TEACHING PHARMACOLOGY: ISSUES OF LANGUAGE AND LEARNING IN A MULTILINGUAL CLASSROOM SETTING

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Submitted in fulfilment of the requirements for the degree of

Philosophiae Doctor Educationis

in the Faculty of Education

at the

Nelson Mandela Metropolitan University

December 2012

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Teaching Pharmacology: Issues of language and learning in a multilingual classroom setting.

DECLARATION:

In accordance with Rule G4.6.3, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

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DATE: 20 November 2012

This work is dedicated to:

Ronny, for his unending love, support and assistance and for being my instant-response Excel expert;

Sarah-Jane and Melissa-Anne, for their love and belief in their mother; for believing that she can accomplish almost anything – even from a distance!

Denise Raubenheimer, my late mother, for raising me to be the person I am today.

ACKNOWLEDGEMENTS

A work such as this cannot be undertaken in isolation and the completion of this research project has required the assistance and support of many people. I would, therefore, like to indicate my sincere appreciation to the following persons who helped, guided, encouraged and supported me during this journey.

To my supervisor Professor Paul Webb: thank you for having faith in me and accepting a Pharmacy academic as a PhD candidate. During this research project I have learnt many new skills, insights and approaches from you and under your guidance have been introduced to and developed in the field of educational research.

I would like to voice an especial thank you to the BPharm2, BPharm3, and BPharm4 students of 2011 who were the subjects for this study. Without your enthusiastic participation I could not have completed this task. May you continue to grow and develop in our profession of Pharmacy.

To my colleagues in the Pharmacy Department at NMMU, especially to my fellow pharmacology lecturers, thank you for your continued support throughout this project. I am mindful of the additional burden that was placed on my colleagues in Pharmacology while I was on research sabbatical during the final stages of the project – thank you.

Over the last two years several people have provided assistance and I would like to thank them for their time and generosity in contributing to various aspects of the study. Dr Lyn Webb, Faculty of Education: thank you for facilitating the exploratory talk workshop. Dr Hanna van Lingen from Student Counselling and Dr Sarie Snyders and Fransisco de Vega

from Student Academic Development: thank you for the assistance with administration of Kolb's LSI. Bronwyn Seymour, Andrea Watson, and Marilies van Rooyen: thank you for the assistance with the assessment of English reading comprehension. The Supplementary Instruction team of Liesl Smith and SI leaders Sibabini Khatsha and Pavan Derodra: thank you for your assistance during SI sessions. Finally I would like to thank Cathy Candasamy for assistance with the extraction of student marks and Jackie Hitchcox for assistance with final formatting.

For assistance with statistical analysis of the data I would like to thank Danie Venter, who assisted with the initial analysis and Dr Jacques Pietersen for his invaluable assistance with the inferential statistics.

I am greatly appreciative of the privilege of being granted a research sabbatical by the university. Without the opportunity afforded, by the sabbatical, for unbroken focus on the project I would have been unable to complete the study in the time-frame achieved. I am also appreciative of the bursary granted by the Faculty of Education to assist with printing and binding.

Finally to my husband Ronny and my daughters Sarah-Jane and Melissa-Anne: thank you for your support and love over the years and especially through the process of completing this body of work.

ABSTRACT

The medium for teaching and learning in South African universities is not the mother tongue of the majority of students and this has been reported to be a barrier to achievement (Department of Education, 2002). Poor English language skills, as well as poor discipline specific vocabulary knowledge, can lead to poor study techniques with the students resorting to rote learning as they are unable to interpret the recommended texts (Gow, Kember, & Chow, 1991; Shembe, 2002). In 2005 at the NMMU a significant difference was reported between the marks achieved for the Pharmacology 2 (ZCL2) module by English first language (EFL) students and the English second language students (EAL) (Boschmans & McCartney, 2005). These finding provided motivation for this study which interrogates issues of language and learning in a multilingual Pharmacology classroom.

A mixed methods approach, which employed a concurrent triangulation design with quantitative dominance, was used. Two parallel studies were undertaken. One consisted of a quasi-experimental, pre-test and post-test control group design using an intervention which consisted of the application of the didactical practice of exploratory talk with an experimental sample group during ZCL2 Supplementary Instruction sessions (SI). A second study involved a parallel data collection from the ZCL303 and ZCL401 Pharmacy students at the NMMU to investigate possible effects of academic progression. Purposive, homogenous sampling was used in selection of the samples.

The mean ZCL2 mark for the experimental group (58.70±14.14%) of students who experienced the intervention (application of exploratory talk) was significantly higher (p = .0004) than the mark achieved by the ZCL2 comparison group (46.47±14.48). This

difference was of high practical significance (Cohen's d = 0.85). This quantitative finding was supported by the qualitative data where the students expressed support for the discussion sessions (application of exploratory talk) held during SI sessions. There was a significant increase, with academic progression, of English reading comprehension amongst the EFL students (p = .025) but not in the EAL students and BPharm1 weighted average (p < .001) as well as SI attendance (p = .02) correlated significantly with achievement in ZCL2.

The findings of this study provide insights into the teaching of Pharmacology in a multilingual classroom. The qualitative results in addition to strengthening the quantitative findings through triangulation have provided a rich, deep and detailed description of the lived experiences of Pharmacology students. The data will provide insights into students' experiences for Pharmacy academics and are a resource for understanding student perspectives.

Key words:

Exploratory talk, Pharmacology, English first language (EFL), English second language (EAL), Pharmacy education.

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LIST OF ABBREVIATIONS

AC	Abstract conceptualisation
AE	Active experimentation
ANOVA	Analysis of variance
APAP	Admissions and Placement Assessment Programme
BPharm	Bachelor of Pharmacy
CE	Concrete experience
CHE	Council on Higher Education
EAL	English as alternative (not first) language
EFL	English as first language
EVT	Educationally valuable talk
ELVT	Educationally less valuable talk
ERTIC	Faculty Research, Technology and Innovation Committee of Education
HET	Higher Education and Training
LSI	Learning Style Inventory
MPharm	Master of Pharmacy
NMMU	Nelson Mandela Metropolitan University
PharmD	Doctor of Pharmacy
RO	Reflective observation
SADEC	Southern African Development Community
SI	Supplementary Instruction
SPM	Standard Progressive Matrices
UK	United Kingdom
UKZN	University of Kwazulu-Natal
USA	United States of America
ZCL2	Pharmacology 2 presented in 2nd year of the BPharm degree
ZCL2Com	ZCL2 comparison group
ZCL2Exp	ZCL2 experimental group
ZCL303	Pharmacology 3 presented in 3rd year of the BPharm degree
ZCL401	Pharmacology 4 presented in 4th year of the BPharm degree

CHAPTER ONE
INTRODUCTION AND OVERVIEW

1. INTRODUCTION

Pharmacology is one of the four major subjects in the four year Bachelor of Pharmacy (BPharm) programme offered at the Nelson Mandela Metropolitan University (NMMU) and Pharmacology modules are presented in three of the four years of the BPharm programme (BPharm2, BPharm3 and BPharm4). The Pharmacology modules constitute 100 (20.3%) of the 492 credits for the degree and, as such, Pharmacology constitute a major component of the degree.

Pharmacology is a scientific discipline spanning the fields of medicine and biology and encompassing the study of actions, effects and uses of drugs (Rang, Dale, Ritter, Flower, & Henderson, 2012). As a scientific discipline Pharmacology requires the acquisition and use of many technical/scientific terms (Yuksel & Mercanoglu, 2010). Long et al. (2008), in a study at the University of Brighton in the United Kingdom (UK), demonstrated that MPharm (Master of Pharmacy) students with English as first language achieved higher scores in a scientific comprehension test than students whose first language was not English. This finding suggests that a language of instruction which is not the student's first language could impact on achievement.

A low level of English language ability was found by Gow et al. (1991) to lead to poor study techniques with students utilising their time to interpret the texts and being unable to decipher deeper meaning from the work. This finding was further supported by work by Diaz-Gilbert (2004) who found a lack of understanding of certain basic and common

Pharmacy and health related words when encountered in isolation or in context. In addition students falsely believed they knew the meaning of certain words and confused the meaning of similar words. A study undertaken at the Manchester School of Pharmacy and Pharmaceutical Sciences revealed a strong correlation between final year grades in the MPharm programme and grades in their diagnostic test in English (admission requirement) (Sharif, Gifford, Morris, & Barber, 2003).

Nevertheless, there appears to be some controversy in southern African literature as to whether proficiency in English is a predictor of success in tertiary level studies. Dambisya and Modipa (2004) found that, at the University of the North (now University of Limpopo, Turfloop Campus), matriculation results for English did not correlate with success at a first year BPharm level. Similarly, Wu-Pong and Windridge (1997) in the United States of America (USA) found that there was no difference in performance at the end of year one of the PharmD (Doctor of Pharmacy) programme between students with English as first language (EFL) and those students for whom English is an additional language (EAL). However, initial studies have indicated the possibility of correlation between language and achievement in Pharmacy classes at the NMMU (Boschmans & McCartney, 2005). These findings motivated this study.

Achievement in Pharmacology at the BPharm2 level is an area of concern at the NMMU, particularly in the context of home language and achievement. A study, undertaken in 2005 amongst the BPharm2 Pharmacology students at this university indicated a statistically significant difference (p = .024, unpaired Student's t-test) in achievement in Pharmacology for EFL students (51.8±17.5%; n = 31) compared to EAL students (44.3±16.2%; n = 68) (Boschmans & McCartney, 2005).

Since the first democratic elections in South Africa in 1994 the student population at NMMU has become increasingly diverse. In 2011 60.6% of students at NMMU were black, 23.7% were white and 13.7% and 2% were coloured and Indian respectively (T. Webb, Strategic Planning, NMMU, personal e-mail communication, September 6, 2012). Currently the majority of the students study in a language (English) which is not their mother tongue. Of the BPharm students who participated in this study 59.21% had a home language other than English - the language of instruction - highlighting the importance of determining the effect of instruction in English on achievement in Pharmacology by EAL students. As such, this study aimed to investigate issues of English as language of instruction and student achievement in Pharmacology at the NMMU.

2. RESEARCH QUESTION AND STUDY OBJECTIVES

The research question for this study was:

Is achievement in Pharmacology at the Nelson Mandela Metropolitan University a factor of language proficiency and language use?

In order to fully explore this research question the following sub-questions required investigation:

- Are the initial findings of differences in achievement between second-year Pharmacy students in terms of their home language (Boschmans & McCartney, 2005) still apparent in the current cohort of second-year students?
- Do English skills correlate with achievement in Pharmacology 2 (ZCL2)?
- Do English skills and Pharmacology vocabulary knowledge differ between EFL Pharmacology students and EAL Pharmacology students?
- Does a students' first language, if it is not the language of instruction, impact on the learning styles of the students?

- How do EAL students, as compared to EFL students, approach studying Pharmacology, what are their attitudes towards Pharmacology and what, if any, coping skills have they developed in order to master the material presented in the Pharmacology module?
- Does the introduction of the dialogic practice of exploratory talk increase reasoning, English skills and achievement in Pharmacology in students?

This study, therefore, aimed to explore the issues arising from the use of English as a language of instruction relative to achievement in Pharmacology of EAL students as compared to English first language (EFL) students registered for the BPharm degree at the NMMU.

The study objectives were to:

- Determine whether achievement in Pharmacology differed between EFL and EAL students;
- Evaluate whether English skills correlated with achievement in Pharmacology 2 (ZCL2);
- Assess whether English skills and Pharmacology vocabulary knowledge differed between EFL Pharmacology students and EAL Pharmacology students;
- Investigate whether students' first or second language status impacted on their learning styles;
- Explore, amongst EAL students as compared to EFL students, the approach to studying Pharmacology, attitudes towards Pharmacology and any coping skills students may have developed in order to master the content of the Pharmacology module; and

- Establish whether introduction of the dialogic practice of exploratory talk increased reasoning, English reading comprehension skills and achievement in Pharmacology amongst students.

3. RESEARCH DESIGN

The sample comprised all BPharm2 students enrolled for Pharmacology 2 (ZCL2) in 2011 and the BPharm3 and BPharm4 students enrolled for Pharmacology (ZCL303 and ZCL401 respectively). The third and fourth year students were used as comparator groups in order to determine patterns of academic progression in the BPharm programme. In addition to exploring achievement in Pharmacology in terms of language proficiency and use, the study employed an intervention – introduction of exploratory talk as a pedagogic tool – to determine whether an improvement in academic achievement in Pharmacology could be attained in Pharmacology students. The practice of exploratory talk was implemented during ZCL2 Supplementary Instruction (SI) sessions. The students attending ZCL2 SI sessions were designated as the experimental group and the ZCL2 students who did not attend SI sessions served as the comparison group. Supplementary Instruction sessions are led by an appointed senior student, the SI leader, and provide additional academic support for students enrolled for a module, in this case ZCL2. Sessions, based on the content of formal theory lectures presented during the week, were held twice a week. Attendance at SI sessions was voluntary. The sessions were held on campus at a time when there were no scheduled lectures or practical sessions.

The study consisted of three phases. *Phase One* was the pre-intervention phase when the baseline data were collected. *Phase Two* consisted of implementation of the intervention and during *Phase Three* the post-intervention data were collected.

A mixed method design utilising both quantitative and qualitative methods was used. Qualitative and quantitative data collection and analysis took place together during the research process, i.e. a concurrent triangulation approach was used (Creswell, 2009). Data were collected prior to the intervention to provide baseline data and after the implementation of the intervention (introduction of exploratory talk to SI sessions) to serve as post-intervention data. The pre-intervention data were compared to the post intervention data to determine whether the intervention resulted in significant improvements in achievement in Pharmacology, English reading comprehension, Raven's SPM, Pharmacology Vocabulary Questionnaire, and a change in Kolb's study style category (Figure 1.1). Additionally a parallel data collection process occurred amongst the ZCL303 and ZCL401 students in order to determine the effects (if any) of academic progression.

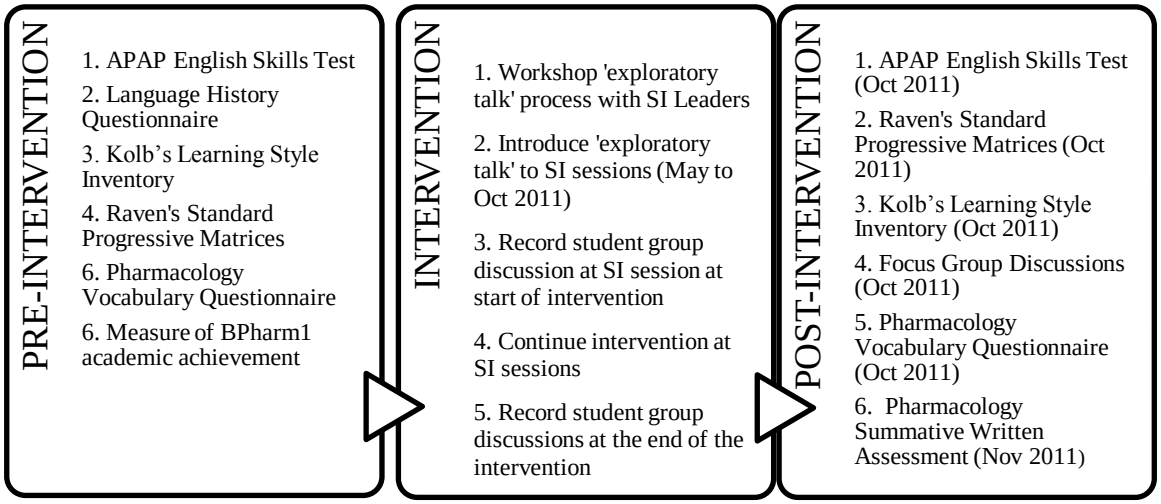


Figure 1.1. Outline of the research process indicating pre-intervention (baseline) assessments, the intervention phase and the post-intervention phase. APAP = Admissions and Placement Programme.

The research design is summarised in Figure 1.2 which indicates the sample, methods used, how the data were collected and the instruments used to generate the data.

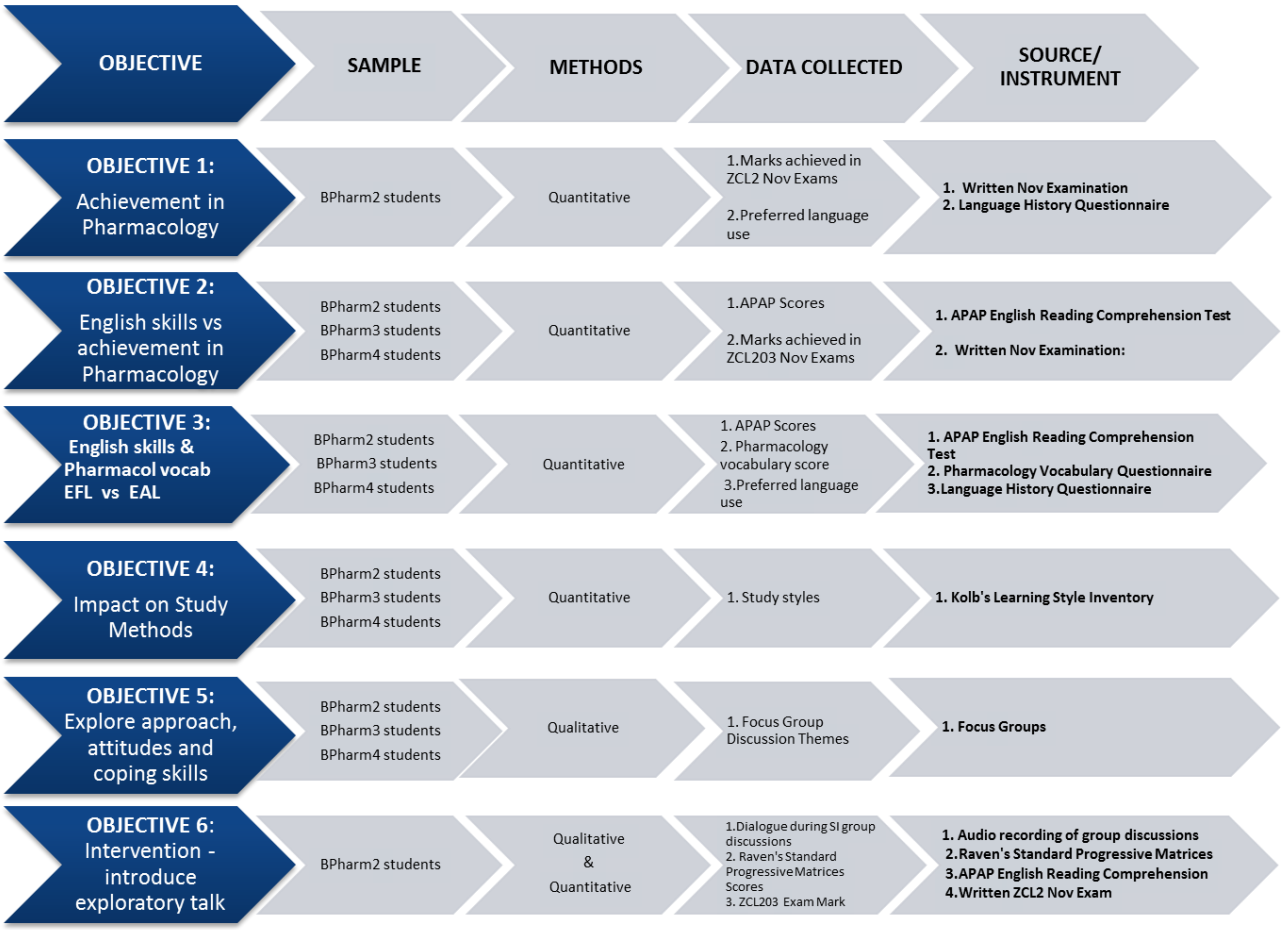


Figure 1.2. Outline of data collection per study objective indicating the nature of data collected and data collection tool. EAL = English as additional language. ZCL2 = Pharmacology 2.

4. METHODOLOGY

As noted earlier, a mixed methods approach was employed in order to provide quantitative and qualitative data for triangulation and deeper understandings and meaning making (Creswell, 2009).

4.1. Quantitative data

The following quantitative tools and measures were used to achieve objectives 1, 2, 3, 4, and 6.

4.1.1. Measure of BPharm1 academic achievement

The weighted average mark for BPharm1 was used as a measure of prior academic achievement. The scores for the BPharm1 modules were weighted according to the credit value of the module and the average mark was then calculated (Chapter 3, Section 5.1.6).

4.1.2. Pharmacology 2 Academic Achievement

The marks achieved for the Pharmacology 2 November examination (Figure 1.2: Objectives 1, 2 & 6) were recorded for each group and analysed using relevant statistical techniques.

4.1.3. Language History Questionnaire

This purpose-designed, structured, researcher administered questionnaire was used to gather data about past and present language use including use of language within the family (Figure 1.2: Objectives 1 & 3).

