	3.84	4
Multidisciplinary integration encouraged me to relate ideas in one discipline to those in another discipline.	2.3	4.5	10.2	48.9	34.1	4.08	4
The multidisciplinary integration approach has shown me how much of what I learn today seems relevant to my future training for a career in healthcare.	0	2.33	3.4	43.2	51.1	4.43	5
I find that the multidisciplinary integrated curriculum has increased my stress load.	2.3	10.2	13.6	22.7	51.1	4.10	5
The multidisciplinary integrated teaching has helped me to recognize the interrelationships within and between the various disciplines.	0	4.5	4.5	53.4	37.5	4.24	4
Overall I have learned with understanding a great deal in this multidisciplinary integrated block.	4.5	11.4	33.0	31.8	19.0	3.50	3
I am satisfied with the level of content integration of the 4 disciplines in the block.	3.4	14.8	33.0	30.7	18.2	3.45	3

The guide to interpret the average scores is as follows: 0 - 0.8 very dissatisfied, 0.81 - 1.6 dissatisfied, 1.61 - 2.4 neutral, 2.41 - 3.2 satisfied, 3.21 - 4.0 very satisfied.

Students' responses to the open-ended questions

The most common aspects facilitating students' learning and understanding identified by students were the interactive tutorial sessions (33%); the academic learning sessions including resource lectures and practicals (30%); the integrated learning of disciplines (26%); and, the tutor's support and feedback to students (8%). Among the aspects that students liked most in the block the more frequent were: specific disciplines (28%); the integration of disciplines (13%); and the tutorial sessions (13%). With regard to the aspects that students disliked most during the academic block the most frequent were: the work overload (17%); specific disciplines (16%); and, the written assessment exercises (15%). Regarding the students' suggestions to improve the course it was noticeable that 19% of participants considered the increase of resource sessions offered by specific disciplines whilst only 8% recommended the time allocation for self-directed learning.

A summary of the themes identified from the students' responses to the open-ended questions is presented in Table 2.

The following quotes illustrate the range of answers observed regarding students' views on learning facilitation, likes and dislikes, as well as recommendations on integration:

Aspects students liked most

"Firstly, being an individual who has only recently acquired the true interest of knowledge on how to study, I would say the initial strongly influencing factors would be the interaction with members of our class...."

"Learning with individuals shows you ways of how [to] isolate when [to] study the information you place more important at your fingertips...."

"The motivation from tutors is strong, since they highlight the need of being well knowledgeable."

Table 2: Topics identified by students in the open-ended questions

Aspects facilitating learning	Integrating all aspects of the case
	Discussion of cases in tutorials
	Complementing tutorials with practical exercises and lectures
Aspects that students liked most	Tutorial sessions in a different format from the previous courses
	Integrating all subjects at the same time
	Feedback from assessments
Aspects that students disliked most	The ongoing tests (they put too much pressure on them)
	The workload to be covered in the blocks is too much
	Learning objectives are not completely clear and demarcated
Aspects of the course that students would like to change	To remove the ongoing practical tests
	To be given more precise learning objectives for each case
	To have more time for self-directed learning
	To be given more orientation on the expected performance in IPA and MEQs
	To have more specific questions in the MEQs
	To have more time for writing MEQs

Aspects students disliked most

“Reading the unnecessary topics [*from pathology and microbiology*] is both time wasting and boring.”

“...workload. It is not important to test students by examining them on topics that were not emphasised in resources or tutorials.”

Aspects of the course that students would like to change

“Lots of work to be done throughout the year; it is very stressful. Please streamline the learning objectives if at all possible. More sense[ible] lectures as well...”

“I will recommend the course, it is good, very practical and we shall, definitively, recall our studies from this year in future years!”

Table 3: Students' perceptions of expectations and self-attainment regarding integration

What do you think is expected from you with the integration of the four subjects in the block?	Why do you think you have reached (or not reached) the intended outcome in Block 2?	Would you recommend that this course, as an integrated course, continue?
"To be able to think broadly and be able to integrate all aspects of the patient and case."	"This block was too loaded. Likewise, the content is not easy to deal with. The covered systems are really broad but there was too little time to go through them thoroughly."	"Yes, if more time is allocated for blocks such as this one."
"Overall understanding of basic concepts, then we will be able to manage patients holistically. All the topics are interrelated and can't be separated, so, the integrated approach is a good way to help us learn."	"Although I may not know everything, my overall knowledge is good, I can identify where the integration come in. It helps with broaden[ing] my thinking: for example when I read pathology then read Chem. Path, having a broad knowledge of both subjects, which helped me to understand better, the process[es] that are occurring."	"Yes, because of the overlapping nature of the courses certain concepts are constantly revisited and reinforced within me & this will allow us to remember important fact[s] for clinical years."
"Is to be able to integrate all 4 subjects and be able to [find a] link between causes of disease, their outcome and how to manage them. No subject must be superior to the other ones because the clinical practice [of] all of them [is] important in order to understand the disease and [its] management."	"The time frame is too short to grasp the important points so that leads to the point of studying to pass, yet no information for long term [is] stored. The time of Wednesday also is reduced {sessions are shorter} resulting in not finishing all the learning issues."	"Yes, but enough time is needed and each subject should get equal time like others."

Integration of the course

On the question dealing with what the students thought was expected from them with the integration of the four subjects in the block, three common codes were identified in their answers (about 25% of respondents identified more than one of these codes):

1. Future vision for clinical application (56.5%)

"Overall understanding of basic concepts, then we will be able to manage patients holistically."

"This integration actually gives us the chance to be able to treat a patient as a whole not a patient with individual causes and management."