4.1.4. Admissions and Placement Assessment Programme (APAP) English Skills Test

The APAP English Skills Test is a Reading Comprehension Test which assesses reading skills and sentence meaning. The test has been devised and verified at NMMU (Foxcroft, Watson, Seymour, Davies, & McSorley, 2002) and is written by prospective students prior to acceptance into a programme at NMMU. As indicated in Figure 1.2 (Objectives 2 & 3) the BPharm2, BPharm3 and BPharm4 students all rewrote the test in 2011 for comparative purposes.

4.1.5. Pharmacology Vocabulary Questionnaire

This purpose-designed, researcher administered questionnaire was used to assess understanding of relevant physiological and basic pharmacological words presented in isolation and when used in context (Figure 1.2: Objective: 3). The questionnaire content was

validated by academic staff in the Pharmacology Division and the questionnaire was piloted prior to application in the study samples (Chapter 3, Section 5.1.3).

4.1.6. Raven's Standard Progressive Matrices

The Raven's Standard Progressive Matrices test was used to determine the students' level of reasoning and ability to solve problems (Figure 1.2: Objective 6). There is strong evidence in the literature to substantiate the use of Raven's Standard Progressive Matrices test for this purpose (Carpenter, Just, & Shell, 1990) and correlation between scores on Raven's Standard progressive Matrices and academic achievement have been shown (Raven, Raven, & Court, 1998; Richardson, 2001; Webb & Treagust, 2006).

4.1.7. Kolb's Learning Style Inventory

Kolb developed an *Experiential Learning Cycle*, based on the work of Lewin who proposed a *Cycle of Adult Learning*, to describe the sequential stages during the process of learning. Kolb further described four characteristic sets of learning preferences where learning is characterised according to the way in which an individual uses the learning phases (Kolb, 1984). Kolb's Learning Style Inventory, which is used to assess learners' preferences with regard to abstract versus concrete and action versus reflection (Kolb, 1985), has been used to assess students' learning preferences in general. As the Kolb Learning Style Inventory has been used previously to assess learning preferences in Pharmacy students (Pungente, Wasan, & Moffett, 2003) and pharmacists (Austin, 2004b), it was chosen to assess student preferences in this study.

4.2. Qualitative data

Qualitative data were collected in order to achieve objectives 5 and 6 (Figure 1.2). The data collection tools are depicted in Figure 1.2 and briefly discussed below.

4.2.1. Focus Group discussions

A focus group discussion on attitude towards and approach to studying Pharmacology was held with BPharm2 students after the intervention (Figure 1.2: Objective 5). The discussions were recorded and transcribed. Themes were developed inductively from the data and focus group discussions were also held with BPharm3 and BPharm4 students for comparative purposes in order to investigate possible progression in terms of the approach, attitudes and coping skills as students progress through the BPharm degree.

4.2.2. Supplementary Instruction group discussion

Group discussions were recorded (audio-recording) (Figure 1.2: Objective 6) during a SI session at the start of the intervention and at the end of the intervention period (Figure 1.1). Selected transcripts of the recordings were analysed to determine whether there had been an increase in the level of discussion, namely a greater percentage of higher-order (exploratory) talk (Mercer, 1996) post intervention.

5. ETHICAL CONSIDERATIONS

Ethics approval for this study was granted by the Faculty Research, Technology and Innovation Committee of Education (ERTIC) at the NMMU (Ethical Approval Reference number: H11-Edu-CRT-006). Full disclosure of the research aims was made to all students verbally and in writing and they were informed that participation was voluntary and that they could withdraw from the study at any stage. The participants were requested to complete written informed consent forms prior to participating in the study (See Section 9 in Chapter Three). No student withdrew, confidentiality was maintained at all times, and no respondent identifiers were linked to the data when results were reported.

6. OUTLINE OF THE STUDY

Chapter One provides an introduction to, and an overview of, the study. The study aim and objectives are presented, a short description of the study design is provided, and the methods employed and the steps taken to proceed ethically in the research process are briefly discussed.

Chapter Two provides a review of the literature pertinent to the study. The topics of language policy in South Africa, language policies at universities, English as a medium of instruction at universities, and barriers associated with the use of English as a medium of instruction as well as background pertaining to learning styles and assessment of Spearmen's *g*, are interrogated. The study was grounded in the theory by undertaking in-depth search of the academic literature pertinent to the study. Relevant electronic databases were searched using search terms pertinent to the specific topic under investigation (multiple searches were undertaken).

A discussion of research methodologies pertinent to education research followed by a detailed presentation of the methodology used is presented in Chapter Three, while the results and analysis of the results are presented in Chapter Four (quantitative data) and Chapter Five (qualitative data). The implications of the results are discussed in Chapter Six with reference to the study objectives. Conclusions and recommendations are presented in Chapter Seven.

7. TERMINOLOGY

Various terms are used in this study relating to language use and research methodology. A brief definition of each, as used in this document, is presented below:

Comparison group – The comparison group included those subjects, in the quasi-experimental component of this research study, who were not part of the experimental group.

Comparator group(s) – The comparator groups did not participate in the quasi-experimental component of the study but were interrogated to determine effects (if any) of academic progression.

English as additional language (EAL) – An individual for whom English is not the primary or first language.

English first language (EFL) – An individual for whom English is the primary or first language.

First language/primary language – The language in which the individual considers themselves to be more/most fluent.

HET – Higher Education and Training - The designation used in South Africa to denote the teaching and learning environment at university level.

Mark(s) – term used in South African educational circles to indicate a student's grades.

Mother tongue - The first language learnt by an individual as a child.

Preceptor – Term used, in USA, for tutors assigned to guide PharmD students through experiential learning placements.

Second language (L2) - A language other than the language in which the individual considers themselves to be more/most fluent.

As mention is made of professional Pharmacy qualifications in countries other than South Africa a brief comparative explanation of the qualifications is also provided below:

South Africa: Bachelor of Pharmacy (BPharm) a four year professional bachelor degree post Grade 12 at school level.

United Kingdom (UK): Master of Pharmacy (MPharm) a four year professional master degree post A levels.

United States of America (USA): Doctor of Pharmacy (PharmD) a four year professional doctoral degree post a two to three year undergraduate programme in basic sciences and humanities.

CHAPTER TWO
LITERATURE REVIEW

1. INTRODUCTION

The literature review for this study focuses on three issues, namely, the de jure and de facto language policies at universities, the use of English as language of instruction, and the effect of dialogue and exploratory talk on student learning. As the setting for the study was a university in South Africa (Nelson Mandela Metropolitan University), and the group under investigation consisted of the BPharm students at NMMU, the topics listed above will be restricted to the educational sector (university level) and to the profession of Pharmacy. Literature relating to theoretical aspects of assessment of Spearman's g (general intelligence) and learning styles with reference to the Pharmacy profession is also presented as the study explores whether, academic progression or the intervention applied to the ZCL2 sample, mediates alteration in these parameters.

2. LANGUAGE AS A BARRIER TO ACHIEVEMENT IN THE HIGHER EDUCATION ENVIRONMENT

The *Language Policy for Higher Education Institutions* document indicates that for many students in South Africa the medium of instruction at universities was a barrier to achievement (Department of Education, 2002) and that throughput rates at the HET level in South Africa have been an issue for concern. Letseka and Maile (2008) reported a graduation rate of 15%. This is one of the lowest graduation rates in the world. In 2000 there were 120 000 student enrolled in HET institutions (Department of Education, 2005). The projected graduation date for these students was the end of 2003 (assuming that the students had

registered for a basic three year undergraduate programme). Fifty per cent of the students had dropped out by 2003 with 30% of the original intake having dropped out during 2000 (the first year of study). Of the remaining 60 000 students only 44% graduated within the three year period. This means that of the original 120 000 students who enrolled in 2000 only 22% or 26 400 students graduated within the minimum three year period. A further important factor to take into consideration is the demographic profile of successful students at HET institutions. Over the period 2001 to 2004 the average success rate for undergraduate contact students at public higher education institutions was 76% (Department of Education, 2005). Success rate was calculated using full time equivalent student enrolments. However, the success rate varied from 84% for white students to 69% for African students and 74% and 80% respectively for Coloured and Indian students (Department of Education, 2005).

Although high first year attrition rates in tertiary education can be found throughout the world in South Africa these high attrition rates are accompanied by low participation rates in tertiary education (Scott, 2009). Many factors have been reported to contribute to the high drop-out rate. A few of these factors are: financial and personal problems (Scott, 2009); under preparedness for the HET environment; structure of the curriculum (Scott, Yeld, & Hendry, 2007); and use of English as medium of instruction (Ngcobo, 2009). In developed countries the participation rates are in the region of 60% while in South Africa participation rates in higher education are 60% for whites, 51% for Indians, and 12% for each of the black African and coloured sectors of the population. Despite the low participation rates 70% of students enrolled in HET in South Africa are black African or coloured (Department of Education, 2009).

2.1. Role of language

Differences in academic performance between white and black students have been reported for the University of Cape Town (Madiba, 2010b). The variance was as great as 20% and occurred across all faculties. Poor English language skills were considered to be one of the predominant contributory factors as the medium of instruction for teaching and learning was English. Shembe (2002) confirmed the importance of students understanding basic concepts in chemistry and the improved understanding that could be achieved by the use of isiZulu alongside English as media of instruction. According to Shembe (2002) students who cannot understand the concepts (due to language barriers) resort to memorisation without understanding and then return the information verbatim during assessments. Memorisation without understanding leads to poor performance and a high drop-out rate amongst students for whom English is not the primary language. Paxton (2009) in a study investigating the use of a multilingual glossary in the discipline of economics reported that academic curricula are often poorly accessible to EAL students. During interviews with students a student commented that "It is easy to learn when you using your home language but with English you need to start learning language before you get to the concept" (Paxton, 2009, p. 355). Relating to adoption of memorising without understanding another student said "...when you are studying you find some words that are too much for us to understand and you go to the dictionary even the dictionary can't really help so you tend to memorise when you are writing. So we memorized …" (Paxton, 2009, p. 355).

The role of language in achievement is further reinforced by a study carried out by Steenkamp, Baard, and Frick (2009) who investigated student perceptions of reasons for non-achievement. Poor language skills were one of the factors the students perceived to contribute towards poor performance.

In 2007 the Council on Higher Education published the results of a study investigating academic performance at the HET level during the period 2001 to 2005 (Scott et al., 2007). The outcomes of the study supported the data presented by Letseka and Maile (2008) in that Scott et al. (2007) stated that "…notwithstanding the achievements of the past decade, the higher education sector is not meeting key output goals…. Performance is unsatisfactory in terms of overall output and equity of outcomes" (p. 29). Once again one of the factors deemed to be partially responsible for the poor performance of black African students was poor English language skills.

Van der Walt and Dornbrack (2011) suggested that programmes at the tertiary level should acknowledge that many students who access tertiary education are ill prepared in terms of English language skills. Strategies that could be used to assist these students included "an opportunity to reflect, talk through, read aloud and discuss in their home language will facilitate the acquisition of academic skills in English… the provision of notes, handouts and assessments in more than one language can greatly enhance students' understanding of the content" (van der Walt & Dornbrack, 2011, p. 103).

2.2. Language and achievement in Pharmacy education and training

In Australia, the UK, and the USA, where multilingual student bodies are encountered, the use of English as medium of instruction has also been reported to act as a barrier to Pharmacy student success (Diaz-Gilbert, 2004; Hassell, Seston, Eden, & Willis, 2007; Holder, Jones, Robinson, & Krass, 1999; Long et al., 2008).

Long et al. (2008) assessed the effect of English as a second language on academic achievement in Pharmacy students in the UK (University of Brighton). Pharmacy students across the years of study were administered a vocabulary test. The authors concluded that non-English first language speakers were at a significant disadvantage when compared to

English first language students. Of interest was the finding that vocabulary knowledge improved with age and year of study amongst English first language students but showed no improvement amongst students for whom English was not their first language (Long et al., 2008).

Diaz-Gilbert (2004) proposed in an article based on a group of Pharmacy students enrolled at the University of the Sciences in Philadelphia, USA, that students whose first language was not English were at a disadvantage compared to students whose first language was English. Diaz-Gilbert (2004) reported that the EAL students had a poor understanding of basic Pharmacy and health related words. The students confused words that sounded the same or looked similar. Lastly the study indicated that the students' perceptions of their vocabulary knowledge did not match the measured vocabulary knowledge. Failure to easily comprehend the vocabulary used in text books, references, notes and assessments could lead to confusion, problems with processing required information and impaired performance.

Further research by Diaz-Gilbert (2005) indicated that writing skills amongst students whose first language was not English were below the required level and that this created a barrier towards achievement in course work associated with experiential placement. The students enrolled in the study were in the final year of the PharmD and had already successfully completed English courses for students whose first language was not English. The study reported that 90% of students involved in the study were aware of the deficiency in their vocabulary and consequently their writing skills. Students stated that: "I have problem with very easy language like patient level English…" (Diaz-Gilbert, 2005, p. 4) and "…sometimes I find myself using words and I'm concerned about the other, do they understand right away…" (Diaz-Gilbert, 2005, p. 4). Some students also indicated that writing was problematic because "…grammar was difficult due to translating first language

to second language and inability to apply grammar rules" (Diaz-Gilbert, 2005, p. 4). The preceptors also indicated that there were deficiencies in the writing skills (grammar, vocabulary and spelling) of the Pharmacy students with EAL. In addition to the submission of documents with poor written English the preceptors (term used, in USA, for tutors assigned to guide PharmD students through experiential learning placements) also pointed out that the EAL Pharmacy students required additional time to complete written tasks. This placed the students at a disadvantage as they were unable to submit their documents on time (Diaz-Gilbert, 2005).

Pharmacists require not only good written but also good verbal English skills. A pharmacist is required to take down a patient's medication history and must therefore be able to comprehend the verbal information provided by the patient and translate the information into professional written English. Both students and preceptors indicated weakness amongst EAL students in this area. To illustrate the problem with translation of verbal information to written English a student commented "The patient told me 'I feel flush' I didn't know what should I write because you can say flush like become red and flush like water…" (Diaz-Gilbert, 2005, p. 7).

A study undertaken in Turkey investigated the correlation between student's knowledge of Pharmacology technical vocabulary (in English which was not the student's first language) and achievement in final examinations (Yuksel & Mercanoglu, 2010). The vocabulary was extracted from pharmacological texts. Although a significant correlation ($p < .05$) was found between vocabulary knowledge and achievement the correlation was not a strong correlation ($r = 0.38$). Yuksel and Mercanoglu (2010), therefore, suggested that the vocabulary list could not be used as a tool to assess which students would encounter academic difficulties.

A further consequence of a poor English vocabulary is the impact on student understanding of written texts consulted during the Pharmacy programme. A text commonly prescribed in Pharmacy programmes, *Pharmacotherapy: A Pathophysiological Approach* (DiPiro et al., 2011), had an average Gunning FOG Index for readability of 18.1 and primary literature articles pertaining to pharmacotherapy had an average Gunning FOG Index of 19.2 (Fuller, Horlen, Cisneros, & Merz, 2007). A Gunning FOG Index of 5 corresponds to *very easy reading* while a score of > 16 is *very difficult to read* of a level comparative to a legal document (Roberts, Fletcher, & Fletcher, 1994). When the reading ability of third professional year PharmD students was compared to readability of literature and the text book it was found that the average reading ability of the students (mean score of 16.5 obtained using the Nelson-Denny Reading Test Grade Equivalent score) fell below the level required for comprehension of the relevant literature (mean score of 19.2) and text (mean score of 18.1) (Fuller et al., 2007). Of the population tested 89% were English first language speakers and 11% were EAL students. The implication is that even students whose first language is English may experience difficulties in comprehending text books and literature that are required reading during a Pharmacy programme.

2.3. Attrition rate and academic achievement

When investigating the attrition rates amongst Pharmacy students in the UK Hassell et al. (2007) found that attrition rates were higher for non-UK or European students than for UK and European students. These authors did not investigate which factors were responsible for the difference in attrition rate; however, they proposed that language was one of the factors that could influence failure to complete the degree. Poor English literacy skills were linked to failure to complete the Pharmacy degree within the minimum prescribed period in students enrolled at the University of Sydney, Australia by Holder et al. (1999). Of the students with poor English literacy skills 66% were non-English first language speakers.

Academic achievement by the 1997 first year student intake at the Manchester School of Pharmacy and Pharmaceutical Sciences was investigated by Sharif et al. (2003). A strong correlation was observed between final examination marks (in 2001) and marks obtained for an English skills test taken at the beginning of the first year of study in 1997. The 1997 first year class consisted of a group of white students and a group of students of Asian origin. Although there was a correlation between final exam marks and the English skills test scores for the class as a whole there was no correlation between the English skills test scores of the white students and the final exam marks. The authors proposed that, although the Asian students with good English skills performed as well as the white students, for those students of Asian origin with poor English skills language acted as a barrier to achievement (Sharif et al., 2003). The School of Pharmacy and Pharmaceutical Sciences acted on the outcomes of the study by instituting a language intervention course which is taken (dependent on the student's score in the diagnostic test) by 60% of first year students (Sharif, Gifford, Morris, & Barber, 2007). Following implementation of the remedial English course the correlation between the final exams and the scores on the English skills test was no longer found to be significant in 2002.

In contrast to the correlation between poor English skills and poor academic achievement reported by Hassell et al. (2007), Holder et al. (1999), and Sharif et al. (2003), studies by Wu-Pong and Windridge (1997) in the United States and Dambisya and Modipa (2004) in South Africa have indicated no correlation between non-English first language or pre-admission English skills and achievement in a professional Pharmacy degree. The influence of first language status as a predictor of success in the first year of the PharmD programme at Virginia Commonwealth University, United States of America, was investigated by Wu-Pong and Windridge (1997) who found that there was no difference in performance at the end of year one of the PharmD programme between students with English

as first language and those students whose first language was not English. Dambisya and Modipa (2004), in South Africa, reported that English scores achieved at matriculation did not correlate with academic achievement in the first year of the BPharm programme or time taken to graduate. Therefore, there appears to be some controversy in the literature as to whether English skills or non-English first language status impacts on achievement in the professional Pharmacy undergraduate programme. This study thus aims to investigate the issue of English as the language of instruction and academic achievement amongst BPharm students at a South African University.

3. LANGUAGE POLICIES AT SOUTH AFRICAN UNIVERSITIES

Although the HET language policy documents in South Africa clearly provide a directive for the use of African languages as media for teaching and learning in higher education at the same time there is a contradiction within the documents in that the use of English as a medium of instruction is also promoted. The policy:

> ... paves the way for the use of English as a main language of learning and teaching and as such, it can be said to provide evidence of an attempt to be responsive to demands of internationalisation as well as acknowledging the importance of local languages.
>
> van der Walt (2010, p. 254)

Thus although the constitution entrenches the right to education in the learner's home language the Department of Education (2002) language policy for higher education institutions implies that the use of African languages as media of instruction at the HET level is a long term goal.

3.1. The de jure situation

The Constitution of South Africa (1996) states that "every person shall be entitled to instruction in the language of his or her choice where this is reasonably practical" (Section

32). But the Department of Education policy documents are less explicit on the topic of language(s) to be used as medium of instruction in that the *Language Policy for Higher Education Institutions* states that language should not be allowed to act as a barrier to access to, or success in, higher education and encourages the use of African languages in teaching (Department of Education, 2002).

In 2004 the Department of Education published a report relating to language use at tertiary institutions, namely *The Development of Indigenous African Languages as Media of Instruction in Higher Education*. This report advocates that universities should promote the official languages of the provinces in which the university is situated. This directive must be seen in the light of the 11 official languages that were recognised in the South African Constitution (1996). Examples of application of this policy are: the official languages recognized in the *Language Policy* of NMMU (2010) – a university situated in the Eastern Cape Province – are English, Afrikaans and isiXhosa (the dominant languages in the province); the official languages recognised by the University of KwaZulu-Natal – situated in the province of KwaZulu-Natal – are isiZulu and English (Ndimande-Hlongwa, Balfour, Mkhize, & Engelbrecht, 2010); and the official languages recognised by the University of Cape Town – situated in the Western Cape Province – are English, Afrikaans and isiXhosa (Madiba, 2010b).