2. Facilitating understanding (43.5%)

“It helps with broaden[ing] my thinking: for example when I read pathology then read Chem. Path, having a broad knowledge of both subjects, which helped me to understand better, the process[es] that are occurring”.

“Given the clinical presentation I am able to predict the likely outcome and the pathologic test results, chemical pathology results and the likely causative agents to recommend the appropriate management.”

3. Developing learning skills (32.6%)

“To be able to think broadly and to be able to integrate all aspects of the patient and case.”

“... to apply it to the clinical situation is not easy but it is helpful. It teaches us how to be interpretive.”

On the question regarding their perceptions of the level of integration reached during the block, “Why do you think you have reached (or not reached) the intended outcome in the block?”, 69.8% of respondents felt that they had experienced a positive achievement and described the benefits as facilitating their learning and understanding, finding the common grounds among the disciplines and enhancing their ability to think broader. However, out of those students achieving integration, 27.9% had the impression that they had reached only a partial level of integration, which was attributed by some to a work overload:

“The time frame is too short to grasp the important points so that leads to the point of studying to pass.”

“Reading the unnecessary topics is both time wasting and boring.”

“I am not quickly grasping concepts and I am not flexible enough to be able to relate concepts for proper understanding, I am trying very hard.”

“I felt as if I did [reach integration] in some aspects but I was left behind especially in pathology, it was packed for the block....”

On the question concerning recommending the continuation of the integrated course, most of the respondents (95.6%) recommended that the programme continue to be offered in the integrated approach, even though they all felt that it put “too much pressure” on them due to the need to cover a compacted content of the four disciplines in a relatively short preparation time, which sometimes forced them to adopt a strategic-learning approach whereby they studied the topics just to be able to cope with the heavy load and to ensure their own academic progress, not actually to learn.

“Definitely, ultimately we have to be the jack of all trades. Knowing one aspect of a subject will not help, eventually one has to know all that has to be learned about a certain condition, not pathology in isolation or pharmacology in isolation....”

“Definitely yes, because it gives us exactly what we would be doing in the practical situation hence it improves our competence and confidence.”

“Yes, because starting as early as now to integrate makes it easier in [the] future because when the patient needs help the doctor should integrate all the information....”

“Yes, because of the overlapping nature of the courses certain concepts are constantly revisited and reinforced....”

Tutors' perceptions of integration

Eight tutors volunteered to participate in the study. Two of them were excluded because their theoretic background and points of view might have created bias in the analysis of the results.

Tutors' responses to the questionnaire

The results from the semi-structured questionnaire to guide tutors through the areas of integration and integrated learning are presented in Table 4. Due to the small number of participants the results could not be statistically analysed.

Table 4: Quantitative analysis of tutors' perception of integration

The MBChB III integrated curriculum: (n=6)	SA	A	N	D	SD
Facilitates my teaching skills	2	4			
Promotes increased student engagement	3	3			
Promotes increased student learning	2	2	2		
Promotes increased faculty interaction	2	2	2		
Increases my workload	4		2		
Lacks direction/sense of purpose	2		2	1	1

SA: Strongly agree; A: Agree; N: Neutral; D: Disagree; SD: Strongly disagree

Concerning the questionnaire, all respondents agreed that the organisational arrangement of the integrated curriculum facilitated their teaching skills and promoted student engagement. On the question of whether integration increased student learning, two remained neutral and the other four agreed (two of them strongly agreed). Two tutors were neutral but the others agreed that the integrated curriculum increased faculty interactions. Four tutors strongly agreed that integration increased their workload, and two were neutral. For the last question on the lack of direction/sense of purpose of the integrated curriculum, two tutors strongly agreed, two were neutral, one disagreed and one strongly disagreed.

Tutors' responses to the open-ended question:

In the open-ended section of the questionnaire, the analysis of the frequencies of the tutors' responses did not show any meaningful pattern. However, tutors' answers contributed with broader perspectives about the explored themes. The following comments and suggestions were made by the tutors:

“Doctors should be involved in teaching shortly after finishing their studies to solve staffing problems and to prepare them better for their part 1 of Fellowship (M.Med)...”

“Cases for PBL [and] scenarios for exams should involve clinicians, who are better [at] creating the product...”

Semi-structured tutor interviews:

What is curricular integration of pathology?

All the tutors were aware of the meaning of integration. They also agreed on the need for integration as a means of facilitating an appropriate learning environment and enhancing students’ motivation to study. Some tutors also emphasised the need to enhance the vertical integration within the course. Horizontal integration was also regarded among the tutors as an important factor facilitating learning. Some ideas from the tutors are quoted below:

“What we have here as integration is sometimes trying to keep in the students’ memory an association between previous learning, building on top of this learning and also within the year having some kind of commonalities”.

What are the advantages and disadvantages of horizontal versus vertical integration as seen by tutors?

“... Advantages start when they don’t memorize unnecessary information given in a textbook or separated discipline, they don’t separately learn topic by topic, but they try to learn disease processes and the necessary information (physiology, anatomy, pathology) for the process...”

What is your understanding of an integrated curriculum?

“The curriculum in which all the subjects started from anatomy, physiology, biology, biochemistry from basic sciences integrated with clinical subjects...”

Can you describe some of the types of integration that you are aware of?

“... all knowledge ha[s] to be integrated so that students understand the disease process in an integrated way, the normal structure and function, the abnormal structure and function, and finally the management, so ultimately they will treat patients at hospital...”

Can you explain what some of the advantages of the current integrated model of undergraduate education may be?

“... They don’t memorize unnecessary information given in a textbook or by separated disciplines, they don’t separately learn topic by topic, but they try to learn disease process and the necessary information (physiology, anatomy, and pathology) for the disease process...”