3.2. The de facto situation

Although the Department of Education language policies were published in 2002 and 2004 respectively, progress towards implementation of African languages as media of instruction at higher education institutions has not been extensive. In a paper presented in 2007, five years after the publication by the Department of Education of the first policy specifically relating to language policies at HET institutions, Deyi, Simon, Ngcobo, and

Thole (2007) reported that little progress had been made in the application of the policy. Three years later Madiba (2010b), discussing the implementation of multilingualism at the University of Cape Town, stated that:

> At present, all the language policies of South African Universities, with the exception of the few historically Afrikaans universities, have adopted policies that advocate English as the primary medium of education and administration. So far there is no university in South Africa that makes use of indigenous African languages as the primary media of education in other than language disciplines. In most of these policies, the commitment to African languages is mainly to their development or intellectualization with a view to using them as media of teaching, learning and research in the distant future.
>
> Madiba (2010b, p. 330)

In 2012 (van Dyk & Coetzee-van Rooy) commented that even though South Africa had developed excellent language policies for education, most higher education institutions in the country had focused on the implementation of administrative language policies, and consequently had made little progress in terms of implementing multilingual teaching and learning at the university level.

Madiba (2004) recommended that at university level the relevant African language (depending on the geographical position of the university and the demographic profile of the students) should be used in a complementary manner alongside English as the media of instruction. This approach is known as the *complementary language use approach* (Ndimande-Hlongwa et al., 2010).

However, a study by de Kadt (2005), who explored the attitudes of Zulu students attending the University of KwaZulu-Natal towards the use of English, clearly indicated that the students strongly advocated the use of English as a tool for success in post-university life and therefore, saw the need for fluency in English. A study by Dalvit and de Klerk (2005) at Fort Hare University more explicitly examined the attitudes of students towards the use of

isiXhosa as a medium of instruction. These students were also very aware of the value of English in contributing to success in their careers post-university as well as the acceptance, nationally and internationally, of English as the language for communication in the fields of business and science. Although the students considered English as more appropriate for assessment and as a medium of instruction in disciplines considered to be more "prestigious" (Dalvit & de Klerk, 2005, p. 12), such as Information Technology and Economics, the students did see a role for the use of isiXhosa as a medium for instruction in the first year of a programme. Additionally the Fort Hare students acknowledged that code-switching could be beneficial when used in the arena of teaching and learning.

The perceptions of students arriving at university will have been shaped by their experiences during primary and secondary school. If in the school system English has been elevated to the position of primacy for teaching and learning purposes and teachers have promoted the use of English the students, on arriving at university, will want English to be the dominant language used during teaching and learning. Thus, language used for teaching and learning in the school system will obviously impact on student perceptions about language use as the medium of instruction at the university level.

Webb, Lafon, and Pare (2010), in an article on the use of Bantu languages in education, clearly showed the preference of learners (and parents) for the use of English as medium of instruction. In the Eastern Cape English is the home language for only 5.7% of learners, however, 70% of learners select English as the primary medium of instruction. A similar trend was found in Gauteng, KwaZulu-Natal, and Limpopo (Webb et al., 2010). The primary reason for the importance placed on English as medium of instruction at school by pupils and parents was the perceived link between mastery of English and upward mobility and greater likelihood of success in life after education.

3.3. Language practices in selected South African universities

Literature on language use in teaching and learning, both in South Africa (Adler, 1998; Barwell & Setati, 2005; Clerk & Rutherford, 2000; Setati, 1998; Setati, Malofi, & Langa, 2008) and in other parts of the world (Cummins, 1979; Gutiérrez et al., 2002), has clearly demonstrated the cognitive value of incorporation of mother-tongue or the primary language of the learner as a medium of instruction. Taking cognisance of the desire of students to be taught in English, and the didactical advantage of inclusion of mother tongue as a language for teaching and learning, an approach incorporating the complementary use of an appropriate African language alongside English as the dominant language of instruction would appear to be desirable. Three universities in South Africa that have, in terms of policy, adopted a complementary language use approach are the University of Cape Town, the University of KwaZulu-Natal, and NMMU (Madiba, 2010b; Ndimande-Hlongwa et al., 2010; NMMU, 2010).

The Language Policy of the NMMU (2010) states that English is the predominant language for teaching and assessment, and the language used for internal governance and administration. However, recognition is given to the fact that English is the "primary language of not more than one third of the NMMU's students." (NMMU, 2010, p. 4). The suggested approach at the NMMU (2010) is based on *additive multilingualism* or "...the appropriate utilisation of established proficiency in the language best known to learners in the process of enhancing academic skills in English..." (NMMU, 2010, p. 2). The NMMU language policy document states:

> ...to ensure optimal access to language-mediated knowledge, two avenues to achieve this objective need to be pursued: (i) Effective literacy in English, by means of which all students should acquire the ability to communicate through the spoken and written word in a number of contexts – academic, social, and in their future careers in this

> language; and (ii) Optimum use of the student's primary language (if not English) to ensure cognitive assimilation into the university sphere of knowledge acquisition.
>
> (NMMU, 2010, p. 4)

In adopting the complementary language use model the University of Cape Town has piloted several projects to explore application of the model in different disciplines (Madiba, 2010b). The pilot projects included a concept literacy project in statistics, physics, law, health science, and economics (Madiba, 2010a), and the incorporation of bilingual tutorial sessions in economics (Paxton, 2007). The concept literacy projects involved the development of multilingual, electronic, language corpora for the discipline. These multilingual glossaries (translated from English into the remaining 10 official languages) were introduced to first year students to assist in conceptual learning of important concepts embedded in the discipline (Madiba, 2010a). Paxton (2007) explored the utilisation, during tutorials, of the student's primary or first language in the development and understanding of new concepts and presented possible methods, for use in English medium universities, for scaffolding support for EAL students. The outcomes of the study indicated that the use of tutors conversant in the relevant African language alongside glossaries was of benefit to the student. Being able to discuss and receive clarification in the student's mother tongue led to a better understanding of discipline specific concepts.

Ndimande-Hlongwa et al. (2010) reported that progress, at the University of KwaZulu-Natal, in implementation of the language policy based on the complementary language use approach had been mediated via a three year isiZulu language development programme for students and staff. The programme involved the implementation of discipline specific conversational isiZulu language courses for staff and students in three disciplines (nursing, education, and psychology) and development of English/isiZulu discipline specific vocabulary sets (Ndimande-Hlongwa et al., 2010).

3.4. Implementation of language policies by BPharm providers in South Africa

The BPharm degree is offered at seven universities in South Africa: NMMU; North-West University; Rhodes University; University of Limpopo (one degree offered on two campuses, one at the Medunsa campus in association with the Tshwane University of Technology and the other at the Turfloops campus); University of KwaZulu-Natal (UKZN); University of the Western Cape; and University of the Witwatersrand (South African Pharmacy Council, 2012). The medium of instruction at all these institutions, except for North-West University, is English. Afrikaans is the medium of instruction in the School of Pharmacy situated on the Potchefstroom campus of North-West University. Afrikaans students may also be required to study in a second language when, for financial reasons, they enrol at a university closer to their home town than Potchefstroom.

In South Africa the Schools of Pharmacy have attempted to incorporate the principles relating to language use embodied in the policies of the Department of Education in various ways. The School of Pharmacy at the Afrikaans medium North-West University has introduced simultaneous translation into English during all Pharmacy lectures and practical sessions from BPharm1 through to BPharm4 and all assessments are set in both English and Afrikaans (North-West University, 2011). The NMMU and the Witwatersrand University have introduced compulsory credit bearing courses in Pharmacy-related isiXhosa (NMMU, 2011)(M. Danckwerts, personal communication, 29 October 2012) and at the University of the Western Cape the curriculum includes isiXhosa or Afrikaans (S. Malan, personal communication, 28 October 2012). IsiZulu or Afrikaans has been introduced at the University of Kwazulu-Natal (UKZN, 2010) (Table 2.1).

Table 2.1
Language courses incorporated into the BPharm programmes at South African universities

UNIVERSITY	LANGUAGE COURSES			
	Language	**Compulsory or Elective**	**BPharm Year Level**	**Additional Comments**
NMMU	isiXhosa	compulsory	4	Conversational medical isiXhosa
	English	compulsory	1,2	Extended (5 year) programme. English for Pharmacy module
North West University			1,2,3,4	Simultaneous translation into English, from medium of instruction which is Afrikaans, during all lectures and practical sessions
Rhodes University	isiXhosa	elective	4	isiXhosa for Pharmacy students
University of Limpopo	English	compulsory	1	
University of Kwazulu-Natal	isiZulu/ Afrikaans	compulsory	1	isiZulu for non-isiZulu speakers and Afrikaans for isiZulu speakers
University of the Western Cape	isiXhosa/ Afrikaans	compulsory	2	isiXhosa for non-isiXhosa speakers and Afrikaans for isiXhosa speakers
	English	compulsory	1,2	Extended (5 year) programme incorporated into other modules.
University of the Witwatersrand	isiXhosa	compulsory	3,4	Presented during Pharmacotherapy module - medical terminology
	English	compulsory	2	'Read On' programme for English supplementation. Voluntary for all 2nd year students but compulsory for repeat students.

The curriculum at Rhodes University includes a BPharm4 elective course for which one of the options is an isiXhosa module (Rhodes University, 2012). At the University of Limpopo (Medunsa Campus and Turfloops campus), where the medium of instruction and assessment is English, a first year module in English language is part of the curriculum. This module assists EAL students with the academic use of English (Department of Pharmacy University of Limpopo, 2012).

Due to the low percentage of learners achieving the required matriculation results for direct university entry, especially for programmes such as Pharmacy that require mathematics and/or science as admission requirements, many students gain access through an extended

curriculum (Deyi et al., 2007). In these programmes the students, mainly from previously disadvantaged schools, are required to: "...grapple with scientific concepts, general academic vocabulary and its corresponding expressions that are often foreign to them" (Deyi et al. 2007, p. 12) in English which is not their primary language. The use of a language as the medium of instruction that is not the students' primary language is, according to Deyi et al. (2007) the reason for poor outcomes associated with the extended curriculum and bridging programmes.

In order to cater for these students several of the universities offering the BPharm programmes also offer a five year Extended BPharm programme where the degree is offered over 5 years with the first year of the programme split over two academic years. The aim is to facilitate access to the programme for students who have not met the matriculation score requirements for entry to the four year BPharm programme. In an attempt to ameliorate the effect of English used as the medium of instruction most of the Pharmacy extended programmes offer a developmental language module (generally English). For example the University of the Western Cape has included a compulsory English language module in the first year of the Extended Programme (School of Pharmacy UWC, 2012) and at the NMMU a module entitled *English for Science and Health Sciences* is part of the first year and a module *English for Pharmacy* is part of the second year compulsory modules for the extended programme (NMMU, 2012). At the University of the Witwatersrand an online course, *Read On*, is compulsory for all repeat second year students and is a voluntary course for the remainder of the BPharm2 students (M. Danckwerts, personal communication, 29 October 2012).

Thus, although as yet there is no documentation of the incorporation of the student's primary language into teaching and learning practices, initial steps (inclusion of language

courses in the BPharm programme) have been initiated at most of the universities offering the degree.

4. ENGLISH AS LANGUAGE OF INSTRUCTION

The progress achieved in the development and alignment of language policies at universities with the policy requirements of the Department of Education - *Language Policy for Higher Education Institutions* (Department of Education, 2002) and *The Development of Indigenous African Languages as Media of Instruction in Higher Education* (Department of Education, 2004) – varies from institution to institution at the institutional level as well as at the level of BPharm programmes (See Section 3 in Chapter 2). Van der Walt (2010) postulated that the degree to which bi- or multilingual language policies have been implemented at universities occurs along a continuum from purely monolingual institutions to institutions that have implemented multilingual policies relating to teaching and learning (Figure 2.1). According to van der Walt (2010) the move away from English as the sole medium of instruction in tertiary education has:

> ...led to institutions becoming increasingly multilingual *in the practice of learning and teaching* to the extent that one can plot a continuum of bi/multilinguality from acknowledging students' language difficulties by offering academic language support at one end, to official bi/multilingual policies on the other...
>
> van der Walt (2010, p. 258)

There are many similarities between the move towards multilingual delivery of teaching and learning in South Africa and the UK. Although legislation had been written in both countries to empower indigenous languages, the application of these policies and day to day use of indigenous languages in teaching and learning has lagged behind the idealism of the legislation (Balfour, 2010).

It would seem, taking into account the progress made thus far, that at the majority of universities English will remain as the dominant medium of instruction in South Africa for the next five to 10 years while indigenous languages are being developed as complementary languages in teaching and learning. This means that, in the interim, consideration must be given to the impact of the use of English as the dominant medium for instruction on student achievement and the development of indigenous languages as media for teaching and learning.

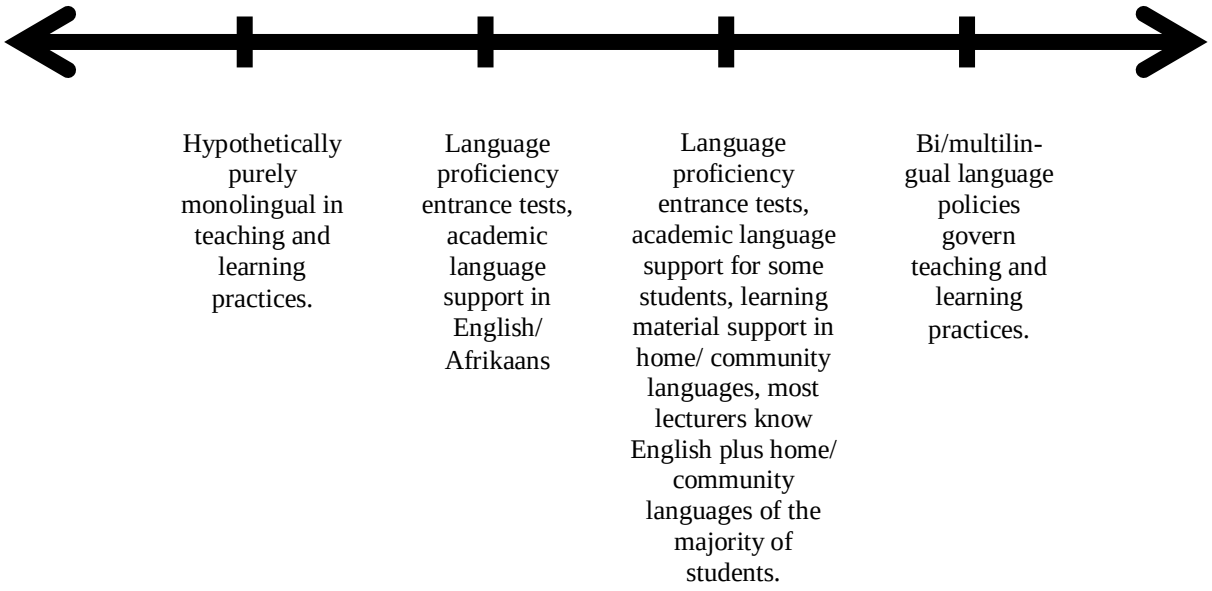


Figure 2.1 A continuum of bi/multilingual teaching and learning practices in university education. Adapted from van der Walt (2010).

4.1. Research on language use

Research, both internationally and in South Africa, has reported cognitive and linguistic advantages derived from the use of bi/multilingualism in teaching and learning when the language of instruction is not the mother tongue or primary language of the student (Adler, 1998; Barwell & Setati, 2005; Clerk & Rutherford, 2000; Cummins, 1979; Setati, 1998; Setati et al., 2008).

According to Cummins (1979) "... only a programme which attempts to promote the child's academic and cognitive development through both their first language and second language is likely to result in cognitive and academically beneficial form of additive bilingualism" (p. 246). The incorporation of the student's first language into learning starategies, when the child's second language (English in many cases in South Africa) is used as the primary medium of instruction, complements the learning achieved in the second language (Cummins, 2005). Research has shown that conceptual knowledge and skills can be transferred across languages. This finding implies that when an EAL student's first language is used alongside English understanding of concepts and academic knowledge gained in the student's first language will be transferred to English. This occurs because "...common cross lingual proficiencies underlie the obviously different surface manifestations of each language proficiency" (Cummins, 2005, p. 7) (Figure 2.2).

Language skills are required for interpretation and correct answering of written assessments. Clerk and Rutherford (2000), in a study of first language learners which investigated the diagnosis of misconceptions in science assessment in secondary school learners, concluded that language difficulties played a significant role in misinterpretation of questions. Clerk and Rutherford (2000) also proposed that further research should investigate the phenomenon in EAL learners in comparison to EFL learners as one could postulate that the problem would be greater in EAL learners who would probably be less able in the language used for setting the assessment.

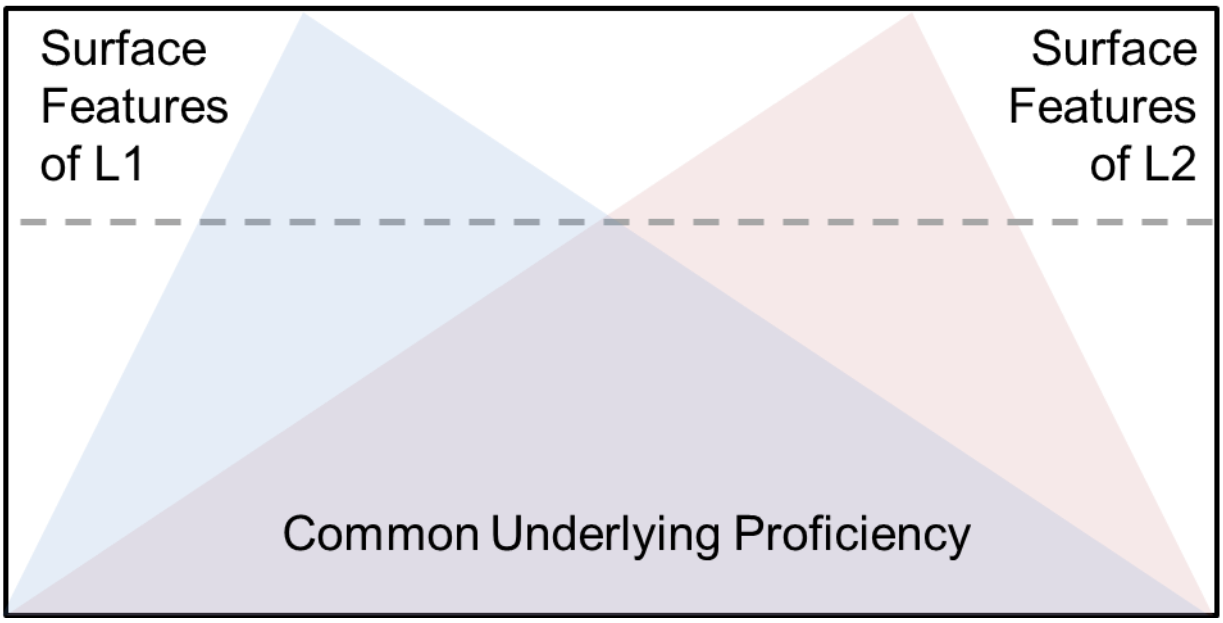


Figure 2.2 Cummin's dual-iceberg representation of bilingual proficiency. Adapted from Cummins (2005).

4.2. Code switching

Code switching is used by both teachers and learners in the South African school system (Setati, 1998). Setati (1998) defines code-switching as "...the use of more than one language in a single speech act" (p. 34) and reported that code-switching was used in the senior primary mathematics classroom for three purposes. These purposes were to: reformulate or re-explain without additional information; translate or a direct repeat in the alternative language; and provide new information relating to the lesson. Further work by Setati et al. (2008) (also in secondary school mathematics classrooms) illustrated that the simultaneous provision of written problems in both English and the learners' first language, combined with the use of code-switching between the learners' first language and English, did not detract from the mathematical problem but allowed for clarification and greater understanding and participation by learners. A similar finding was reported by Rollnick and Rutherford (1996) who investigated the use of mother tongue alongside English during group work sessions in secondary school science classrooms. Rollnick and Rutherford (1996) found that: "...the use of SiSwati served several important functions including articulation

and elimination of alternative conceptions, clarifying of concepts and formulating ideas" (p. 91).

4.3. Language of instruction

As previously stated, there are many drivers for the use of English as medium of instruction at the tertiary level: the world wide drive towards globalization and the use of English as international language in business (Chimbganda, 2005); desire of students to be lectured in English especially in the disciplines of economics and information technology (Dalvit & de Klerk, 2005); an international drive towards internationalisation of universities (van der Walt, 2010); and the large number of academic journals and textbooks that are published in English (van der Walt, 2010).

Less research has been published on the implications of the use of English as a medium of instruction at the tertiary education level. Those that exist at the university level encompass studies on: the use of English as medium of instruction for programmes attended by students whose mother tongue is not English including looking at the language used in assessment (Harrison & Morgan, 2012); low levels of academic literacy in first year university students (Petersen-Waughtal & van Dyk, 2011); comprehending information verbally communicated during lectures (Singh, 2009); student perceptions of English proficiency (Coetzee-van Rooy, 2011); relationship between language and conceptualisation (Madiba, 2010b; Meyer & Land, 2006); use of discipline specific glossaries (Madiba, 2010a); and introduction of indigenous language modules in professional programmes (Ndimande-Hlongwa et al., 2010).