What are some of the pitfalls/disadvantages of the current integrated model of undergraduate education that you foresee?

“One of the main disadvantages is that the lectures ... delivered in connection with tutorial cases, are not be[ing] prepared in an integrated way, so that they are not still integrated as lectures to be able to push that integration together and this is one disadvantage I have noticed...”

In what ways is this integrated curriculum different from the traditional curriculum?

“... if we go into the traditional thing, each subject will be a separate kingdom, and some lecturers very often didn’t know what were [said] and [taught] in other subjects by other people”.

What is the effect of integration on the students’ learning environment?

“...I am quite happy with their learning environment because students learn freely and the number you choose is reasonable, and most tutors give freedom for students to make mistakes, there could be problems, students will not make them intentionally, but because of the basic answers and body language, students may be frightened...”

What are your impressions with regard to the students’ current learning environment?

“... Students’ learning environment here, we usually encourage students to integrate tutorials that we conduct, students will lead the group, tutors are there to guide them, not to teach. Most of the time, when a student talk[s] too much, the group can tell you. They really lead the group and encourage integration of different subjects....”

Do you identify changes in the students’ current learning environment? If yes, which ones?

“The students’ learning environment is very good for learning, because they are exposed not only to the so-called integrated curriculum, but at the same time, that curriculum is carried on in PBL tutorial sessions, and for me that creates a very good learning environment for them.”

How does the current integrated curriculum contribute to/affect the students’ learning environment?

“Learning environment is not only in tutorials, also clinics, [students are] free to visit staff members, and call me any time to clarify doubts, so all will be happy, I think we tried to do so [to a] very large extent...”

A summary of the main answers obtained during the tutors’ interviews is given in **Table 5**.

Table 5: Summary of the main answers obtained during the tutors’ interviews

What is curricular integration of pathology?	What are the advantages of horizontal versus vertical integration?	What are the disadvantages of horizontal versus vertical integration?	What is the effect of integration on students’ learning environment?
<i>“To facilitate the understanding of the disease processes and their management.”</i>	<i>“One of the advantages of the integration is that the learning is connected with the PBL case during [the] tutorial process.”</i>	<i>“... when it comes to non-infectious diseases, micro[biology] cannot be truly integrated, although we tried to do so, one way or another...” “Some topics can’t be covered by micro[biology] or [anatomical] path[ology], like psychiatric disorders...”</i>	<i>“Most tutors give freedom to the students to make mistakes, there could be problems, students will not make them intentionally.”</i>
<i>“Integration is sometimes trying to keep in the students’ memory an association between previous learning, building on top of th[is] learning, and also within the year having some kind of commonalities quoted.”</i>	<i>“I think that there is some advantage, but is it the benefit of integration or [is it] the benefit of the method that we have with those small groups?”</i>	<i>“... that the lectures ... delivered in connection with tutorial cases, have not been prepared in an integrated way.”</i>	<i>“Students will lead the group; tutors are there to guide them, not to teach. They really lead the group and encourage integration of different subjects...”</i>

<i>"I believe that still more coordination and integration in general [are] needed not only horizontally but vertical[ly also] and in connection with the previous year, more integration with physiology, with biochemistry, with anatomy...."</i>	<i>"... advantages start they don't memorize unnecessary information given in a textbook or separated discipline, they don't separately learn topic by topic, but they try to learn [the] disease process."</i>	<i>"...in my opinion, there is something wrong probably here because they are free, sometimes too free shooting, and sometimes those shots are very far away from the target..."</i>	<i>"... When we say that there is culture of reading here and so on, very often this culture of reading is brought from home..."</i>
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Analysing the quantitative and qualitative students answers, majority of them agreed with the need to keep integration, with small variations addressing mostly the formulation of the learning objectives and the workload (to be decreased). Yet, there were 27.9% who acknowledged they covered partially the content just as a strategic way to pass their exams, due to time restrictions for deeper approach. Nevertheless the majority of the respondents (95.6%) recommended keeping the integrated programme, after addressing the aspects which needed to be changed.

Tutors also agreed with the need to keep integration for it promoted increased student engagement and facilitating teaching skills, however most of them agreed with the excessive workload, and only two of them felt there was lack of direction or sense of purpose with integration. This issue was corroborated by the students' answers stating that they have to follow a shallow coverage of some topics or a strategic approach, due to time restrictions and content overload.

DISCUSSION

The results of this study support most of the advantages and disadvantages of integration mentioned in the reviewed literature (Bandaranayake, 2011; Dandannavar, 2010; Gale, 2006; Khantan, 2008; Russell, 1978; Van der Vecken et al, 2009 & Van der Vecken et al 2013).

All the respondents in this study agreed that integration enhanced their ability to understand and connect the contents gathered from all disciplines on the same topic. The tutors also found integration useful for the students, as a way of enhancing their learning skills. Some of the tutors, however, queried whether the enhanced learning skills of the students were a result of integration or were due to the PBL system used. The students also acknowledged the advantages of integration; however, most of them admitted that integration was also fast paced and burdensome and requested either a slower pace for learning the content or extra time for self-study. Despite the perceived advantages of integration, both groups of respondents also found integration laborious, stressful and time consuming.

Integration

Most of the students agreed that the integrated approach showed them the relevance of the learned content for future application, and all the tutors agreed that integration facilitated their teaching skills as well as promoted student engagement. The findings of this study support Dandannavar's (2010) proposal to change from a traditional curriculum to an integrated one in medical schools, as well as Jones (2009). The findings on the students' perception were also validated from a similar study carried on in 2008 by Garcia-Jardon et al (2011).