Written assessments play a critical role in the HET environment and serve as gatekeepers to success with students whose home language is not English often encountering difficulties with the vocabulary used in examination papers (Harrison & Morgan, 2012).

Often the difficulty is not with the discipline specific words but with the ordinary words used when compiling questions for the examination. Harrison and Morgan (2012) investigated the use of *Simplified English* (also known as Simplified Technical English) in the construction of examination papers and examined questions from six engineering undergraduate examination papers (set in English) that were written by students whose primary language was not English. The papers were screened using a relevant software programme for appropriateness of word use and sentence construction. Based on the findings of their study Harrison and Morgan (2012) recommended that examination papers set for classes containing high numbers of EAL students should be reviewed with the assistance of a language practitioner. The authors suggested this compromise as the complexities associated with the writing of Simplified English dictated that it would not be practical for academics to set examination papers in Simplified English.

Problems associated with understanding of examination papers arise as a consequence of the poor academic literacy skills of university entrants. Academic literacy skills were tested, using the *Test of Academic Literacy Skills*, before and after a period of experiential in-service training in a sample of 733 students (at NQF level 5) in the College of Law at UNISA (Petersen-Waughtal & van Dyk, 2011). The mother tongue of 99% of the subjects was an African language and for 71% of the subjects the language of teaching and assessment at school was English. The results indicated very poor academic literacy skills in that 98% of the participants fell into the extremely high risk band having attained a score of less than 44% on the test (Petersen-Waughtal & van Dyk, 2011). Scores within the extremely high risk band indicate that the student has "...an extremely high risk of not completing their studies successfully" (Petersen-Waughtal & van Dyk, 2011, p. 108).

Students with English as a second language not only encounter difficulties with written English but also have problems with spoken English. Singh (2009), who had extensive experience in teaching English as a second language at the tertiary level, suggested that students "...experience problems with the accents of their teachers, with how fast they speak and the examples they may use" (p. 282-283). Furthermore many EAL students are not only listening and taking down notes during lectures but are also translating into their mother tongue. These students, therefore, tend to fall behind and miss out on critical information (Singh, 2009). Earlier research by Singh (2004) indicated that EAL students often felt inhibited in posing questions during lectures and thus failed to receive the clarification of concepts they required.

A discrepancy was found between the self-perceptions of English skills and actual scores achieved on tests amongst EAL students at the tertiary level (Coetzee-van Rooy, 2011). Possible reasons postulated for the variance were that the participants: rated their English skills relative to that of their community; viewed their English skills in the context of the ability to communicate verbally with others and not in the context of cognitive language proficiency; were multilingual and scored their English skill in, for example, reading relative to the same skill in their other languages. If the participant did not undertake a lot of reading in the other languages they would therefore rate their English reading skill highly (Coetzee-van Rooy, 2011).

Students often struggle with the understanding of the language and concepts of a discipline when newly introduced to the discipline (Madiba, 2010b). Language plays a vital role in building and scaffolding understanding of concepts (Meyer & Land, 2006). In any discipline there are certain threshold concepts which, if a student attains an understanding of the concept, act as a breakthrough for the student shifting them into a state of a more

advanced understanding of the discipline allowing them to conquer and understand more advanced concepts (Meyer, Land, & Baillie, 2010). In order to understand a concept, the student must have the correct understanding of the terminology involved thus any misunderstanding or confusion about the terminology can be a barrier to mastering threshold concepts (Meyer & Land, 2006). The understanding of discipline specific terminology would be more problematic for students whose first language is not the language used as the medium for instruction.

4.4. Glossaries and language development approaches

Madiba (2010a) proposed that "...multilingual glossaries can be used to fast-track concept literacy among English as Additional Language students" (p. 225). The University of Cape Town had initiated the development of corpus-based multilingual glossaries in the disciplines of Statistics, Economics, Law, Physics, and Health Sciences. The benefit of corpus-based glossaries is linked to the fact that terms are presented in context. According to Madiba (2010a) contextualization allows the students to "...have multiple exposures to the to the term and to analysis, students develop decontextualization which involves deep learning processes essential for conceptualization and academic development" (p. 237). The provision of contextualisation in addition to the translation of the terms into various African languages allows students to engage with the concepts in their primary language allowing for concept thresholding.

The School of Nursing at UKZN initiated a pilot project to develop multilingual skills amongst graduates and academic staff (Ndimande-Hlongwa et al., 2010). This was achieved by developing "subject-specific words, phrases and meanings for nursing in isiZulu" (p. 350) for use by students (and staff) and the implementation of a basic isiZulu module for non-isiZulu speaking students during the first year of the programme. Feedback received was that

the module was useful but the ability to communicate in isiZulu would need to be continually developed during the programme (Ndimande-Hlongwa et al., 2010). The non-isiZulu first language students were placed in clinical placement groups with isiZulu first language students to encourage further development and use of isiZulu for communication. Academic staff and clinical placement facilitators were targeted and encouraged to attend a purpose designed course in conversational isiZulu relevant to the practice of nursing**.** By providing both students and staff with basic isiZulu skills the aim was to encourage the use of isiZulu in communication with patients while at the clinical training sites.

4.5. Language development approaches employed in Pharmacy programmes

Educational initiatives to develop English language skills in Pharmacy students have been reported in Australia (Stupans, March, & Elliot, 2009), Italy (Felice & Sturino, 2002), the USA (Graham & Beardsley, 1986; Parkhurst, 2007) and in South Africa (Klos, 2011, 2012).

The Australian initiative took place at the University of South Australia where 64% of students (in 2005) were not English first language speakers (Stupans et al., 2009). In response to the large number of EAL students, specialist staff members of the Language Learning Centre at the university presented group sessions to the EAL Pharmacy students during the third year of the programme. Topics presented were: "...reading and comprehending professional writing; identifying the main points in an article; writing a summary ... self-correction of written work ... and oral communication skills" (Stupans et al., 2009, p. 7). English writing skills were analysed for errors at the beginning of the third year prior to the language course and again at the start of the fourth years after the students had completed the course. There was a reduction in errors when the students were tested at the beginning of the 4th year indicating an improvement in English proficiency (Stupans et al., 2009).

During the initial stages of Pharmacology modules students need to acquire not only the discipline specific knowledge but also need to learn the language of Pharmacology(Yuksel & Mercanoglu, 2010). In a review of second language learning of science Rollnick (2000) suggested that all learners when first exposed to science (which can reasonably be extended to a scientific based subject such as Pharmacology) need to learn the language of the discipline. When the medium of instruction is English this is relatively straightforward for English first language speakers but for EAL students the process is more complex. The students "...have to overcome far greater hurdles" (Rollnick, 2000, p. 115). One of the ways to overcome the hurdles is to ensure that instruction incorporates the use of the student's first language (Rollnick, 2000).

The University of Calabria, Italy, employed this approach to improve the English skills of third and fourth year Pharmacy students. The English language development sessions were incorporated into the presentation of discipline specific content in order to contextualise the experience within the discipline (Felice & Sturino, 2002). Analysis of English video and written discipline specific material was used to develop English skills. The embedded English language training was introduced in response to the students language development needs resulting from the proliferation of study material presented during the various modules that was written in English (Felice & Sturino, 2002).

Early work by Graham and Beardsley (1986) in the USA revealed the effectiveness of a discipline specific communication course for EAL Pharmacy students which significantly improved the communication skills of the participants. Parkhurst (2007) reported on a more recently developed course which was aimed at improving English oral communication skills of EAL Pharmacy students where class exercises and assessment

involved Pharmacy related tasks focused on "patient counselling rather than a general reading comprehension or grammar test" (Parkhurst, 2007, p. 5).

Recently an academic support module to improve English skills and anatomy and physiology knowledge was developed and presented to first year Extended Programme BPharm students at NMMU (Klos, 2011). The approach used was similar to the courses presented to Pharmacy students in Australia, Italy, and the USA in that the South African module was discipline or genre specific and the material presented during the English language module was related to a discipline specific course module, namely Anatomy and Physiology. Klos (2011) argues that presenters of language support modules "...need to liaise with content subject lecturers to understand their expectations regarding the acceptable manipulation of words in the context of their academic community. This will lead to insight regarding the development of suitable contextualised language learning material and strategies" (p. 149). Another factor which can increase the efficacy of English support modules is to make the content culturally accessible. Klos (2012) modified the English for Pharmacy module at NMMU to incorporate the subject of traditional medicine as the topic for a writing exercise which integrated the students' subject-specific language learning with their prior experience and culture, as recommended by Vygotsky (1981). In this way "The English for Pharmacy course introduced culturally sensitive language teaching that minimised learner marginalisation in a multicultural learning situation" (Klos, 2012, p. 85).

These Pharmacy specific interventions to improve English skills in EAL students all incorporated discipline specific material. However, none of the interventions used the primary language of the students alongside English as the medium of instruction, a practice which has been initiated in some disciplines at South African tertiary institutions (Madiba,

2010a; Ndimande-Hlongwa et al., 2010), but has not as yet been implemented in the discipline of Pharmacy.

4.6. Why English for Pharmacy?

The use of English as the language of instruction in Pharmacy programmes in South Africa is in part due to the proliferation of English material in the Pharmaceutical Sciences. These include text books, data bases and journals. A similar reliance on academic material published in English has been reported in Italy. At the University of Calabria, Pharmacy students reported that they used English 97.5% of the time when consulting text books for their major pharmaceutical subjects, 81.3% when consulting specialised reviews and journals for research purposes and 70.5% of the time when attending guest lectures (Felice & Sturino, 2002). In the discipline of Nursing a similar scarcity of reference material in the first language of the students has been encountered in Taiwan. A 2011 search of the *Chinese Electronic Periodical Services* and the *Cumulative Index to Nursing and the Allied Health Literature Databases* yielded only 21 journals published in Chinese in comparison to 760 journals published in English (Chang, Chan, & Siren, 2012).

A pharmacist or prospective pharmacist's ability to comprehend and communicate in English is not only important in terms of academic achievement during the undergraduate programme but also following graduation. After the undergraduate degree the graduate pharmacist will once again encounter English used as the language of assessment prior to full professional registration as a pharmacist. BPharm graduates are required to work under supervision of a registered pharmacist for one year and must successfully pass the South African Pharmacy Council (SAPC) Pre-registration Examinations before they can register as

a pharmacist. English is used by SAPC as the language of assessment for the Pre-registration examinations during the intern year[1].

The ability to communicate verbally is an essential tool for a pharmacist as pharmacists with good communication skills have been shown to positively contribute to patient health outcomes (de Young, 1996). Pharmacy students in the USA who spoke English as a second language reported that language served as a barrier to communication and they were aware of the danger implicit in not communicating effectively (Lonie, 2010). In the words of one of the Pharmacy students involved in Lonie's study: "In Pharmacy the consequences of not speaking up may be more extreme and dangerous. Patients may develop additional health problems, not get healthier or in a worst case scenario, die." (Lonie, 2010, p. 16).

South Africa is a multilingual society with 11 official languages (Constitution of South Africa, 1996) and according to the 2011 census English is the first home language for only 9.6% of the population (Statistics South Africa, 2012). Therefore, a pharmacist in South Africa should preferably possess effective communication skills not only in English but also in a relevant indigenous language(s) – dependent on the geographical region of practice.

5. DIALOGUE, LANGUAGE AND LEARNING

Vygotsky (1978) proposed that the process of learning involves the interplay of both social and psychological factors. The seminal work of Vygotsky lead to the development of the sociocultural theory of the processes of teaching, learning, and cognitive development (Mercer, Wegerif, & Dawes, 1999). Grounded in the sociocultural theory of cognitive development Mercer et al. (1999) described the three roles played by language in the process

[1] The Assessment Tools (Question Papers) are in English, but, the intern may answer in either English or Afrikaans as these are the languages of instruction used at the various universities accredited by SAPC.

of intellectual growth as: "…a cognitive tool which children come to use to process knowledge; as a social or cultural tool for sharing knowledge amongst people; and as a pedagogic tool which one person can use to provide intellectual guidance to another" (p. 96). In other words "…social experience of language use shapes individual cognition. Through engagement in dialogues, children gain the psychological benefit of the historical and contemporary experience of their culture" (Mercer et al., 1999, p. 96).

5.1. Development of the didactical practice of exploratory talk

Exploratory talk is a term that was first defined by Barnes (1976) who proposed that there were two forms of talk that occurred in the classroom: *exploratory talk* and *presentational talk*. Exploratory talk is used when learners were developing ideas and understanding, it was hesitant and broken phrases are used. While using exploratory talk the student builds her/his understanding of a concept and obtains feedback from her/his peers (Barnes, 2008). Presentational talk in contrast was well formulated and structured and the speaker adjusted the talk to suit the audience/recipient of the talk. Mercer (1996), using the experimental data generated during the SLANT (Spoken Language and New Technology) project in the UK, suggested that discourse produced by children during group work could typically be divided into three categories or different types of talk. The categories proposed by Mercer (1996) were:

> 1) …***disputational talk***[2]***,*** which is characterized by disagreement and individualized decision making. There are few attempts to pool resources, or to offer constructive criticism of suggestions…Disputational talk also has some characteristic discourse features, notably short exchanges consisting of assertions and counter-assertions.
> (2) … ***cumulative talk,*** in which speakers build positively but uncritically on what the other has said. Partners use talk to construct a "common knowledge" by accumulation. Cumulative talk is characterized by repetitions, confirmations and elaborations...

[2] Quotation with bold, italic font presented as in the original article by Mercer (1996).

> (3) ***exploratory talk*** occurs when partners engage critically but constructively with each other's ideas…Statements and suggestions are offered for joint consideration. These may be challenged and counterchallenged, but challenges are justified and alternative hypotheses are offered. Compared with the other two types, in exploratory talk ***knowledge is made more publicly accountable and reasoning is more visible in the talk.*** Progress then emerges from the eventual joint agreement reached.
>
> (Mercer, 1996, p. 369)

Previous research had shown that children working in groups did not always demonstrate task orientated, productive activity (Galton & Williamson, 1992). However, Mercer (1996) demonstrated that if teachers explained the desired behaviour to children and involved the children in drawing up ground rules for group interaction an increase in advantageous discourse (explanatory talk) occurred. Suggested ground rules were: "…all information is shared; the group seeks to reach agreement; … takes responsibility for decisions; reasons are expected; challenges are accepted; alternatives are discussed before a decision is taken; and all … are encouraged to speak by all group members" (Mercer et al., 1999, pp. 98-99).

Since the original work by Mercer (1996) defining exploratory talk, various researchers have demonstrated that children in the UK who had been exposed to and taught how to use exploratory talk during group problem solving exercises demonstrated an increased problem solving ability (Mercer et al., 1999). The increase in problem solving ability associated with children's involvement in exploratory talk was also demonstrated, in totally different cultural settings, for example in Mexico (Rojas-Drummod, Pérez, Vélez, Gómez, & Mendoza, 2003) and in South Africa (Webb & Webb, 2008; Webb, 2009; Webb & Mayaba, 2010; Webb & Treagust, 2006).

Mercer et al. (1999) designed a programme to develop exploratory talk use by children. The programme was known as TRAC – Talk, Reasoning and Computers. The study

was conducted with 9 to 10 year olds (Year 5 in the UK education system) and involved an experimental as well as a control group. The children participated in the 10 week programme during which the experimental group were encouraged to use exploratory talk during the activity. Prior to, and on conclusion of, the intervention the children wrote the Ravens Standard Progressive Matrices test as a measure of problem solving ability. Mercer et al. (1999) reported that there was a significant increase in the incidence of exploratory talk after the intervention in the experimental group as well as in scores obtained for the Raven's test. The study also found that children worked more effectively together when using the discourse mode of exploratory talk. Thus the use of structured language (exploratory talk) to reason and solve problems with peers led to an improvement in individual non-verbal reasoning as required for completion of the Raven's test.

Rojas-Drummod et al. (2003) adapted a programme, developed by Dawes, Mercer, and Wegerif (2000), to the sociocultural environment in Mexico. The programme consisted of various activities designed to encourage the use of exploratory talk amongst children. A cohort of 10 to 12 year olds attending school in Mexico City (Grades 5 and 6) were the subjects for the study. An experimental as well as a control group was employed in the study. Following implementation of the programme designed to encourage the use of exploratory talk amongst the children the researchers noted an increase in discourse involving exploratory talk during group work. There was also an increase in the experimental group, as compared to the control group, of individual as well as group problem-solving ability. This study illustrated that the introduction of discourse such as exploratory talk would appear to improve reasoning ability of children across sociocultural groupings. Preliminary work by Fernández, Wegerif, Mercer, and Rojas-Drummod (2001) illustrated that once taught the skills of employing exploratory talk the children were discriminatory in their use of exploratory talk during group discussions. When the problems were too simple or too hard for the children

they employed more cumulative talk whereas when it was useful to use exploratory talk the amount of this kind of talk increased (Fernández et al., 2001).

Further work by Mercer, Dawes, Wegerif, and Sams (2004), with Year 5 children in the UK illustrated that the inclusion of the practice of exploratory talk in teaching methods not only improved reasoning skills (as tested using the Raven's test) but also increased understanding of scientific principles. A programme, called *Thinking Together*, was developed to specifically facilitate the incorporation of the didactical practice of exploratory talk into daily lessons (Mercer et al., 2004). An increased understanding of scientific principles was demonstrated by the significant improvement in SATs (set of assessments provided to schools by the Qualifications and Curriculum Authority in Wales and England) science question scores in classes where exploratory talk was employed compared to scores achieved in classes where exploratory talk was not introduced.

5.2. Dialogue in multilingual classrooms

The studies undertaken by Mercer et al. (2004); Mercer et al. (1999) in the UK and by Rojas-Drummod et al. (2003) in Mexico were presented in the mother tongue of the learners. The educational environment in South Africa is more complex with many learners being taught in English which is not the first or primary language of the learners. In South Africa children are taught in their mother tongue for the first three years (Grade 1 to 3). Thereafter the medium of instruction is decided by the school. In the majority of cases (for reasons discussed in Section 3 of Chapter 2) English is used as the medium of instruction and assessment. This switch occurs at a stage when the children are still developing English language skills. The early switch to English as the medium of instruction hampers not only mastery of concepts and academic development but also impairs development in the children's mother tongue language skills (Cummins, 1979). Lack of effective language skills

can impact on learning as language is "…a cognitive tool which children come to use to process knowledge; as a social or cultural tool for sharing knowledge amongst people; and as a pedagogic tool which one person can use to provide intellectual guidance to another" Mercer et al. (1999, p. 96).

English is used in Botswana as the medium of instruction from Standard Six (Year 8) for children whose primary language is Setswana. Studies by Arthur (1994) suggest that the use of English decreased the amount of exploratory talk occurring in the classroom thus removing an opportunity for the children to gain a fuller understanding of the work. In South Africa code-switching is a common practice in multilingual classrooms and the didactical tool of exploratory talk must be viewed, in South Africa, within the context of established language use practices in schools.

5.3. Dialogue in South African classrooms

The introduction of the dialogic practice of exploratory talk into multilingual class rooms has been explored in South Africa at the primary and secondary level of education (Setati, 2002; Setati & Adler, 2000; Setati, Adler, Reed, & Bapoo, 2002; Setati et al., 2008; Webb & Webb, 2008; Webb, 2009; Webb & Mayaba, 2010; Webb & Treagust, 2006; Webb, Williams, & Meiring, 2008), while at the HET level Deyi et al. (2007) explored the use of multilingualism in classroom discussion.

Setati and Adler (2000) investigated the use of language in the teaching of mathematics in secondary school classrooms in South Africa and looked at the extent of code switching and the level of discourse that was exploratory in nature. Learners whose primary language is not the language used for teaching and learning:

> …have to cope with the new language of mathematics as well as the language in which mathematics is taught (English). They are also trying to acquire communicative competence in mathematical language where learning to articulate the meaning of

> certain concepts involves the development of a language that can best describe the concepts involved.
>
> (Setati & Adler, 2000, pp. 247-248).

Although Setati and Adler (2000) were referring to mathematics the scenario could be extended to the study of Pharmacology at the tertiary level. In order to master Pharmacology students need to be able to articulate pharmacological concepts in the language (terminology) of Pharmacology. In some EAL students this is complicated by poor English language skills (language of teaching and learning).

Setati and Adler (2000) proposed a model for the transitions between the informal spoken language and the formal mathematical language in a multilingual classroom where the informal spoken language is not the formal language of teaching and learning (in this case English) (Figure 2.3). The transition from informal spoken to formal written language occurred at three levels in a multilingual classroom: from spoken to written language; from primary language to English; and from informal to formal mathematical language.

Setati and Adler (2000) did not show a direct route from informal spoken mathematics in the primary language to written formal mathematics in the primary language as the mathematical register is not well developed in most African languages and, as noted earlier, English as a language of teaching and learning has a dominant position in South Africa and is the desired language for teaching and learning for most learners and their parents (Webb et al., 2010).

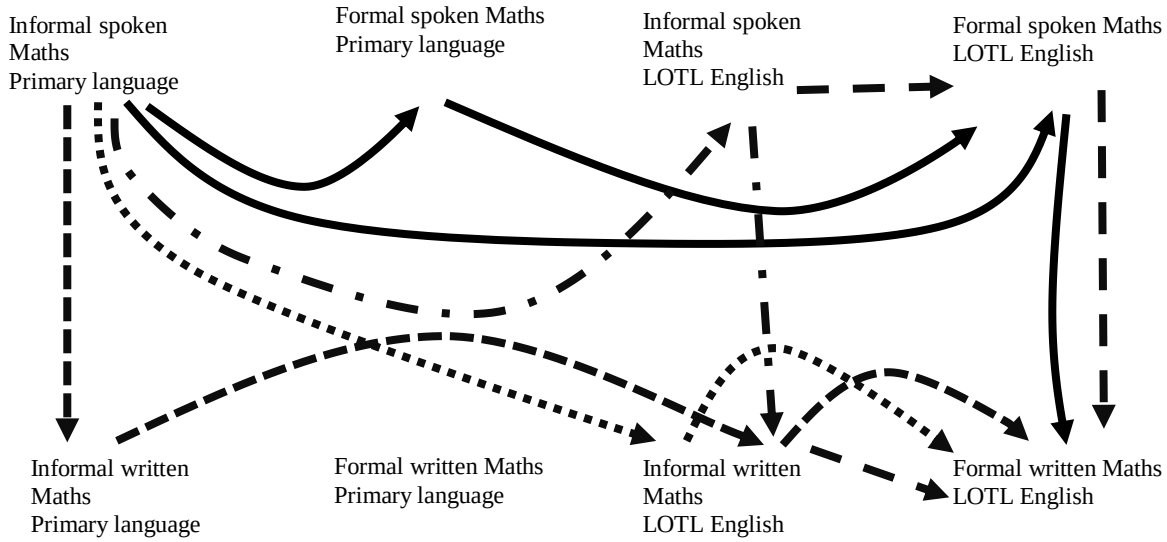


Figure 2.3 Possible pathways for transition between informal spoken mathematics and formal written mathematics in a multilingual classroom. Spoken and written mathematics can be conducted in either the primary language of the learners or in the LOTL, English. LOTL = Language of teaching and learning. Adapted from Setati and Adler (2000).

An increase in the use of group work, and thus creation of space for learners to participate in exploratory talk, was observed from 1996 to 1998 in the classrooms of teachers enrolled for the Further Diploma in Education in Mathematics, Science and English Language Teaching at the University of Witwatersrand (Setati et al., 2002). However, although the added exposure to opportunities to become involved in informal discourse of the exploratory type benefits learners it is also essential for learners in the secondary school environment to be given opportunities to develop discourse in the formal spoken and written communication of the discipline. Alongside the increased time allocated in the teaching day to group work and exploratory talk, Setati et al. (2002) noted a decrease in the opportunities for talking or writing discipline specific discourse. According to Setati et al. (2002):

> The wide spread 'take-up' by most teachers in the study of forms, such as group work, that increase the possibilities of learning from talk (i.e. of learners using language as a social thinking tool) indicates that this practice is easily integrated – at least in form – into existing teaching and learning repertoires. However, learning from talk is significantly limited if it is not supported or complemented by strategies for learning to talk, i.e. learning subject specific formal or educational discourses. There

> appears to be a danger that the advocacy of talking to learn and use of main languages is being incorporated or taken up at the expense of learning to talk mathematics or science.
>
> Setati et al. (2002, p. 147)

Thus while encouraging the use of the learner's primary language during group work discussions to facilitate the application of exploratory talk, and therefore fostering conceptual development, the teacher must mediate transition to the formal discourse of the discipline. The teacher therefore needs to ensure that the balance is maintained between informal discussion/ opportunity for exploratory talk and formal discipline specific discourse (both spoken and written) (Setati, 2002). Adler (2001) referred to this conflict as the "dilemma of mediation" (p. 3).

Setati et al. (2008) provided evidence to support the argument for the use of multilingualism in the teaching and learning of mathematics in South African schools. The study was conducted in a Grade 11 classroom in Johannesburg, South Africa. Lessons were observed and video recorded after which learners were interviewed. The observations supported the view that multilingual use of language by learners for problem solving can make the process transparent and can contribute to a better understanding of the mathematical problems by the learners.

Webb and Treagust (2006) further explored the issues around language of instruction and the use of exploratory talk in the classroom in South Africa. In a study, amongst grade seven science learners, the implementation of the practice of exploratory talk resulted in a significant improvement in problem solving and reasoning skills (measured using Raven's Standard Progressive Matrices Test) when compared to a comparison group. The implementation of the approach of exploratory talk as a teaching tool was implemented in mathematics classrooms in the Eastern Cape, South Africa, where the primary language of

the learners was isiXhosa and the language of teaching and learning was English (Webb & Webb, 2008). When teachers did not emphasise or require the use of English only during discussion groups, the amount of informal discussion increased. Webb and Webb (2008), however, warned that some teachers understanding of the concept of collaborative learning and exploratory talk was flawed and that in-service training and assistance in implementation in the classroom was required.

Webb et al. (2008), further investigated the concept of learner dialogue during learning. Concept cartoons and an argumentation writing frame were introduced in grade nine science classrooms to stimulate discourse. The outcomes of the study were unclear but would seem to indicate a role for the use of this technique in stimulating dialogue leading to a deeper understanding of concepts. Webb and Mayaba (2010) further expanded the strategies employed to improve teaching and learning of science in second language primary school classrooms by investigating the effect of an integrated strategies approach in grade six and seven science classrooms in seven primary schools in the Eastern Cape, South Africa. The approach involved the use of "reading, writing, talking and doing" (Webb & Mayaba, 2010, p. 35) in completing a science based task. Following the intervention there were significant improvements, compared to the comparison group, in reading (in English), in listening skills (in English and isiXhosa) and in writing skills (in isiXhosa). These studies clearly indicate the advantages of using strategies such as exploratory talk in second language learners not only improve reasoning skills (improved scores on the Raven's test) but to improve discipline related skills.

5.4. Dialogue in university classes

At the university level dialogue in classrooms does not always reach the desired level which would indicate implementation of reasoning leading to a fuller understanding.

Attwood, Turnbull, and Carpendale (2010) found that the dialogue in first year psychology classrooms was mainly disputational or cumulative, while discussion which took place in fourth year psychology classrooms was exploratory in nature. This finding suggests an increase in the form of dialogue associated with greater reasoning skills with academic progression in the university environment. Earlier work by Krashen (1981) indicated that there were cognitive benefits derived from the use of a student's first language during the learning process. Deyi et al. (2007) investigated the use of the students' first language in combination with English during an exercise in Chem-Maths for Foundation Level Chemical Engineering students at the Cape Peninsula University of Technology. The investigators concluded that there were "cognitive advantages in using multilingualism" (Deyi et al., 2007 Conclusion section, para 1).

Other research at the university level has suggested methods for application of sociocultural theory of cognitive development by application of discourse analysis. Uzuner (2007) recommended classification of on-line dialogue as either *educationally valuable talk* (EVT) or *educationally less valuable talk* (ELVT), Foster (2009) used discourse analysis to understand interaction amongst undergraduate Information Management students, and Flowers and Cotton (2007) investigated the impact of self-categorisation of discourse amongst postgraduate students.

Uzuner (2007) proposed a modification of the categorisation of dialogue for application to on-line talk. Talk was classified as EVT or ELVT. Markers of EVT were talk that was exploratory, invitational, argumentational, critical, heuristic, reflective, interpretive, analytical, informative, explanatory or implicative in nature. Talk that was defined as ELVT was either affective, judgemental, experiential, reproductional or miscellaneous (off topic or course logistical) in nature (Uzuner, 2007). A rubric was developed for assessment of on-line

dialogue applying the EVT and ELVT classifications. Uzuner (2007) suggested that the EVT and ELVT system of classification could be used for "…rubric-based assessments and consciousness-building activities" (p. 409).

Visschers-Pleijers, Dolmans, Wolfhagen, and van der Vleuten (2005), while investigating the effectiveness of tutorials in problem based learning (at the university level, second year medical students) found that 24% of the group productivity score was derived from exploratory questioning and 2% from cumulative reasoning. The confirmation, in the perceptions of the students, that exploratory questioning played an important role in the effectiveness (in terms of a learning experience) of tutorials would seem to support the findings of Mercer (1996) that exploratory talk is one of the most effective kinds of talk for collaborative learning.

The discourse generated during the presentation planning stage of a group investigation into the topic of Information Management was analysed by Foster (2009). During information collection exploratory talk was the most frequently occurring form of discourse. The extent of exploratory talk used amongst the groups varied from 9.09 per cent to 88.24 per cent with a mean of 48.25 per cent. Foster (2009) believes that, in the context of group information seeking activities, exploratory talk as well as disputational and co-ordinating talk can be regarded as educationally valuable.

The outcomes of the study by Flowers and Cotton (2007) would seem to caution the use of self-categorisation of on-line discussion contributions by students without adequate preparation and support. In the study postgraduate students classified contributions to an on-line discussion according to the classification system whereby each contribution was classified either as: posing a relevant question; offering unsolicited input; offering deep responses; or offering shallow responses. Analysis demonstrated a decrease in the total

number of contributions, the number of cognitive units decreased significantly, and the percentage of high-level units decreased (Flowers & Cotton, 2007). Flowers and Cotton (2007) suggested that the decrease in quality and quantity of entries could be a consequence of "…increased self-consciousness from the treatment" (p. 102) with a participant stating "…my horrific discovery of how poor my spelling is!" (p. 102).

The literature clearly indicates that strategies such as the implementation of the practice of exploratory talk, while integrating the use of the EAL student's first or home language, can improve problem solving ability and improve academic achievement. These findings motivated aspects of this study, namely the investigation of the issues of language of instruction in the teaching of Pharmacology in a multilingual classroom and the assessment of whether an intervention, in the form of the introduction of the practice of exploratory talk, promotes reasoning skills and/or academic achievement in Pharmacology**.**

6. EDUCATIVE ABILITY AND ASSESSMENT OF SPEARMAN'S g

Spearman proposed that there is a common or general factor in mental ability. This factor, known as Spearman's *g,* is required in different degrees for different activities. There are two main components of Spearman's *g*: *educative* ability; and *reproductive* ability. Raven's Standard Progressive Matrices (SPM) have the ability to measure the educative ability of Spearman's *g* (Raven et al., 1998) and have been stated to be "…the best test of abstract or nonverbal reasoning ability, and this is itself widely regarded as the essence of 'fluid intelligence' and of Spearman's *g*" (Lynn, Allik, Pullman, & Laidra, 2004, p. 1250).

Educative ability refers to the ability to deduce additional or further meaning from that which is already known. Thus Raven's SPM "…measure the ability to educe relationships" (p. G7) (Raven et al., 1998). According to Raven et al. (1998) "…effective educative ability involves a great deal more than 'problem solving' alone. Effective educative

behaviour requires problem-identification, re-conceptualisation of the whole field (not just the problem) and monitoring of tentative solutions for consistency with *all* available information" (p. G12). Raven's SPM are reported to be independent of language as they are constructed from symbols which are common in all societies with written language(s) (Raven et al., 1998). However a bias towards language, despite the non-verbal presentation, has been documented amongst South African psychology students whose first language was an African language (Israel, 2006). On conclusion of the study it was noted that:

> …significant differences in the types of errors made on the basis of ability and home language, but not gender. The post-hoc analyses suggested that those of higher ability or first language English speakers were more likely to make incomplete correlate errors, while those of lower ability or speaking African first languages were more likely to make confluence of ideas errors.
>
> (Israel, 2006, p. 5)

Incomplete correlate errors are errors made when the correct rationale or method is used but the process is not carried through to the end. In contrast confluence of ideas errors occur when the person is unable to discriminate between the options and selects the most complex option. This option will contain some of the correct elements but also includes incorrect elements (Babcock, 2002).

Reproductive ability, the second component of Spearman's *g*, is the ability to reproduce a culture's store of verbal concepts. Ability to achieve in an academic examination is more closely related to reproductive ability than educative ability as it requires knowledge of and ability to use these stored ideas (Raven et al., 1998). Reproductive ability can be measured using Raven's Vocabulary Scales.

In a similar vein Spearman's *g* has by some authors also been divided into two components known as *crystalised* intelligence and *fluid* intelligence (Buschkuehl & Jaeggi, 2010). Crystalised intelligence refers to knowledge obtained from past experience (similar to

Spearman's reproductive component of *g*) while fluid intelligence refers to the ability to cope with new situations (similar to Spearman's educative component of *g*). Raven's SPM measures fluid intelligence (Buschkuehl & Jaeggi, 2010).

6.1. The Flynn and Jensen effects

An increase in general scores for Raven's SPM has been noted with time. This rise in intelligence scores with time is generally known as the Flynn effect (Brouwers, van de Vijver, & van Hemert, 2009). Brouwers et al. (2009) investigated the relationship between scores obtained on Raven's SPM and characteristics for each country tested relating to education and year of publication of the data. The authors conclude that the Flynn effect was not an artefact, that there was a progressive increase in scores per decade and the effect is not only present in countries whose economies are growing and can invest more financial resources into the countries education system. However, Brouwers et al. (2009) reported that the size of the Flynn effect was related to a country's affluence with more affluent countries showing a smaller increase.

The Flynn effect has been postulated to have occurred due to improved nutrition since 1900. A similarity is drawn between the increase in stature which has occurred in the general population since the 1900s (Lynn, 1990). Flynn (2009) postulated that effects of nutrition, at least since the 1950s, are not responsible for the increase in scores on Raven's SPM with time. Flynn (2009) proposed that the increase was probably multifactorial and contributory factors could have included "…historical causes (technology), the ultimate sociological causes (nutrition, family, schooling, work, leisure) and the proximate psychological causes (new habits of mind)" (p. 25).

Tests, such as Ravens SPM have been reported to be an excellent measure of fluid intelligence or Spearman's *g*. Lynn et al. (2004), reported differences in scores achieved by

black African Americans and white Americans. These lower Raven's SPM scores, which have also been reported in sub-Saharan African cohorts, have been attributed to the Jensen effect (Rushton, 2012). The Jensen effect relates to the differences for a specific variable in scores on IQ or intelligence tests such as Raven's SPM that are rich in the g-component (g-loaded) (Rushton, 2003).

While further exploring the Jensen effect Rushton and Skuy (2000) examined the performance of two cohorts of South African university students on Raven's SPM. A difference in scores was reported between the black and white cohorts (IQ equivalent scores of 84 and 105 respectively which correspond to mean scores (out of 60) for Raven's SPM of 43.32±8.79 and 53.90±4.11 respectively (Rushton & Skuy, 2000). To further investigate the apparent low scores Rushton, Skuy, and Frodjhon (2002) administered the Raven's SPM to students in the Faculty of Engineering and the Built Environment at the University of Witwatersrand. The raw scores (out of a total of 60) obtained for the black, white, and Indian students were 50±6.4, 56±2.6, and 53±4.9 respectively (Rushton et al., 2002). These raw scores would convert to IQ scores of 97 (black students), 110 (white students), and 102 (Indian students). Rushton et al. (2002) have suggested that factors that could contribute to the differences in the scores need to be investigated. Possible areas for investigation are: the "…supposed cultural fairness of the nonverbal SPM" (p. 420); whether the IQ scores achieved for the cohort of black students are predictive of academic achievement levels as they have been shown to be for western students; and to assess what the "…true mean African IQ is" (p. 421). Wicherts, Dolan, Carlson, and van der Maas (2010) systematically reviewed a large number of published data sets on the performance of sub-Saharan Africans on the Raven's SPM. The authors concluded that although the mean IQs in Africa were being measured at approximately 80 when compared to western norms the Flynn effect had not yet

reached Africa and that this was responsible for the differences discerned in the Raven's Matrix scores obtained in the USA and the UK as compared to Africa (Wicherts et al., 2010).

6.2. Improving intelligence

Buschkuehl and Jaeggi (2010) reviewed 11 studies that demonstrated that an intervention could improve performance in intelligence tests. The intervention in most of the studies involved training to improve working memory. Klingberg, Forsberg, Westerberg, and Hirvikoski (2002) investigated the effect of memory training in a group of children with attention deficit hyperactivity disorder. The outcomes of the study demonstrated that working memory could be trained and that the cognitive improvement could be transferred to other tasks for which training had not been received. Unfortunately Buschkuehl and Jaeggi (2010) reported that other researchers had been unable to repeat the findings of Klingberg et al. (2002). However, Jaeggi, Buschkuehl, Ionides, and Perrig (2008) also demonstrated that training of working memory induces a cognitive improvement, as measured using Ravens Advanced Progressive Matrices, that can be transferred to tasks on which training was not received and that the effect was dose dependent.

Research in the field of education has also demonstrated that training (application of the didactical tool of exploratory talk in a cohort of learners) results in an improvement in a task for which training has not been received. For example, when group discussions employing the technique of exploratory talk was introduced in a classroom the performance of the learners in an academic discipline, such as, mathematics or science improved and in addition a gain was demonstrated in scores obtained for the Raven's Standard or Coloured Progressive Matrices indicating a general cognitive improvement not related only to the task in which training was received (Mercer et al., 1999; Rojas-Drummond, Mercer, & Dabrowski, 2001; Webb, 2009; Wegerif, Linares, Rojas-Drummod, Mercer, & Velez, 2005).

7. LEARNING STYLES

Learning style research has been an active area of research for about four decades with many diverse disciplines actively involved in the area (Cassidy, 2004). Various instruments have been developed for assessment of learning style. In a review Cassidy (2004) listed 24 different learning style models or instruments as well as three over-arching frameworks that could be used for categorising learning styles (Table 2.2).

Curry (1983) described a layer-like model of learning behaviours. The outer layer, *instructional preference*, described the learning environment preferred. This layer is the most susceptible to influence and change. The next layer, *social preference*, referred to the type of interaction preferred for learning (that is independent/dependent, collaborative/competitive, and participation/avoidant). The third layer, *information processing*, pertains to the intellectual approach to processing information. The final and innermost layer, which is the least susceptible to influence and change, is *cognitive personality type* (Curry, 1983).

The second framework was proposed by (Riding & Cheema, 1991), who suggested a categorisation according to two dimensions describing the manner in which information is processed: *wholist-analytic*; and *verbaliser-imager*. The manner in which individuals process information either as a whole or subdivided into component parts relates to the wholist-analytic domain. The verbaliser-imager domain pertains to whether information is preferably processed as words or images (Riding & Cheema, 1991).

Table 2.2
Taxonomy of learning style models. Adapted from Cassidy (2004)

Model	Curry (1987)				Riding & Cheema (1991)	Rayner and Riding (1997)		
	Instructional preference	Social interaction	Information processing	Cognitive personality	Wholist-analytic	Personality centred	Cognitive centred	Learning centred
Witkin (1962) Field dependence/independence				●	●		●	
Kagan (1965) Impulsivity-reflexivity				●	●		●	
Holzman and Klein (1954) leveller-sharpener				●	●		●	
Pask (1962) Holist-serialist				●	●		●	
Pavio (1971) Verbaliser-visualiser				●			●	
Gregore (1982) Style delineator				●	●		●	
Kauffmann (1079) Assimilator-explorer				●	●		●	
Kirton (1994) Adaption-innovation				●	●		●	
Allinson and Hayes 91996) Intuition-analysis				●	●		●	
Kolb (1984) ELM			●					●
Honey and Mumford (1992) LSQ			●					●
Vermunt (1994) LSI			●					●
Entwistle and Tait (1995) Surface-deep			●					●
Biggs et al. (2001) SPQ			●					●
Schmeck et al. (1991) ILP			●					●
Hunt, Butler, Noy and Rosser (1978) Conceptual level			●					●
Dunn, Dunn, and Price (1989) LSI	●	●						●
Reichman and Grasha (1974) Styles of learning interaction model	●	●						●
Ramirez and Castenada (1974) Child rating form	●	●		●				●
Reinert (1976) ELSIE				●				●
Hill (1976) Cognitive Style Interest Inventory				●				●
Letteri (1980) learner types				●				●
Keefe and Monks (1986) learning style profile	●	●		●				●

The third framework listed by Cassidy (2004) was initially proposed by Rayner and Riding (1997). This framework categorised the learning style models or instruments into *personality-centred*, *cognitive-centred*, or *learning-centred* approaches.

Cassidy (2004) categorised the 24 models/instruments according to the three frameworks (Table 2.2). Kolb's Learning Style Inventory was categorised according to the Curry (1983) framework as information processing or as learning-centred according to the Rayner and Riding (1997) scheme.