It was only relatively recent (during the last decades of the last century) that integration became essential, due to the rapid expansion of knowledge in individual sciences and disciplines, making it almost impossible to cope with these huge, ever-increasing amounts of content (Cooke et al., 2006); hence, integration became almost a necessity in the medical curriculum, being recommended by educators to students.

The recommendations by the HPCSA during its visit to the WSU Faculty of Health Sciences for accreditation of the MBChB programme in 2003 triggered several actions, including the creation of a task team, several meetings and workshops with the advice of reputable invited external assessors. Among the recommendations made were increasing the level of horizontal and

vertical integration. As a result, the staff of Phase 2 started to prepare the action plan to enhance horizontal integration besides the tutorial sessions, starting with integration of all assessments and tests.

Curriculum integration might be considered as a spectrum, with different levels represented by the various types of integration. Integration is present within the same discipline, for example when the content of general pathology is applied to systemic pathology or when a given drug or group of drugs in pharmacology has undesirable effects due to interaction with other drugs. This is what the author personally regards as intra-disciplinary integration. Integration among disciplines can be either intra-modular / horizontal in an academic year, or vertical, through the continuity of basic sciences re-emphasised during clinical years, as the clinical issues are rooted in the basic sciences (Kanthan, 2008). Ten models of curriculum integration have been described recently by Fogarty (2009, p10).

Notwithstanding the type of learning activities, there is no doubt about the advantages of integration in a curriculum. Bandaranayake (2011, p69-79) strongly emphasises the need for teachers to plan activities that will encourage student-derived integration in the medical curriculum. Kanthan & Mills (2006) also recommended the use of active learning experiences as a way to enhance the students' reasoning process through integration of knowledge. Integration in a medical curriculum is also associated with considerable guidance and learning actions (Stone, 2000). The latter may explain why most of our respondents among the staff and students regarded integration as increasing their workload.

The changes in the MBChB III curriculum at WSU have been gradually implemented. The changes, though slow and subtle, have taken place, hence the need to explore the students' and staff's perceptions of integration. The results of this research are viewed in a positive light, as the advantages of the integration from students were favourable viewed. Most of them liked the PBL tutorial sessions that were presented in a different way from the ones conducted in basic sciences; despite the author agreed with the advantages and disadvantages of the PBL system reported by Wood, 2003. The integration of all subjects at the same time and the feedback received after the assessments were among the other issues the students like most.

The tutors also acknowledged the advantages of integration by emphasising the students' improved reasoning compared to learning isolated discipline issues by heart. Nevertheless, resistance to integration has been reported (Malick & Malick, 2011), mostly due to various issues

related to rejection of change, unsupported infrastructure, not understanding the process or reluctance to embark on integration (resistance to change). As a result of these issues, many educators promote integration, whereas others are opposed to it (Rosenthal et al, 2004; McGrath et al, 2006). The present study showed similar points of view from some tutors. All of them perceived integration as beneficial and necessary for students' learning, yet some of them found it laborious and time consuming, probably because of the unsupported infrastructure due to a shortage of staff.

Kanthan, described the integrated medical curriculum in 2008 as follows:

"... the medical curriculum that has greater content integration of the various subjects, disciplines, and systems. This integrated curriculum aims to move students beyond mere fact and concept acquisition; to a level of scientific fluency by using the common language of medical science so that they can think creatively about medical solutions" (page 8).

He (Kanthan 2008) also recommended the need to perform parallel assessments of the curricular changes in order to gain a perspective balance on the curriculum changes. Such recommendation is currently of the utmost importance for the school of medicine at WSU, which is currently embarked in changing back to a 6-year medical curriculum.

In 2011 Bandaranayake launched his book on integration of the medical curriculum and its history, advantages and disadvantages. The results of our study confirmed Kanthan's (2008) and Bandaranayake's findings (2008), respectively, on standardize assessment among the advantages and disadvantages of the integrated curriculum. More than 50% of the student respondents in our study considered integration as useful, broadening their future vision for clinical application (56.5%), 43.5% agreed that integration facilitated their understanding and 32.6% acknowledged that integration helped them in developing learning skills.

Smith (2005) reported the advantages of integration, as well as several "concerns about negative consequences of integration" from sceptic educators; such as "the students would not cover basic sciences, integrated curriculum is superficial and is only for gifted students" among some others, like Jones (2009). Bandaranayake (2011) on the other hand, considered that the disadvantages of integration to teacher and student were more perceived than real (page 73).

One of the major disadvantages of non-integrated learning mentioned in the health education literature is related to the increased fragmentation that was appearing with the continuous

growth of the body of knowledge within the sciences and their individual disciplines (Dahle et al. 2002). Before the era of knowledge explosion, students were expected to know by heart, in detail, all the contents of the individual disciplines as part of their learning outcomes. The continuous broadening of knowledge by research contributions makes it more complicated for this knowledge to be covered by medical students within their normal study period. The time that students use to go deeper into a given content is time that they cannot spend on the common issues regarding the same topic among the integrated disciplines. Bandaranayake (2011, page 76) also considered the reluctance of some departments/ disciplines to give up some timetable hours, reflecting only the uneasiness that other disciplines utilize their time, even though such time might be allocated to more fruitful attempts on another content.

Dandannavar (2010) admitted the limitations associated with the lack of integration, while Kanthan (2008) warned medical educators against deviating from the core knowledge content, losing sight of the whole by going into detailed, fragmented content. Once students embrace an integrated curriculum, they are able to notice clearly why it is necessary to integrate and also realise that covering the contents of different disciplines in isolation limits their ability to link concepts. The answers from our students' survey supported Kanthan's findings (2008) and the concerns on the negative consequences of integration mentioned by Smith (2005). More than 80% of our respondents agreed that the multidisciplinary integration encouraged them to relate issues from different subjects, showed them what is relevant for their future learning and reflect on how they were learning.

Duplication of knowledge may be found in programmes where there is poor or no collaboration among teachers planning and implementing their subject content for the same students on a common topic. This duplication is often unnecessary, sometimes sacrificing more useful information. This does not imply that reinforcement of knowledge is not necessary, but the way in and the extent to which it is reinforced; should be appropriate and vary (Bandaranayake, 2011). Responses from the faculty members enrolled in our study differ. Some tutors agreed that integration facilitated the study and management of the diseases; whereas others acknowledged that the lectures were prepared in a not integrated way and students benefited more from integrated tutorials rather than from the rest of learning activities. Scepticism in some of them was reflected in the answer that the "culture of reading in some of them was brought from home rather than acquired during their learning sessions/environment (Table 5).

Integration is also not limited to integration across disciplines but may even be found within the same discipline. For example, MBChB III students at WSU cover the general pathology module during the first block when they come from basic sciences. Yet, they will have to apply this content all along the rest of the systems and blocks; hence, such content must be emphasised. The integrated assessment of MBChB III was implemented on 2005 following recommendations of the National Qualification Framework (NQF, 2000).

The majority of the student respondents in this survey agreed on the advantages of integration to improve their analytical skills. Horizontal integration takes place among different subjects taught within the same academic year, whereas vertical integration occurs among different subjects taught during different academic years (Vidic & Weitlauf, 2002). The benefits of integration are regarded by Kantham (2008) when emphasizing that "*Integration erases the compartmentalization of knowledge by breaking down the artificially structured silos of discipline specific knowledge.*" (p.34). The present study is an example of an approach to horizontal integration of four disciplines within the same academic year.

Integration in the MBChB III programme increased the students' level of satisfaction with the integrated content of the four disciplines (3.45 average and a mode of 3), as reflected in Table 1. Regarding the aspects that students disliked most (Table 1), the emphasis was focused on the increased workload to be covered within the block and the unclear, poorly demarcated learning outcomes. The same applied to the surveyed tutors, with more than 75% agreeing that integration increased their workload as well (see Table 2). One of the priorities among the students was the need to have more free time to study the content. The students commented on the need for time to focus on self-directed learning during working hours instead of spending the whole day seated in a classroom. This was also mentioned by Kitzes et al (2006); as one of the priorities in integrated courses: the need for self-study and self-reflection. A very positive response to integration from both students and staff was obtained in this study. The staff, however, still found integration very laborious, which had been previously reported by researchers exploring the same topic, such as Khantan (2008) and Bandaranayake (2011).

Dick et al, (2007) also recognised among the advantages of integration a source of motivation for the staff and a possibility of decreasing the content overload by covering only the main topics of the content. Following this latter recommendation and considering students' responses in the present study, the need to modify the content in some of the disciplines in MBChBIII at WSU

(particularly microbiology and anatomical pathology) to the main topics only, as was recommended by various external assessors of the MBChB programme during the past 10 years, should be strongly considered.

Some of the disadvantages of integration were also emphasised by Russell (1978), who mentioned the high staff-student ratio and the tendency to present too much detailed content as some of the common negative sides of integration. Van der Veken et al, (2009) mentioned the impact of emphasising clinically relevant issues during basic sciences as a way to confirm the potential of an integrated contextual curriculum. The disadvantages mentioned above were also commented on by both students and staff members in the current study, with particular emphasis on the workload emanating from teaching and learning, probably as a result of multi-factorial causes such as reduction of staff with high student-staff ratio, inappropriate integration, wrong core content and high student engagement, taking more time. Some 'obstacles' to integration, similar to the ones mentioned by Brueckner and Gould (2006) were found in the current study; mostly related with the lack of time from the staff to prepare better integrated courses.

With the use of the research tools, several instances of content overlap were identified among two or more of the involved disciplines within the integrated course. The repeated topics sometimes were addressed as a way to enhance reasoning skills and at other times just for the sake of assessment and as a way to remind the students that it was necessary to apply the covered content already learned.

From the tutors' point of view, in the current study, one of the most repeated mentioned issues as obstructive to integration was the insufficient number of staff hence, the lack of time.

Learning outcomes:

The learning outcomes in the present study were a cause of concern from students' point of view. Only 41% of the respondents agreed on their clarity. Most of the respondents considered that the learning objectives were vague, unclear and poorly demarcated. The learning objectives were also identified by most of the students' respondents as a part of the course that needed to be changed. It contrasted with the point of view of the staff involved in the study. None of the faculty's respondents mentioned/realized that there might be something wrong with the formulation of the learning objectives expected from the course. The author has the opinion that the learning objectives are vague, unclear or overwhelmingly lengthy, hence impossible to

reach within the week for each case, resulting in a dragging uncovered content and students' poor preparation for the assessment. In other words, the current learning objectives in term of outcomes are the Achilles' tendon of the integration of the MBChB III course at WSU.

Perceptions on the value of integration

The majority of the students perceived integration as a future vision for clinical application (56.5%) and as a facilitator for their understanding (43.5%). However, in terms of the learning outcomes, precise learning objectives was one of the main issues that students recommended to be modified ("To be given more precise learning objectives for each case"), as well as having more time for self-directed learning.

Bandaranayake (2011) considers integration as a "combination of different elements into a meaningful "whole" (page 10); and emphasized that "the more the teacher integrates for the learner; the less the learner learns to integrate by himself" (page 37).