7.1. Kolb's learning styles

The experiential learning model of Kolb (1984) proposes a cyclical model of learning where learning is a continuous interactive experience with individuals showing preference for certain stages of the cycle. According to the experiential learning model, learning is "…the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p. 41). There are two opposing methods of *grasping* experience. These are via experiencing the concept termed *concrete experience* (CE) or by conceptual and analytical thinking termed *abstract conceptualisation* (AC). There are also two opposing methods of *transforming* experience. Preference might be for reflecting or considering the task and possible solution before application termed *reflective observation* (RO) or by active trial and error learning termed *active experimentation* (AE) (Kolb, 1985). Within the cycle of learning (Figure 2.4) CE and AC are in opposition to one another along the continuum of perception and AE and RO are in opposition along the continuum of the processing of information.

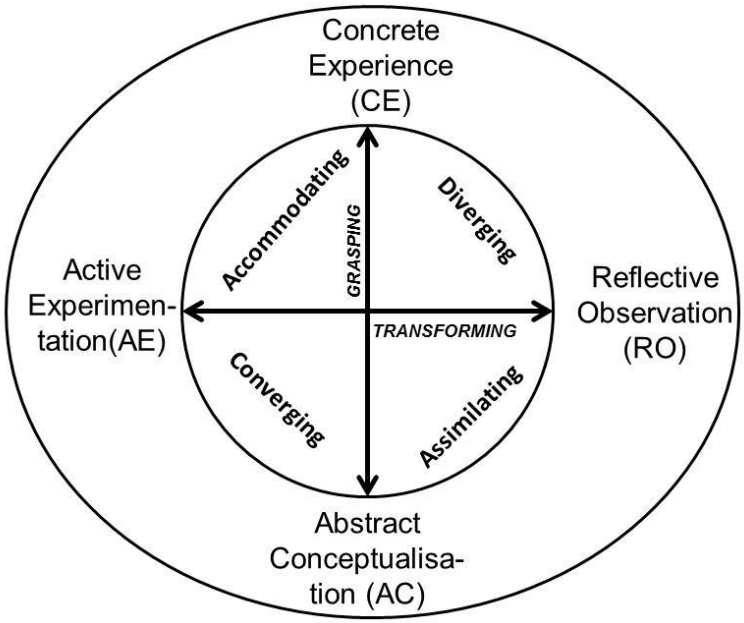


Figure 2.4. Kolb's learning cycle. Adapted from Kolb (1984).

An individual's relative position along the continuums will define the individual's learning style as *accommodator, diverger, assimilator,* or *converger.* The characteristics of the learning styles are:

> Accommodator: "…they are best at Concrete Experience and Active Experimentation. Their greatest strength lies in doing things…"
> Diverger: "…best at Concrete Experience and Reflective Observation…They excel in the ability to view concrete situations from many different perspectives…"
> Assimilators: "…dominant learning abilities are Abstract Conceptualisation and Reflective Observation…greatest strength lies in the ability to create theoretical models…"
> Convergers: "…dominant learning abilities are Abstract Conceptualisation and Active Experimentation…greatest strength lies in the practical application of ideas…"
>
> (Kolb, 1981, p. 238)

The relationship between Kolb's learning styles and personality type, early educational specialisation, professional career, current job role, adaptive competencies, culture and Kolb's learning styles has been researched (Joy & Kolb, 2009; Kolb, Boyatzis, & Mainemelis, 2001). Between 1971 and 1999 over 1004 research items (from journal articles to doctoral

thesis) relating to the experiential learning style model and the Kolb Learning Style Inventory have been published (Kolb et al., 2001) indicating that the method has been extensively validated in different cohorts and provides reliable data.

The Kolb Learning Style Inventory (LSI) is a tool developed to assess the learning styles of individuals. It consists of a set of 12 stems which can each be completed by four possible statements. Each of the statements is related to one of the four elements of the experiential learning cycle. For each question participants are required to score the four statements in order of preference from one to four. No duplicate scores may be given. Preference for concrete experience over abstract conceptualisation is plotted on the y-axis and preference for active experimentation over reflective observation is scored on the x-axis. The plot of the co-ordinates falls within one of the quadrants indicating the learning style (Kolb, 1985).

According to Kolb et al. (2001) there are similarities between the Myers-Briggs Type indicators and the Kolb learning styles. The accommodating learning style is similar to the Myers-Briggs *extraverted sensing* type, Kolb converging style relates to the *extraverted thinking* type and Kolb assimilating and diverging styles to Myers-Briggs *introverted intuitive* and *introverted feeling* type respectively.

7.2. Educational fields and learning styles

Because specialised education in certain fields (for example at the university level) develops and promotes certain types of learning skills it is not surprising that educational specialisation (such as studying for the BPharm degree) influences Kolb learning styles. According to Kolb et al. (2001) "…people with undergraduate majors in…English, and psychology have diverging learning styles, whereas those majoring in more abstract and

applied learning areas such as physical sciences and engineering have converging learning styles…" (p. 197).

> "…professional orientation shapes learning styles through habits acquired during professional training and through the more immediate normative pressures of being involved in a competitive profession"
>
> (Kolb et al., 2001, pp. 197-198).

In other words our day to day activities as professionals as well as the training during acquisition of the profession and during on-going continuing professional development will all influence our learning styles. Thus the finding that there is a higher incidence of certain learning styles within members of the same profession. For example, assimilating learning styles are found more commonly in the sciences and accommodating learning styles are found more commonly amongst professions in business and management (Kolb et al., 2001).

The demand and pressures of an individual's job will also shape their learning style. People who work in the area of planning or research will have a tendency towards assimilating learning style (Kolb et al., 2001). In addition the current project an individual is working on will influence their learning style as the individual adapts to the requirements of the situation, in other words adaptive competencies (Kolb et al., 2001).

7.3. Learning styles and culture

Early studies illustrated that culture (when culture is taken to be the nationality of the subjects) seemed to influence learning styles. Even when the sample had or was developing the same educational specialisation learning styles could differ. Learning styles between accounting students in Australia and Hong Kong differed with significant differences occurring on the AC-CE (grasping of information) and AE-RO (transforming of information) scales (Auyeung & Sands, 1996).

Joy and Kolb (2009) further investigated the influence of culture on learning styles using samples from USA, Italy, Germany, Poland, Brazil, India, and Singapore to investigate the effect of culture on learning styles. The outcomes of the study indicated that culture had a significant effect on the preference for abstract conceptualisation as compared to concrete experience. There seemed to be a link between abstract conceptualisation and in-group collectivism, which suggests that the greater the importance of family and group relationships within a culture the more an individual might be concerned with the abstract ideal of maintaining these relationships rather than in understanding their own lived experience (Joy & Kolb, 2009). Countries with cultural practices which avoid uncertainty showed a preference for abstract conceptualisation over concrete experience indicating that people in such a culture generally preferred not to put themselves at risks by actively being involved in grasping new information. They preferred to distance themselves from the risk and rather gain knowledge by using analytical thinking approaches (Joy & Kolb, 2009). In contrast in such cultures preference for active experimentation versus reflective observation was only marginally significant (Joy & Kolb, 2009).

7.4. Learning styles and Pharmacy

Few studies have been undertaken amongst pharmacists or Pharmacy students investigating learning styles. A study investigating learning styles using Kolb's LSI found that of the population of 166 pharmacists tested 33.8% were assimilators, 32.7% were convergers, 21.2% were divergers, and 12.1% were accommodators (Austin, 2004a). Adamcik, Hurley, and Erramouspe (1996), in 24 final year Pharmacy students, assessed learning styles using Kolb's LSI and reported that 25% were assimilators, 54% were convergers, 8% were divergers, and 12.5% were accommodators. Pungente et al. (2003) applied the Kolb LSI to first year Pharmacy students in a study investigating student preferences for activities associated with problem based learning and found that 19.8% were assimilators, 22.4%

convergers, 21.6% divergers, and 36.2% were accommodators. The switch from dominance in the assimilator/converger zones (33.8% and 32.7% respectively) amongst working pharmacists and dominance in the converger zone (54%) and assimilator zone (25%) in final year Pharmacy students to dominance in the accommodator zone (36.2%) amongst first year Pharmacy students may be due to reduced influence of educational specialisation and profession on learning styles amongst the first year Pharmacy students.

Gurpinar, Bati, and Tetik (2011) investigated whether there was any change in the learning styles of medical students between the first and second years of study. The participants were enrolled in three different institutions where different modes of programme presentation were present: a problem based programme; a hybrid model; and a traditional mode of presentation. Of the participants tested in the first year and re-tested in the second year 49% exhibited a change in learning style with the greatest change occurring in the students who initially were analysed as being divergers. When the influence of the mode of programme presentation was looked at it was noted that the greatest change occurred in the problem based learning group followed by the hybrid presentation mode and lastly the traditional presentation mode group.

In this study we will investigate the presentation of learning styles in the Pharmacology classes (ZCL2, ZCL303, and ZCL401) with academic progression and also whether there is any change in learning styles in the ZCL2 cohorts following the intervention.

8. CHAPTER TWO SUMMARY

In this chapter the outcome of research into the theoretical grounding of principles and parameters relating to the research study is presented. Information on language(s) used for teaching and learning at the tertiary level as well as research undertaken at the secondary and primary school levels in South Africa and elsewhere in the world is presented. This includes

discussion of the language policies pertaining to university level education in South Africa, language as a barrier to achievement, and English as the language of instruction. A background on the role of dialogue in educational practice and a review of research in this area is presented in Section 5 of Chapter Four. Lastly Chapter Four includes a presentation of aspects, relevant to this study, relating to educative ability and Spearman's *g*, and learning styles. Raven's SPM, reported to be a strong measure of Spearman's g, will be employed in this study as a measure of problem solving ability (Lynn et al., 2004) and Kolb's Learning Style Inventory will be used to assess the students' learning styles.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

1. INTRODUCTION

An understanding of the research paradigm within which this study was undertaken, as well as the study design employed, is presented in this chapter. In order to appreciate the significance of the research design and the research paradigm selected, the background to these aspects is briefly presented at the start of this chapter. A discussion of the sample selection, data collection and analysis relevant to the study follows. Finally, ethical considerations and limitations of the study are presented.

2. RESEARCH PARADIGMS

As various definitions and understanding of the term *paradigm* exist in the field of social science research the context in which the term is used in the present study needs to be defined. Morgan (2007) stated that there are four basic versions of the term paradigm used in social research discourse. They are:

- Paradigms as worldviews.
- Paradigms as epistemological stances.
- Paradigms as shared beliefs in a research field.
- Paradigms as model examples.

For the purposes of this study the concept paradigm will be defined as "shared beliefs among the members of a speciality area/research field" (Morgan, 2007, p. 50) as this is the approach adopted by the researcher.

Research paradigms that are prominent in social science research have evolved over the last five decades. Until the late 1960s the predominant research paradigm employed by researchers was the positivist paradigm (Morgan, 2007). Inherent in a positivist approach is the philosophy that the interrogation of social phenomena should be approached using similar methodology to scientific research of physical observations (Johnson & Onwuegbuzie, 2004). Research should be objective, and free from observer involvement. Conclusions are deduced from the data collected, and the researcher's feelings, beliefs, and attitudes should not impinge on the interpretation of findings. Methodology which is quantitative in nature is employed by researchers working within a positivist paradigm (Creswell, 2009). Examples of quantitative methodologies are experimental research, quasi-experimental design, and survey research (Truscott et al., 2010).

During the 1970s to 1980s a more qualitative approach evolved as social science researchers started basing their research philosophy on the constructivist or interpretivist paradigm (Rizo, 1991; Tashakkori & Teddlie, 2003) A researcher working within the constructivist paradigm will develop a theory in an evolutionary manner, from the data collected during the research process (Johnson & Onwuegbuzie, 2004). The constructivist paradigm is embedded in the belief that generalisations cannot be made, and that findings are context and time bound. Thus the deeper the researcher delves into an individual's experiences and beliefs the greater is the understanding of the issue that will evolve. Constructivists also believe that the reality of the researcher cannot be separated from the findings and that interpretation is subjective and will be affected by the attitudes, beliefs, and knowledge of the researcher. Methodologies employed by researchers using a constructivist approach are almost always qualitative in nature and include ethnography, discourse analysis, and action research (Truscott et al., 2010).

As a consequence of these differing philosophies the research findings deriving from researchers working within the two paradigms are presented in a widely differing manner. Researchers working from the constructivist paradigm employ an active style of writing which incorporates and explains the belief base of the researcher. In contrast researchers employing the positivist paradigm will use a detached, impersonal, and passive form of writing (Johnson & Onwuegbuzie, 2004).

Arising from the widely differing philosophies of the positivist and constructivist research paradigms was the development of the incompatibility thesis (Howe, 1988). This belief held that the positivist and constructivist paradigms were in total opposition to one another. Furthermore, the incompatibility theory extended this philosophy to state that the methodologies employed by each of the paradigms were also incompatible and should not be used together in the same research study.

In the late 1980s to 1990s a third philosophy of research evolved. This was the pragmatist paradigm (Howe, 1988). Supporters of the pragmatist paradigm took an opposing viewpoint to the beliefs embedded in the incompatibility theory. Researchers adopting the pragmatist approach to research are of the belief that the research problem is the focus and that all or any research methodology should be employed in order to fully investigate the research problem. The pragmatist philosophy encourages the use of both quantitative (positivist), and qualitative (constructivist) methodologies in the same research study, and is not limited to only one philosophy or perspective of research. The pragmatist belief is that the methodologies employed by advocates of the positivist and constructivist paradigms are complementary and that researchers will derive a more complete picture of the research problem when both qualitative and quantitative methodologies are co-employed (Creswell, 2009). In fact Newman and Benz (1998) proposed that qualitative and quantitative research

existed on a continuum with mixed methods research sited between the two on the continuum as mixed methods research contained aspects of both approaches. The advantage of combining qualitative and quantitative methodologies in the same research study is that it allows both for theories to be tested (positivist paradigm) and to be developed (constructivist paradigm) while undertaking the research.

Johnson, Onwuegbuzie, and Turner (2007) analysed definitions of mixed methods research provided by 19 leading proponents of the approach and proposed the following comprehensive definition:

> Mixed methods research is an intellectual and practical synthesis based on qualitative and quantitative research; it is the third research methodological or research paradigm (along with qualitative and quantitative research). It recognises the importance of traditional quantitative and qualitative research but also offers a powerful third paradigm choice that often will provide the most informative, complete, balanced and useful research results. Mixed methods research is the research paradigm that (a) partners with the philosophy of pragmatism in one of its forms (left, right, middle); (b) follows the logic of mixed methods research (including the logic of the fundamental principle and any other useful logics imported from qualitative or quantitative research that are helpful for producing defensible and usable research findings); (c) relies on qualitative and quantitative viewpoints, data collection, analysis and inference techniques combined according to the logic of mixed methods research to address one's research question(s); and (d) is cognisant, appreciative and inclusive of local and broader socio-political realities, resources and needs.
>
> (Johnson et al., 2007, p. 129)

Mixed methods research was proposed by Johnson and Onwuegbuzie (2004) to be the "third research paradigm in educational research" (p. 112). Creswell (2009) further stated that "for the mixed methods researcher pragmatism opens the door to multiple methods, different world views and different assumptions as well as different forms of data collection and

analysis" (p. 11). Tashakkori and Creswell (2007), in the launch issue of the Journal of Mixed Methods Research provided, for purposes of publication in the journal, a broad definition of mixed methods research as being: "research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of enquiry" (p. 4).

The advantages implicit in the use of mixed methods research are: theories can be both generated and/or disproved in the same study (Tashakkori & Teddlie, 2003); and generalisation of recommendations is possible while at the same time providing an understanding of the findings in context (Johnson & Onwuegbuzie, 2004).

In order to fully answer the research question for this study (Chapter 1, Section 3) a mixed methods approach was required. This means that the research was framed within a pragmatic research paradigm. Pragmatism as a worldview "arises out of actions, situations and consequence" (Creswell, 2009, p. 10). Researchers grounded in the pragmatic approach highlight the research problem instead of focusing on methods and in order to understand the problem will use any applicable method. This often results, as in the present study, in the use of both quantitative and qualitative methodologies when exploring a research question (Creswell, 2009).

3. RESEARCH DESIGN

A quasi-experimental, non-equivalent (pre-test and post-test) control-group design was employed (Figure 3.1). In order to investigate the teaching of Pharmacology the researcher was, by the very nature of the topic, required to select naturally formed groups as the subjects for the study, namely students registered for the Pharmacology modules at the NMMU. The sampling was, therefore, not random in nature but was a convenience sample was used. The convenience samples consisted of the students registered for the modules

ZCL2, ZCL303, and ZCL401. As the sampling was not random the procedure used was quasi-experimental in design (Creswell, 2009). A non-equivalent (pre-test and post-test) control-group design was employed. In this design an experimental group and a control group were selected by convenience sampling. Both the experimental and control group were subject to a pre-test and a post test. Only the experimental group underwent the intervention (Creswell, 2009). In this study the non-equivalent control group design was applied to the ZCL2 sample and the ZCL2Exp group were subject to the intervention while the ZCL2Com group served as the control group.

The non-equivalent (pre-test and post-test) control-group design consisted of three phases: Phase one — pre-intervention phase; Phase two — intervention phase; and Phase three — post-intervention phase. The quantitative component of the study ran through the three phases but the qualitative components were sited in the intervention and post-intervention phases. Parallel data collection occurred from two comparator groups (ZCL303 and ZCL401) to allow for effects associated with academic progression (Figure 3.1).

A concurrent design using the concurrent triangulation strategy, with quantitative dominance, was employed as the research question could be more thoroughly explored using both qualitative and quantitative methodologies (This will be discussed more fully in Section 4, Chapter Three). The concurrent triangulation design also allowed for enrichment of the quantitative findings by the qualitative findings. Both qualitative and quantitative methodologies were employed in the same stage(s) of the project (concurrent). Qualitative/ quantitative data were analysed separately and then discussed side by side with the qualitative data providing qualitative quotations which reinforced the quantitative findings (triangulation).

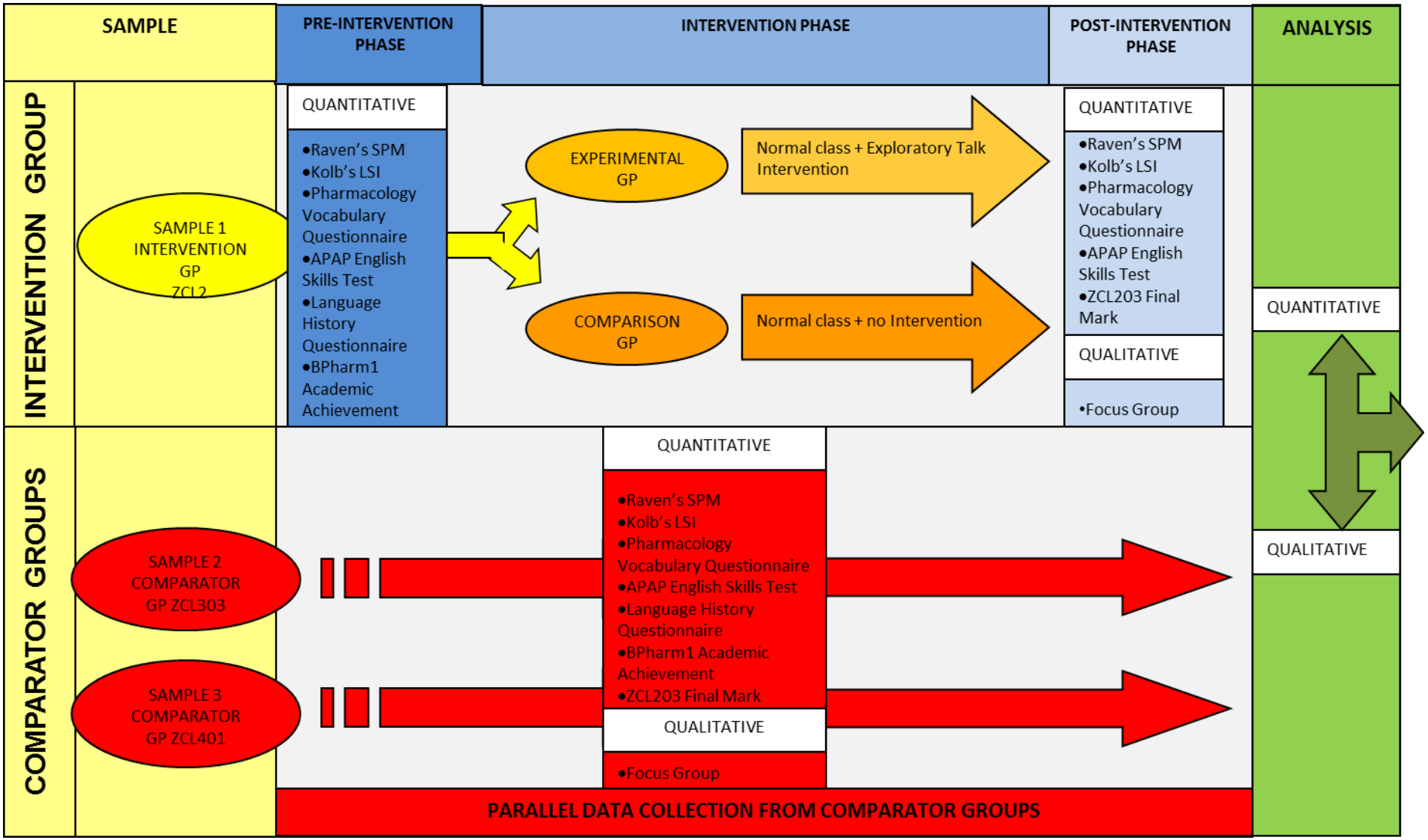


Figure 3.1. Study design indicating sampling and methodology employed. Three convenience samples were selected - students enrolled for ZCL203, ZCL303 and ZCL401 respectively. A non-equivalent (pre-test and post-test) control-group design was applied to the ZCL2 sample with subgroup samples being self-selected by voluntary attendance at SI (Supplementary Instruction) sessions. The intervention was applied during the SI sessions. To determine the effect of academic progression parallel data collection was undertaken from the two comparator samples ZCL303 and ZCL401. A mixed methods design was employed with concurrent triangulation – both qualitative and quantitative data was collected at the same time and then analysed in parallel with enrichment of the quantitative findings by the qualitative findings.