In general, both students and tutors thought that the multidisciplinary integrated curriculum increased their stress load but acknowledged the advantages of integration and wanted it to continue.

The findings of the current study support the advantages of integration for students and tutors as well as the disadvantages thereof for both groups mentioned by Bandaranayake (2011). He regards most of the disadvantages as perceived rather than real, due to the fear of going beyond a discipline-based teaching and learning system used for many decades, misunderstanding of the concept of integration or poor planning and implementation of the integrated curriculum.

Attitudes

The above-mentioned student perceptions of the learning outcomes somehow reflected a resistance amongst some lecturers to review the learning outcomes to reflect integration. Several attempts to achieve this were made but failed in some cases. This was reported by Bandaranayake (2011) as a disadvantage of curriculum integration for teachers and students; as "*many teachers continue to train students as though they were training clones of their own specialty*" (page 62).

These findings concur with those of Muller et al (2008), who point out the complex nature of integrating a curriculum, the different understandings and experiences of students and staff and the need for curricular sequencing and framework requested by the students.

Realities

The MBChB III programme still faces challenges with active student learning during some class activities. Felder and Brent (2009) define active student learning as “*anything course-related that all students in a class session are called upon to do, other than simply watching, listening and taking notes*” (page 3).

Students’ need for more accurate and better defined learning outcomes emerged from the qualitative and quantitative components of the current study. Similarly, 58% of the respondents complained about the uselessness of continuous assessment. It is often not clear from the content of continuous assessment how it is aligned with the learning outcomes, inadequate, as they appear to be. The relevance of some of the topics related to their future application, the length of the answers required and the allocated time for writing, the depth of the knowledge expected and the allocation of marks were all regarded as questionable.

Students remarked that the integrated curriculum increased their stress load. The source of increasing the stress load for the students could be found in the aspects on integration that they disliked most and the aspects that they wanted to have changed in the course, as reflected in Table 1. Also, they felt that the ambiguous formulation of the learning outcomes did not always allow them to have an understanding of what needed to be covered.

Learning environment

Perceptions of the learning environment were explored only among the tutors in the current study. Jamaiah (2008, page 7) defines learning environment as “the environment experienced or perceived by students and teachers”. He performed a revision of the learning environment and concluded that the learning environment/climate could be divided into three categories:

- The physical environment, which includes facilities, comfort, safety, food and accommodation.
- The emotional ambience, such as security, reinforcement and positive methods.
- The intellectual climate (up-to-date knowledge and skills, evidence-based learning and follow-through of learning).

The learning environment was not a primary objective of this study, despite its importance, as the focus was on integration. Nevertheless, the researcher tried to explore the tutors’ awareness of the importance of the learning environment. Some of them perceived the learning environment as the physical tutor-student contact hours, regardless of the students’ self-study,

the emotional ambience, the positive approach to methods of instruction and the intellectual climate. Only one staff member (n = 6) considered the facilities and safety as part of the learning environment. The results of the tutor survey and interviews reflect that the tutors understood the role of the learning environment reasonably well as it related to the time spent with students during tutorials or during the rest of teaching. Most of the tutors, however, disregarded the impact of social networks as learning environment and did not mention the students' social activities as an alternative way of learning (Pontydysgu, 2007, p32-37).

Gaufberg et al (2008) considered as a beneficiary part of the students' learning environment the importance of mentorship and role modelling in medical education; with implications for the professionalism of the medical curricula, allowing the student to problem solve and practice communication skills in boundary challenging situations. The mentorship system is implemented at the school of medicine at WSU once MBChB1 are selected and registered for the programme. Further studies in some of these topics would help to know more on the realities of the students' learning environment.

In summary, the literature reports that some educators have found difficulties in accepting integration, usually due to a lack of information, poor payment, lack of pilot testing, and so forth (Bloom, 2001).

Other problems include bad time management and work overload (Hendry & Fairlay, 2004).

In this study, the major obstacle mentioned from tutors' point of view was the workload, mostly due to the small staff numbers. Students most disliked the continuous assessment, for the reasons discussed earlier.

Mennin (2010b) emphasises that integration is a result of several exchanges and connections at different levels. He acknowledges, though, that just putting all the content together would not automatically lead to integration but would lead to "repeated actions". The results from our survey on students and tutors strongly showed certain advantages and disadvantages of the current system, and improving these in practice is recommended.

CONCLUSIONS

Does integration help students to understand the topics covered during tutorials?

Integration in the medical curriculum at WSU has many advantages, as acknowledged by the students and tutors who participated voluntarily in this study. Integration is regarded as necessary; for it demonstrates the future clinical application possibilities to students.

How do students perceive integration?

There are many advantages of Horizontal integration; which is favourably perceived by students; as they consider it a powerful tool to facilitate learning and understanding among them.

According to the students, integration enhances their critical thinking and helps them to identify the commonalities among the disciplines. Integration facilitates the understanding of the students during tutorials and during their preparation before tutorials. The students perceive integration as beneficial, enhancing their learning with understanding as well as their analytical skills. The students perceive integration as necessary for a future vision and clinical application because it facilitates their understanding and serves as a tool to develop their learning skills. Integration helps the students to understand the topics covered during tutorials and the rest of the classes and enhances their learning skills. The students need more time for self-directed learning, which could be available from decreasing the unnecessary content and processes.

How do tutors perceive integration?

MBChB III staffs consider integration facilitates learning and understanding among the students. Tutors perceive integration as beneficial, necessary and helpful for the students to recall and apply the integrated knowledge. However, they also find integration laborious, difficult to deliver and implement, and time consuming. The tutors perceive integration as beneficial to both the students and themselves, since it enhances their interaction with other disciplines or subjects as well as their teaching skills. However, the tutors also agree that integration increases their stress and workload. The tutors regard integration as beneficial to the students, but it is stressful and time consuming for the staff to deliver the integrated content. They blame this mostly on increased workload due to insufficient staff numbers.

Should the integrated core content involving all disciplines be modified?

As far as the modification of the degree of integration integrated core content involving all disciplines; the two disciplines that students perceive as needing to be more integrated are

microbiology and anatomical pathology, in which students still do not see the need for future application.

The holistic approach to the content covered by all the disciplines with common content (cases) is one advantage of integration. Modification of the current level of integration will only serve to favour it, either increasing it or facilitating it the most.

The learning environment is perceived favourably by both students and tutors. Only a few tutors regard it as poor or risky, mostly considering student and worker strikes, the social environment and the source of motivation to learn.

RECOMMENDATIONS

The recommendations are based on the results and conclusions of this research. It is conceivable that these results and recommendations may be transferred to other medical schools in similar situations.

Continuous evaluation of the programme is essential to ensure quality. Students and teaching staff are very useful, independent but related sources for suggestions about and scrutiny of instructive actions.

Core content for all the integrated disciplines must be determined. Core content explicitly written for individual disciplines is necessary to ensure that no important topics are missed and also to facilitate ownership of the integrated approach by individuals.

The learning objectives must then be formulated in terms of outcomes and competencies and according to topics or cases, based on the core content, without undermining or defeating the basic principles of PBL in a SPICES model curriculum. This will assist in guiding the tutors during their class activities, to be more student-centred and interactive, enhancing participation and stimulating discussion among the students whilst covering the content.

The case studies used in the MBChB III course should be problem based and include aetiology, pathology, treatment and management.

The educators must be encouraged and motivated to contribute and participate. Staff must be regarded as influential in the successful acceptance and execution of the integrated curriculum,

and consequently as being able to recognise the positive and negative aspects of and challenges in its implementation. Approaches to accomplish this must be explored.

Investigation of possible curricular options which retain most useful and positive elements of integration; but which are less time-consuming and place less heavy burdens on staff and students is recommended.

The study recommends a redesign of the integrated MBChB III curriculum in order to enhance integration, with the assumption that it will improve students' learning, favouring the quality of their learning experience within an integrated learning environment.

Assumptions, delimitations and limitations

The following factors are regarded as limitations of the study:

This study was restricted to voluntary participation by students and teachers from a single medical school. Therefore, the opinions may not be representative of all medical schools.

The data collection was limited to a period of one block (January–April 2010).

The collected data deal with the self-reported experiences and perceptions of respondents.

The theory and background of this research were not explained in their entirety to all participants.

The theory of this research was applied to the field of medical educational administration rather than to areas such as educational psychology.

The study was confined to student and tutor perceptions of horizontal integration in only one South African medical school. Vertical integration was not included in the study, which could be a limitation.

There are several components of the learning environment that were not addressed in this study; such as Students' perceptions of Atmosphere and Students' social self-perceptions.

Participation could have been limited because no special funding was sought or obtained to promote student and staff cooperation.

The following factors are potential causes of bias for this study:

The value of the data might have been affected by the students' and educators' level of awareness and quality of connections and relationships.

Further limitations could be due to the participants' ability or lack of recognition, based on their own understanding and learning of the concept of integration in a medical curriculum.

There are several components of the learning environment that were not addressed in this study, such as modification, estimation and assessment of short- and long-term learning.

The results of this study may be incomplete due to the use of various research methodologies (qualitative, quantitative, written surveys, interviews; however; it is also possible that this could become a study strength if the results are independently confirmed by data collected using another method (transferability).

Last but not least, this study has only one researcher on site, and the interpretation and evaluation of the collected information may be limited by the author's perceptions, personal biases, interests and relationships.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from both medical schools (the one the researcher works for and where the research was conducted, and the one where the researcher is currently registered for the MPhil course). So far, no overlapping of the author's proposal has been found – to the best of our knowledge- with any other similar study reported or currently being conducted in any other medical school. No ethical problems were foreseen because the recommendations by Babbie et al (2006) were followed: ensuring the voluntary involvement of the participants, that no harm would be caused and that anonymity and confidentiality were guaranteed. The Ethical Code of Professional Conduct (South African Gazette, 2000) was also strictly adhered to.

Consent for participation in the survey was obtained by the participant's signature (students and tutors) (appendix 4). This consent included permission of tutors for audiotaping of the interviews, followed by verbatim transcription and text analysis. All information collected was handled in a strictly anonymous, confidential and secure manner at all times.

Conflict of interests:

No conflict of interest was been identified.

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APPENDICES

APPENDIX 1

The following questions pertain to the course Integrated Pathology I for MBChB III (anatomical pathology, chemical pathology, microbiology and pharmacology). Please indicate the extent of your disagreement or agreement with each of the following statements by placing an X in the appropriate column.