The portion of the research employing quantitative methodology was more extensive than the portion using qualitative methodology. Ideally in mixed methods research, when the concurrent triangulation design is employed, there should be equal weighting of quantitative and qualitative data, however, the approach used in this study, namely of a greater weighting for the quantitative data is an approach employed in many published concurrent triangulation studies (Creswell, 2009).

4. METHODOLOGY

Various systems for categorising the research methodologies employed in mixed research have been proposed. Creswell and Plano-Clark (2003) reported 12 systems for categorising research methodologies used by researchers in various fields where mixed methods research had been applied. Tashakkori and Teddlie (2003) categorised mixed research as either *mixed method* or *mixed model*. In the mixed model category both qualitative and quantitative approaches are used in all stages of the research. In contrast when a mixed method approach is employed the qualitative and quantitative approaches are used sequentially in isolation from one another – it is only at the interpretation stage of the study that the two approaches are integrated.

Creswell (2009) referred to the methodologies employed in mixed research as: *sequential mixed methods* designs; *concurrent mixed methods* designs; and *transformative mixed methods* designs. In Creswell's classification the sequential mixed methods procedure is similar to the mixed methods model of Tashakkori and Teddlie (2003). Qualitative and quantitative data are collected sequentially such that the alternative methodology is used to enlarge on the findings from the former methodology. In concurrent mixed methods procedures both qualitative and quantitative data is collected at the same time (Creswell, 2009). Thus, concurrent mixed methods methodology is similar to the mixed model category

as described by Tashakkori and Teddlie (2003). Transformative mixed methods methodology uses theories as the overarching framework for the study and applies qualitative and quantitative methodologies when appropriate. Either or both sequential and concurrent approaches may be employed in the same study when the transformative mixed method approach is used (Creswell, 2009).

Within each of Creswell's major design categories for mixed methods research there are further sub-classifications which are categorised according to: the *timing* of the qualitative and quantitative components; the *weighting* of qualitative versus quantitative data; and the approach used for integrating or *mixing* the data (Castro, Kellison, Boyd, & Kopak, 2010; Creswell, 2009).

Timing: relates to when the qualitative and quantitative data are collected relative to one another. The qualitative and quantitative data may be collected at the same time or during the same phase of the study (*no sequence concurrent*), or the qualitative data is collected first then the quantitative data (*sequential qualitative first*) or the quantitative data is collected before the qualitative data (sequential quantitative first) (Creswell, 2009).

Weighting: gives an indication of the predominant research methodology employed in the study and can be defined as either: predominantly qualitative; predominantly quantitative; or equal weighting given to both qualitative and quantitative techniques (Creswell, 2009). Johnson and Onwuegbuzie (2004) designed a matrix which related the *paradigm emphasis decision* (whether there is dominance of either qualitative or quantitative components or not) to the *time order decision* (when the different methodologies are applied relative to one another) (Figure 3.2). The matrix clearly delineates whether the study is of concurrent or sequential design and whether the qualitative and quantitative methodologies are equally weighted or whether one dominates.

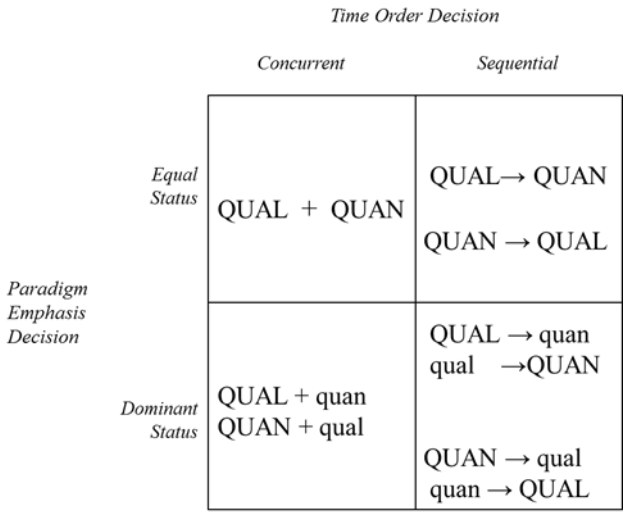


Figure 3.2. Mixed methods design matrix illustrating the *Paradigm Emphasis Decision* (whether qualitative and quantitative methodologies are weighted equally or not) to the *Time Order Decision* (when during the study the qualitative and quantitative methodologies are weighted equally or not) to the *Time Order Decision* (when during the study the qualitative and quantitative methodologies are applied relative to one another). Adapted from (Johnson & Onwuegbuzie, 2004). QUAN = quantitative; QUAL = qualitative. Upper case font versus lower case font indicates the predominance of the methodology in the study. An arrow indicates sequential data collection and a plus sign (+) indicates concurrent data collection.

Mixing: refers to how the qualitative and quantitative data are combined or integrated. The mixing may be either: *connected*; *integrated*; or *embedded* (Creswell, 2009). The data from the first phase of the research may be derived from quantitative techniques and this may then lead to a second phase (qualitative phase) where information from the first phase provides input into selection of the sample and topics to be further investigated. The type of mixing is then said to be connected. If the quantitative data is integrated with the qualitative data the type of mixing is termed integrated. Lastly if the secondary form of data collection is used simply to provide additional information and the data is not connected or integrated the type of mixing is embedded.

The information relating to timing, weighting and mixing of the qualitative and quantitative data within the study is used to sub-divide the design categories, sequential

mixed methods designs, concurrent mixed methods designs, and transformative mixed methods design into six sub-categories. The sub-categories have been depicted diagrammatically by Creswell and Plano-Clark (2003) (Figures 3.3 and 3.4). Sequential mixed methods designs are: (a) sequential explanatory design; (b) sequential exploratory design; and (c) sequential transformative design (Figure 3.3). Concurrent mixed methods designs consist of: (a) concurrent triangulation design; (b) concurrent embedded design; and (c) concurrent transformative design (Figure 3.4) (Creswell, 2009).

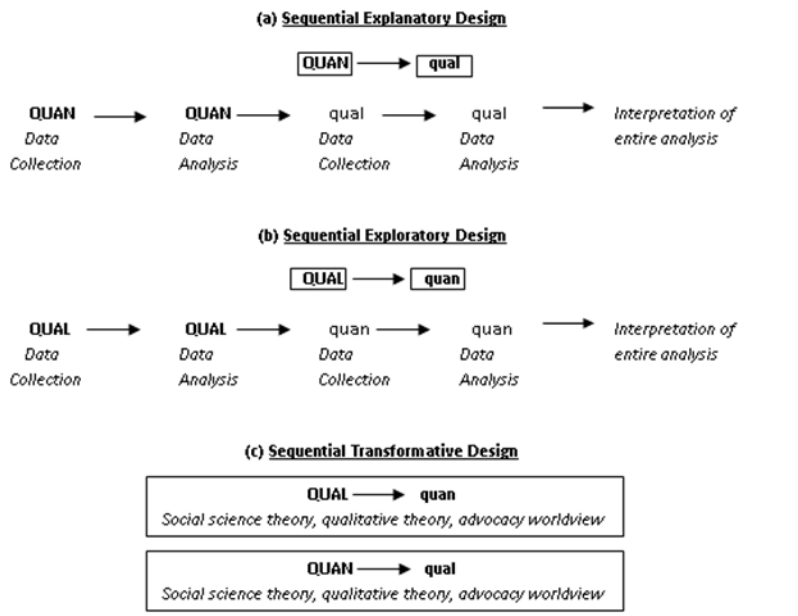


Figure 3.3. Sequential designs depicting the three sub-types (a) Sequential Explanatory Design; (b) Sequential Exploratory Design; and (c) Sequential Transformative Design. QUAN = quantitative; QUAL = qualitative. Upper case font versus lower case font indicates the predominance of the methodology in the study. An arrow indicates sequential data collection while a plus sign (+) indicates concurrent data collection. Boxes highlight the qualitative and quantitative data collection and analysis. Source: Creswell and Plano-Clark (2003)

A concurrent mixed methods design, that was not transformative, was applied in the current study. Thus, either a concurrent triangulation design (Figure 3.4(a)) or a concurrent embedded design (Figure 3.4(b)) could have been used. The differences and similarities between concurrent triangulation designs and concurrent embedded designs in terms of data collection, weighting, and mixing are:

data collection: for both designs qualitative and quantitative data are collected during the same phase of the research study *i.e.*, concurrently (Creswell & Plano-Clark, 2003);

weighting: ideally for concurrent triangulation the weighting of qualitative and quantitative methodology is equal but often in practice the one type of methodology dominates over the other. In concurrent embedded designs one methodology namely qualitative or quantitative will play a lesser role in the design (Creswell & Plano-Clark, 2003).

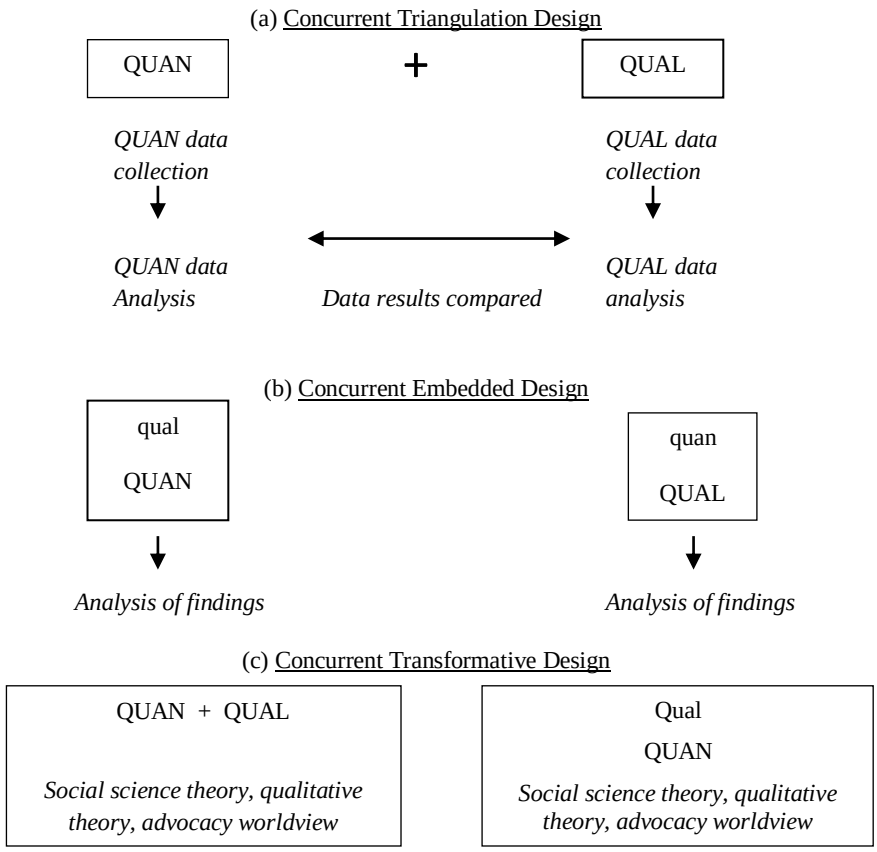


Figure 3.4. Concurrent designs QUAN = quantitative; QUAL = qualitative. Upper case font versus lower case font indicates the predominance of the methodology in the study. An arrow indicates sequential data collection while a plus sign (+) indicates concurrent data collection. Boxes highlight the qualitative and quantitative data collection and analysis. Source: Creswell and Plano-Clark (2003).

mixing: in concurrent triangulation integration occurs at the level of interpretation where the data can be either merged by transforming one type of data into the other or by discussing the qualitative and quantitative data side by side *e.g.*, quantitative results are discussed first and are supported by quotations, from the qualitative data, that support the quantitative data (Creswell & Plano-Clark, 2003). In concurrent embedded designs the qualitative and quantitative data are compared to one another in the discussion section or if the less dominant methodology is used to answer a different research question then the discussion is presented side by side (Creswell, 2009).

This study employed a concurrent triangulation design. The quantitative results were discussed initially and the discussion was enhanced by excerpts from the qualitative results.

4.1. Setting and sample

The study involved an investigation of issues of language and learning in a multilingual classroom setting.

4.1.1. Setting

This research study was conducted at the NMMU, a HET institution situated in the Eastern Cape Province, South Africa. The NMMU is classified as a comprehensive university meaning that the programme mix for the university includes certificate, diploma, and degree programmes at the undergraduate level as well as postgraduate degree and diploma/certificate programmes (IEASA, 2011). Other categories of universities in South Africa are traditional universities (programme mix excludes undergraduate certificate and diploma courses) and universities of technology (offer a similar programme mix to comprehensive universities but with a lesser emphasis on postgraduate research programmes than in the comprehensive universities). One of the programmes students may enrol for at the NMMU is the BPharm

degree which is a four year professional bachelor's degree programme. The study was undertaken amongst students enrolled in the BPharm degree at NMMU.

4.1.2. Sample

When undertaking a research project thought must be given to the manner in which the subjects for the study are selected. The selection of participants is known as sampling. In mixed methods research sampling techniques relating to both qualitative and quantitative methodologies must be employed. Onwuegbuzie and Collins (2007) reported the existence of 24 sampling designs available for use by researchers involved in mixed methods research. The sampling designs included five probability (or random) and 19 purposive (or non-random) sampling designs. The random sample designs, i.e., sampling which allowed for inferences to be drawn from the data, were: simple random sampling; stratified random sampling; cluster random sampling; systematic random sampling; and multi-stage random sampling. The non-random sampling systems included: maximum variation sampling; homogenous sampling; critical case sampling; theory-based sampling; confirming/ disconfirming sampling; snowball chain sampling; extreme case sampling; typical case sampling; intensity sampling; politically important case sampling; random purposeful sampling; stratified purposeful sampling; criterion sampling; opportunistic sampling; mixed purposeful sampling; convenience sampling; quota sampling; multi-stage purposeful random sampling; and multi-stage purposeful sampling (Onwuegbuzie & Collins, 2007).

Another important aspect to be considered when sampling is sample size. Sample size will dictate the degree to which statistical and analytical generalisations can be inferred from the data (Onwuegbuzie & Collins, 2007). The suggested minimum sample size for an experimental research design is 21 participants per group for a one-tailed hypothesis (Onwuegbuzie, Jiao, & Bostick, 2004). The recommended sample size for focus groups as a

data collection procedure is from six to nine participants (Krueger & Casey, 2000) or 10 participants (Langford, Schoenfeld, & Izzo, 2002) or 12 participants (Johnson & Christensen, 2004). When undertaking subgroup sampling three or more participants per sample group is recommended (Onwuegbuzie & Leech, 2007).

In this study a purposive (or non-random) sampling technique was used. The ZCL2, ZCL303 and ZCL401 students were selected as the samples as they were enrolled for the respective Pharmacology modules (were groups with a specific common characteristic) and thus a homogenous sampling scheme was used (Onwuegbuzie & Collins, 2007). A homogenous sampling scheme is employed when the researcher selects "settings, groups, and/or individuals based on similar or specific characteristics" (Onwuegbuzie & Collins, 2007, p. 285). The selected samples possessed information pertaining to the issues of language and learning in a multilingual Pharmacology classroom and were therefore information rich and interrogation of the samples would allow maximum understanding of the study questions. The sampling technique used for this study was, therefore, purposive homogenous sampling.

Sample for quantitative methodologies:

Pharmacology, one of the major disciplines in the BPharm degree, is presented during the 2nd, 3rd and 4th years of the degree as the modules Pharmacology 2 (ZCL2), Pharmacology 3 (ZCL303) and Pharmacology 4 (ZCL401) respectively. The students registered for the BPharm degree at the NMMU were used in this study (Figure 3.5). As mentioned earlier, the samples were: all students registered for Pharmacology 2 (ZCL2); all students registered for Pharmacology 3 (ZCL303); and all students registered for Pharmacology 4 (ZCL401). The sample for the intervention study consisted of all students registered for the module Pharmacology 2 (ZCL2) in 2011. A purposive homogenous sampling technique was used. A

self-sampling technique was then used to select the intervention or experimental group from the ZCL2 sample. The intervention was applied during SI sessions (supplementary Pharmacology sessions presented by senior students as additional academic support for the module ZCL2) which the ZCL2 students attended on a voluntary basis. Those ZCL2 students who attended five or more of the 10 intervention weeks of the SI sessions for Pharmacology (the intervention was applied during the SI sessions for a 10 week period) constituted the experimental group and the remainder of the ZCL2 students formed the intervention comparison group (Figure 3.5). The comparison group included the students who had attended less than 50% of the SI sessions.

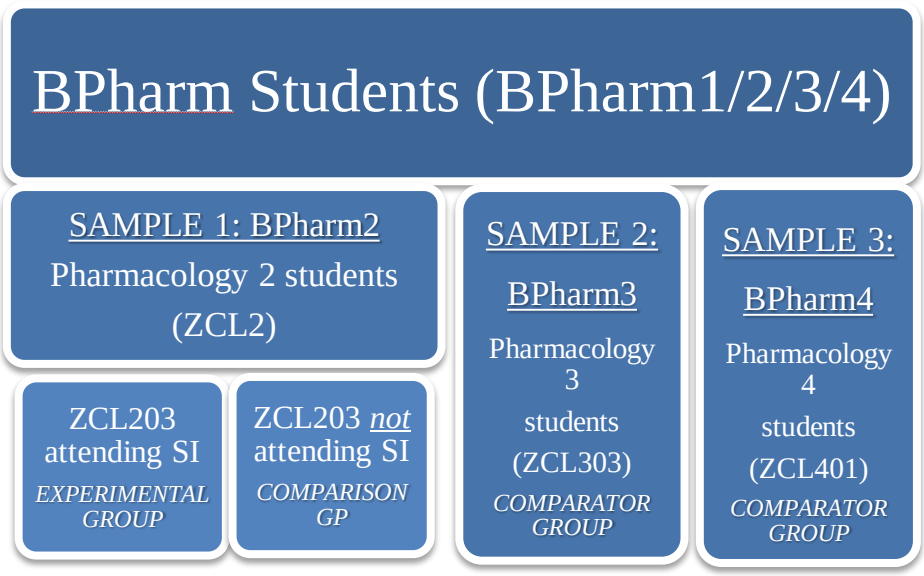


Figure 3.5. BPharm students illustrating sampling employed in the study and depicting the sample used for the intervention (ZCL2) further subdivided into the experimental or intervention group (those ZCL2 students who attended SI sessions) and the comparison group (those ZCL2 students who did not attend SI sessions). Comparator groups consisted of the ZCL303 and ZCL401 students.

In order to determine the effect on the variables of academic progression students registered for Pharmacology 3 (ZCL303) (3rd year of BPharm) and Pharmacology 4 (ZCL401) (4th year of BPharm) served as comparator groups (Figure 3.5). Once again purposive homogenous sampling was employed and all registered students for ZCL303 and ZCL401 were selected as the ZCL303 and ZCL401 samples respectively.

Sample for qualitative methodologies:

For the qualitative components of the study purposive convenience samples were selected. This consisted of selecting individuals who were conveniently available and willing to participate in the study (Onwuegbuzie & Collins, 2007). For the focus group session students from ZCL2, ZCL303, and ZCL401 were invited to participate in the respective sessions while for the subgroup sampling the student discussion groups in the selected SI session were used as the samples.