1 = Strongly disagree (SD); 2 = Disagree (D); 3 = Neutral (N); 4 = Agree (A); 5 = Strongly agree (SA)

Students' perception of integration – quantitative analysis

1 = SD; 2 = A; 3 = N; 4 = D; 5 = SA

	QUESTIONS	SA	A	N	D	SD
1	The integrated pathology content in this block has facilitated enhancement of my analytical thinking skills.					
2	There were clear goals and objectives for the integrated pathology content in this block.					
3	I found the integrated pathology block being centred on learning by reasoning rather than being centred on simply reproducing content.					
4	The exam questions for the block were matched to their goals and objectives.					
5	The content of this block of integrated pathology facilitated active learning opportunities (in-class questions, discussions and group activities).					
6	Multidisciplinary integration encouraged me to reflect on how I am learning.					
7	Multidisciplinary integration encouraged me to relate ideas in one discipline to those in another discipline.					
8	The multidisciplinary integration approach has shown me how much of what I learn today seems relevant to my future training for a career in health care.					
9	I find that the multidisciplinary integrated curriculum has increased my stress load.					
10	The multidisciplinary integrated teaching has helped me to recognise the interrelationships within and among the various disciplines.					
11	Overall I have learned with understanding a great deal in this multidisciplinary integrated block.					
12	I am satisfied with the level of content integration of the four disciplines in the block.					

Open-ended questions:

1. What aspects of this block facilitated your learning with understanding?
2. What aspects of this block did you like the most?
3. What aspects of this block did you dislike the most?
4. Do you have any other comments or suggestions about the course?
- 5- What do you think is expected from you with the integration of the four subjects in the block?
- 6- Why do you think you have reached (or not reached) the intended outcome in Block 2?
- 7- Would you recommend that this course, as an integrated course, continue?

APPENDIX 3

Sample questions for interviews

Note: Sample questions will be framed in language that is clear to participants with avoidance of the use of unfamiliar terminology.

Integrated curriculum

What is curricular integration of pathology – faculty perceptions?

What are the advantages and disadvantages of horizontal versus vertical integration – faculty perceptions?

What is your understanding of an integrated curriculum?

Can you describe some of the types of integration that you are aware of?

Can you explain what some of the advantages of the current integrated model of undergraduate education may be?

What are some of the pitfalls/disadvantages of the current integrated model of undergraduate education that you foresee?

In what ways is this integrated curriculum different from the traditional curriculum?

Learning environment

What is the effect of integration on the students' learning environment?

What are your impressions with regard to the students' current learning environment?

What changes do you appreciate in the students' current learning environment?

How does the current integrated curriculum contribute to/affect the students' learning environment?

APPENDIX 4

Letter of consent for faculty/medical educator interviewees

Thank you for agreeing to be a participant in the research study entitled 'Perceptions of students and faculty of the integration of pathology teaching in the MBChB III programme at Walter Sisulu University'.

The purpose of this study is to monitor the newly implemented integrated curriculum through the lens of the medical educator. In order to protect your interests, I will adhere to the following guidelines:

1. I, the researcher, will observe the individual medical educators' views on the above programme to discuss the possible advantages and disadvantages they have observed with the implemented integrated approach.
2. You will be interviewed for approximately one hour and each interview will be audio recorded.
3. I acknowledge that you may withdraw at any time during the study without penalty or loss of benefits. If you withdraw, the data collected from the interviews and tape recording will be destroyed.
4. You as faculty participant may answer only questions that you feel comfortable with and may choose to refrain from answering any questions that you do not like. You are free to request that the tape recorder be turned off at any time if so desired.
5. As you are being interviewed individually by me in places of your choice and convenience, the information shared by you will be kept strictly anonymous and confidential at all times. All the information gathered will be presented in a summarised fashion, and thus there is no risk of any one participant being identified.
6. The tape will be transcribed and analysed to discover the emerging patterns and themes discussed.
7. The data collected from you will be kept in a secure place at WSU and will be accessed only by me as principal investigator, and it will be made available to the human research and ethics committees (HRECs) of both WSU and SU if the need for a research audit arises.
8. The results of the study will be used for completion of my master's thesis. The confidentiality and anonymity of the participants will be protected through the use of pseudonyms.

If you have any questions about your participation or your rights as a participant in this study, you may contact me, my supervisors or the Office of Research and Ethics at WSU and/or SU on the following contact details:

Prof. M. Garcia-Jardon (principal investigator): 082 202 1032 / 047 502 4883; mgarcia@wsu.ac.za

Prof. E.N. Kwizera (supervisor for WSU): enkwizera@wsu.ac.za

Prof. J. Bezuidenhout (supervisor for SU) jbzuidenhout@sun.ac.za

WSU HREC: ggeorge@wsu.ac.za; mkayongo@wsu.ac.za; ndabata@wsu.ac.za

Postgraduate Studies and Research Office: 047 502 2775

SU Research Development and Support:

Tel: +27 (0)21938-9657

E-mail: fweb@sun.ac.za

Fax: +27 (0)21 931-3352

I, _____, understand that this research project has been approved by the HRECs of WSU (0073/009) and SU (N09/12/353) and I agree to participate. I am aware of the nature of the study and understand what is expected of me, and I also understand that I am free to withdraw at any time throughout the study. A copy of this form has been given to me for my records, and at the end of the study, I will receive a copy of the report generated from the data collected.

Date: _____ Participant's signature: _____

Date: _____ Researcher's signature: _____

Quantitative analysis of scores by topics the students answered

APPENDIX 5

Raw data for semi-structured questionnaire

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	4	2	2	2	1	1	2	3	3	3	2	2
2	2	2	1	3	3	3	3	3	2	2	2	3
3	1	1	1	1	2	1	1	3	4	2	3	3
4	2	2	3	1	2	3	3	4	3	4	3	1
5	3	2	3	3	3	3	4	4	3	3	3	4
6	2	3	2	4	2	3	4	4	2	4	4	4
7	4	2	2	3	2	4	4	4	1	4	4	4
8	3	3	3	4	4	4	4	4	2	4	4	4
9	2	3	2	3	4	3	3	4	4	3	3	3
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14	2	1	4	2	1	1	3	1	4	1	1	1
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16	3	1	2	4	2	1	2	4	4	3	3	1
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