The sample size employed depended on the qualitative method used. For the focus group discussions a sample size of between 5 and 12 was used (Johnson & Christensen, 2004; Krueger & Casey, 2000). For the recording of exploratory talk during the SI sessions a subgroup sampling design was used with between 3 to 5 participants per subgroup as suggested by Onwuegbuzie and Leech (2007).

5. DATA COLLECTION

Data were collected from the three sample groups namely the intervention sample ZCL2 and the comparator groups ZCL303 and ZCL401 (Figure 3.5). For the ZCL2 sample data were collected during the three phases of the study (Figure 3.6). Data collection methods used during the pre-intervention, intervention and post-intervention phases will be further elucidated upon in Sections 5.1 to 5.3. Data were only collected on one occasion for each test applied to each of the comparator groups ZCL303 and ZCL401 (Figure 3.6). The ZCL303 and ZCL401 groups were not part of the intervention study but served as comparator groups to allow for investigation of possible changes associated with academic progression. Thus data collection from these two samples only occurred on one occasion (See Section 5.4).

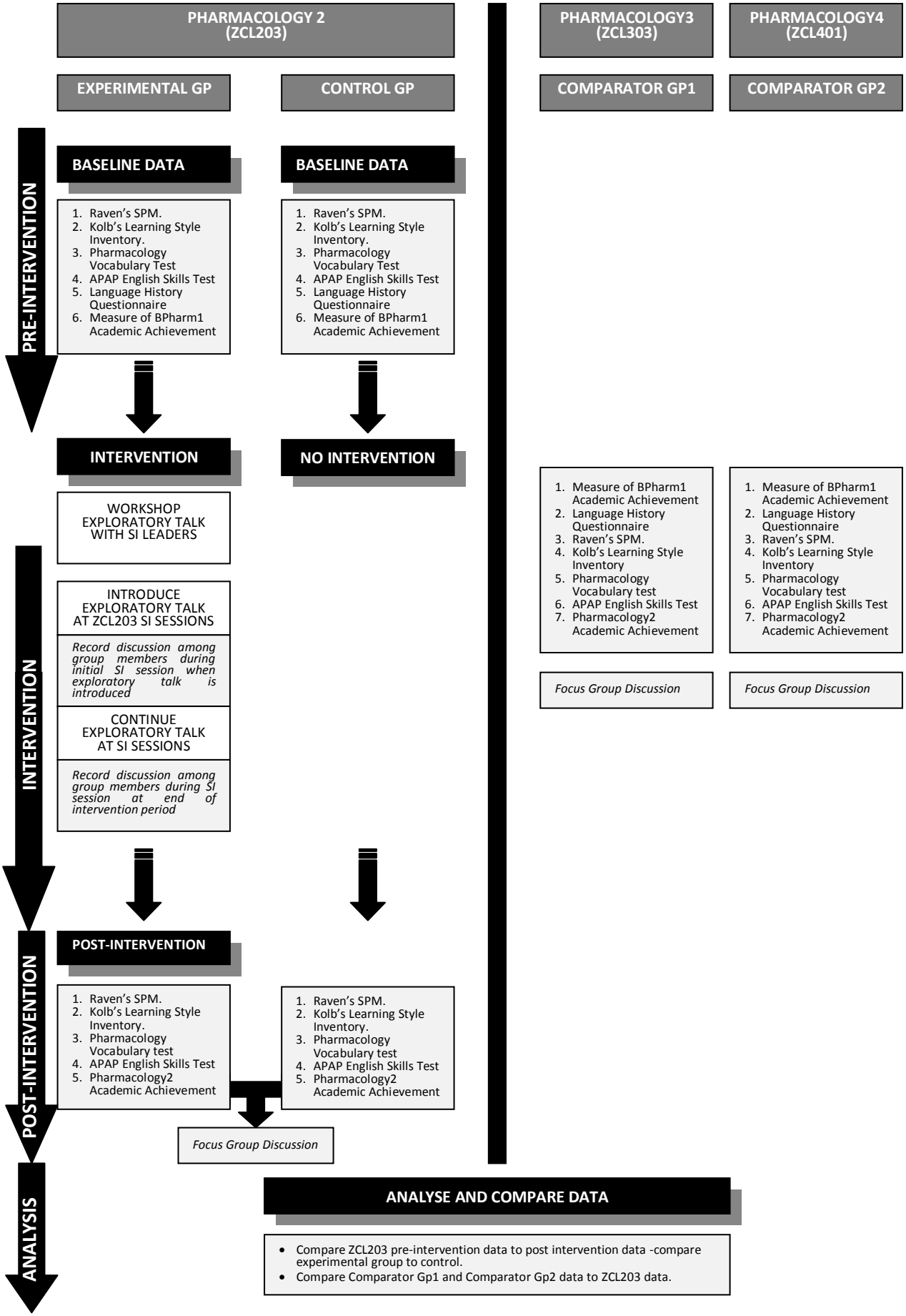


Figure 3.6. Flow chart of study design and methodology indicating the pre- and post-intervention experimental design and the parallel data collection from the comparator groups.

Indicates data collection where *italic font = qualitative data collection* while *normal font = quantitative data collection*
Indicates phase of the study i.e. Pre-intervention/Baseline; Intervention; Post-Intervention; and Analysis.
Indicates sample.

5.1. Pre-intervention data

Pre-intervention data were collected from both the ZCL2 experimental subgroup (ZCL2Exp) and the ZCL2 comparison subgroup (ZCL2Com) (Figure 3.6) and served as baseline data for the study. The instruments used in collecting the data were:

Raven's Standard Progressive Matrices;

Kolb's Study Style Inventory;

Pharmacology Vocabulary Test;

APAP English Skills Test;

Language History Questionnaire; and

Measure of BPharm1 Academic Achievement.

5.1.1. Raven's Standard Progressive Matrices (SPM)

Raven's SPM is a measure of general intelligence or the educative component of *g* as related to Spearman's theory of cognitive ability (Raven et al., 1998). In this study Raven's SPM was administered to assess the participants' abstract reasoning ability as, according to Lynn et al. (2004), Raven's SPM "is widely regarded as the best test, or one of the best tests, of abstract or non-verbal reasoning ability" (p. 1250). Additional information about Raven's SPM is provided in Section 6, Chapter Two.

The Raven's SPM was administered by the researcher to both the ZCL2Exp and the ZCL2Com subgroups during the pre-intervention phase. As recommended by (Raven, Raven, & Court, 2000) the test was administered to the subjects (adults) as a group. The Raven's SPM was administered to each sample (ZCL2, ZCL303, and ZCL401) as separate groups.

For the ZCL2 sample the ZCL2Exp subgroup and ZCL2Com subgroup were combined for the exercise. The students were seated at tables such that they could not copy the responses of their neighbours. Each student was given an answer sheet (Appendix A) and

instructed to place a cross in the relevant box for each problem. The first problem in series A was used to explain the approach. The problems were projected, one at a time, onto a screen using a data projector (In order to prevent infringement of copyright the matrices have not been included as an appendix). The test was administered without a time limit. Each subsequent problem was presented once the group had completed the problem being projected. Completion of the specific problem by the group was determined by observation followed by verbal enquiry by the person administering the test. The answer sheets were collected on completion of the final problem. Completion of the test took between 45 and 60 minutes.

5.1.2. Kolb's Learning Style Inventory

In order to assess the student's learning styles Kolb's Learning Style Inventory was administered. Kolb's Study Style Inventory is based on experiential learning theory (Kolb, 1984). Kolb (1984) stated that learning is "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (p. 41). In assessment of learning style acquisition of knowledge is measured between the extremes of concrete experience (CE) and abstract conceptualisation (AC) and the transformation of experience into learning is measured between the extremes of reflective observation (RO) and active experimentation (AE). Additional information about Kolb's Learning Style Inventory is provided in Section 7, Chapter Two.

The standardised inventory was administered, under test conditions, to the ZCL2Exp and ZCL2Com subjects as one group (Kolb's LSI has not been included in an appendix in order to prevent copyright infringement). The students were seated at desks and the combined question and response sheet for the inventory was handed out. Prior to commencement of the test the students were given verbal instructions on how to fill out the response sheet. Once the

student had finished the completed sheet was handed in. The administration was self-paced in that no time limit was placed for completion of the inventory.

5.1.3. Pharmacology Vocabulary Questionnaire

The Pharmacology Vocabulary Questionnaire was a purpose designed questionnaire, based on the work of Diaz-Gilbert (2004), which was used to test the students' knowledge of simple pharmacological vocabulary when words were presented as a simple list and when presented in the context of a paragraph. The test, therefore, consisted of two parts: Part A (words presented as a simple list); and Part B (words presented in the context of a paragraph) (Appendix B).

The presentation of words in isolation in Part A and then in context in Part B was the method employed by Diaz-Gilbert (2004). However, the vocabulary set employed in the Pharmacology Vocabulary Test for the current study was developed by the researcher, using pharmacological vocabulary extracted from practical sessions, tests and exams written over the previous two years by ZCL2 students. Part A consisted of 50 words listed in alphabetical order. Students were first requested to select whether, in terms of the word, they: *do not know*; *have never seen*; *word is familiar*; or *I know word*. Secondly students were requested to provide a meaning for the word. Part B consisted of five paragraphs which utilised 32 of the words included in Part A. Students were asked to once again select one of the options presented in Part A (do not know; have never seen; word familiar; or I know word) and then to provide a meaning for the word in the context of the paragraph.

A preliminary version of the Pharmacology Vocabulary Questionnaire was piloted, with five postgraduate Pharmacy students, for clarity and ease of understanding and to determine the time taken to complete the questionnaire. The preliminary questionnaire consisted of a list of 162 words presented in isolation (the format used in Part A of the final

version of the Pharmacology Vocabulary Test). The layout of the preliminary questionnaire was as described for the final questionnaire. The average time taken to complete the preliminary questionnaire was 84.5 ± 20.0 minutes. Thus, the number of words presented in isolation in the final questionnaire Part A was reduced to 50 words to allow for time for completion of Part B. The questionnaire was judged, by the pilot group subjects, to be clear and explicit and easy to understand by all pilot subjects. Thus no changes were made to the layout of the questionnaire prior to administration to the study samples.

The Pharmacology Vocabulary Questionnaire was administered to the ZCL2 students (both experimental and comparison subjects) as a group. Students were seated apart from one another so that they could not view one another's questionnaires and no communication was allowed between subjects. Part A of the questionnaire was handed out and verbal instructions on how to complete the questionnaire were given to the group. There was no time limit imposed for completion of either Part A or Part B. The students were instructed to raise their hands once Part A had been completed. Part A was then collected and the student was given Part B with a verbal elucidation on how to complete Part B. The students were once again instructed to raise their hands on completion of Part B. Part B was then collected. The time taken to complete each section of the questionnaire was noted in order to determine whether there was any difference between the groups.

5.1.4. APAP English Skills Test

The APAP English Skills test is an English reading comprehension test employed at the NMMU for prospective student assessment prior to enrolment. The test has been validated for use as an assessment tool for prospective students (Foxcroft et al., 2002).

Respondents were presented with a series of paragraphs of progressing complexity. Following each paragraph were a series of questions with, for each question, several answer

options presented in a multiple choice format. Subjects were required to select the most appropriate response for the question and place an *x* in the relevant square on the answer sheet provided.

The test was applied to the intervention subgroups (ZCL2Exp subgroup and ZCL2Com subgroup) as one combined group. The candidates were seated such that they could not view one another's answer sheets and communication between candidates was not allowed.

There was no time limit for completion of the test. The answer sheets were then scored and subjects were allocated a grade depending on the score (Table 3.1). The subject's reading comprehension was deemed to be either: *proficient* a score of 86 to 100; *functional* a score of between 66 and 85; *expanding* a score of 43 to 65; or *developing* a score of between zero and 42.

Table 3.1
The relationship between the classification of outcome and score achieved on the APAP English Skills Test and the skills demonstrated by the candidates. Source: Centre for Access Assessment & Research (CAAR), NMMU

CLASSIFICATION OF OUTCOME	SCORE	SKILLS DEMONSTRATED
Proficient	86 to 100	Test-takers at this level are able to comprehend passages that, although short, are somewhat complex in terms of the ideas conveyed, and that deal with academic subject matter, often in a theoretical framework. They are able to: • Extract points that are merely implied; • Follow moderately complex arguments or speculations; • Recognise tone; and • Analyse the logic implied by the author in making an argument.
Functional	66 to 85	Test-takers at this level are able to comprehend short passages that are characterised by moderately uncomplicated ideas and organization. They are able to: • Answer questions that require them to synthesise information, including gauging points of view and intended audience; • Recognize organising principles in a paragraph or passage; and • Identify contradictory or contrasting statements.
Expanding	43 to 65	Test-takers at this level are able to comprehend short passages that are characterized by uncomplicated ideas, straightforward presentation, and for the most part, subject matter that reflects everyday experience. They are able to: • Recognise the main ideas and less central themes; • Recognise the tone of the passage when questions do not require fine distinctions; and • Recognise relationships between sentences, such as the use of one sentence to illustrate.
Developing	0 to 42	Test-takers at this level can demonstrate the following skills: • Locate information in short, simple passages by answering literal comprehension questions; and • Answer simple questions where the wording in the answer is the same as that of the passage.

5.1.5. Language History Questionnaire

The Language History Questionnaire (Appendix C) was a purpose designed questionnaire developed to collect information pertaining to the respondent's past, present, and preferred language use. The questionnaire consisted of 16 closed ended questions. Demographic information was gathered by questions one to nine. Questions 10 to 13 interrogated language use history and language use in the home environment. Language use preference was queried by question 14 while question 15 dealt with language use in the primary and secondary school environment and question 16 with current language use on and off campus.

Prior to administration to the test subjects the questionnaire was piloted. The sample for the piloting of the questionnaire consisted of five postgraduate Pharmacy students. The group did not encounter any problems in completing the Language History Questionnaire, however, the researcher noted two areas of concern. The first was the phrase *Tertiary Education prior to current BPharm* in the second last line of the table in question 15. One respondent replied to this question even though they had not read for a tertiary qualification prior to the BPharm degree. The wording was thus changed to *Tertiary Education before current BPharm.* The second area of concern related to questions one and six. The required date format had been typed inside the boxes which made reading the student's response difficult. The required date format was, therefore, placed after the box. The two changes were made to the Language History Questionnaire prior to administration to the test subjects. The average time taken, by the pilot group, to complete the questionnaire was: 17.2 ± 2.17 minutes.

The Language History Questionnaire was administered to the ZCL2 students (both experimental and comparison subjects) as one combined group. The subjects were seated

apart at desks and asked to complete the questionnaire without communicating with one another. Verbal elucidation on how to complete the questionnaire was provided by the researcher. The completed questionnaires were handed in as each student finished. A time limit was not imposed for completion of the questionnaire.

5.1.6. BPharm1 Academic Achievement

The weighted average mark for the BPharm1 modules was used as a measure of prior academic achievement. The BPharm1 modules and relevant credits are presented in Table 3.2. The marks were obtained from the academic records division of the university. The students had provided written informed consent for the researcher to access their student record prior to enrolment in the study (Section 9, Chapter Three).

Table 3.2
Modules presented in the BPharm1 year indicating the respective credits for each module and weighting of each module relative to the total credits for BPharm1

MODULE	MODULE CODE	CREDITS	WEIGHTING
Physiology and Related Pathophysiology of Human Cellular, Muscular and Endocrine Systems	ZSP101	10	0.08
Physiology and Related Pathophysiology of the Human Nervous System and the Senses	ZSP102	10	0.08
Physiology and Related Pathophysiology of the Human Circulatory, Respiratory and Immune Systems	ZSP103	10	0.08
Physiology and Related Pathophysiology of Human Digestion, Reproduction and Fluid Balance	ZSP104	10	0.08
Anatomy for Pharmacy 101	ZAN101	9	0.07
Anatomy for Pharmacy 102	ZAN102	7	0.06
Mechanics and Thermodynamics	FBB101	7	0.06
Electricity, Optics and Atomics	FBB102	7	0.06
Chemistry General	CHG101	15	0.12
Chemistry Inorganic	CHI101	9	0.07
Chemistry Organic	CHO101	6	0.05
Computing Fundamentals	WRFC101	8	0.07
Professional Practice	ZP103	13	0.11
Credits First Year		*121*	

5.2. Intervention data

The intervention for this study consisted of the introduction of the didactical practice of *exploratory talk* during the SI sessions. Previous studies have clearly demonstrated that the application of the didactical practice of exploratory talk resulted in increased academic achievement in learners (Setati et al., 2002; Setati et al., 2008; Webb & Treagust, 2006; Webb et al., 2008; Webb et al., 2010). Further information pertaining to exploratory talk has been presented in Chapter Two in Section 5.

Pharmacology 2 SI sessions were weekly additional academic support sessions, presented by senior students, which the ZCL2 students attend on a voluntary basis. Traditionally the sessions had been presented in a lecture format. Those students who attended 50% or more of the SI sessions were designated as the experimental group. The remaining ZCL2 students were designated as the comparison group in that they were not exposed to the intervention of exploratory talk on a regular basis. During the intervention phase a workshop on exploratory talk was held for the SI leaders, exploratory talk was introduced during SI sessions and audio recordings were made of discussion between group members attending SI sessions at the initiation of the intervention period and at the end of the intervention period (Figure 3.6). The audio recordings allowed the researcher to determine whether there was any change in the type of discourse used during group discussions at the beginning of the intervention period as compared to the recordings made at the end of the intervention.

5.2.1. Exploratory talk workshop for SI leaders

The SI leaders (presenters of the SI sessions) and the researcher attended an interactive workshop presented by a member of the Faculty of Education at NMMU who is familiar with the introduction of the technique of exploratory talk in academic environments.

During the workshop the SI leaders were familiarised with the concept of exploratory talk and provided with suggestions on integration of the technique into the SI sessions. Continued support, during the intervention period, was provided to the SI leaders by the researcher.

5.2.2. Introduction of exploratory talk to SI sessions

The incorporation of the didactical technique of exploratory talk into the ZCL2 SI sessions commenced after the SI leaders had been trained on the application of exploratory talk. The students attending the session were given an explanation of the concept and were then encouraged to employ the technique during the group discussions. The format of the SI sessions was changed, from the previous lecture format, to a format based on group (peer) discussion. During each session the students attending were given a series of questions which required probing of the theory and application to practice. The students then formed groups of from three to five and interrogated the questions as a group. The SI leader circulated between the groups answering queries by directing the discussion in the correct direction.

5.2.3. Audio recording of group discussion at initial SI session

Audio recordings, using a voice recorder, were made of discussions between group members during the initial SI session on introduction of the intervention. Five minute portions of discussion between group members of four groups were recorded. The last three minutes of each recording was analysed for the type of discourse used. The first two minutes of the recording were discarded to allow the students time to get used to the presence of the recording device. The recording was transcribed and then analysed for discourse type by the researcher.

Discourse was classified either as: *disputational talk*; *cumulative talk*; or *exploratory talk* as described by Dawes, Fisher, and Mercer (1992), Fisher (1992), and Mercer (2004).The time period spent using each of the three types of discourse was then analysed in order to

ascertain the extent of exploratory talk employed as compared to the other two types of discourse namely disputational and cumulative talk.

The Nuance speech recognition software, Dragon Naturally Speaking 12®, was used during transcription of the audio recordings from both the SI session group discussions and the focus group discussions. The software only enables transcription of a single-voice, multiple-voice transcription is not facilitated. The approach recommended by Nuance to overcome the inability to transcribe multiple voices was used. The transcriber listened to the audio recording, portion by portion, while dictating the recording into the Dragon Naturally Speaking 12® software. The software was then able to transcribe the dictated material. The transcription was not performed by the researcher but by a second party who was a qualified pharmacist and thus was familiar with the context of the discussions. Following transcription the transcripts were checked against the audio recordings for accuracy by the researcher.

5.2.4. Audio recording of group discussion at the end of the intervention

At the end of the intervention period audio recordings were once again made of discourse amongst group members at a ZCL2 SI session. Recordings were made of discussion amongst six groups. As in the initial recordings (Section 5.2.3) a five minute period of discussion amongst group members was recorded. The initial two minutes were discarded and the final three minutes were transcribed. The transcribed discussion was then analysed, by the researcher, for type of discourse namely, disputational, cumulative, or exploratory. A sample of the discourse analysis was cross-checked by a second party and minimal variations were found.

5.3. Post-intervention data

Post-intervention testing was commenced on completion of the 10 week intervention period. Testing was undertaken in both the ZCL2Exp subgroup and the ZCL2Com subgroup.

In order to determine whether the intervention was effective or not the tests administered during the pre-intervention phase were repeated. Data from the pre-intervention tests was then compared to data from the post-intervention tests to assess any change post-intervention. Two tests were not re-administered these were: the Language History Questionnaire; and the Measure of Prior Academic Achievement (BPharm1 weighted average). The Language History Questionnaire had been used to gather information about past, present, and preferred language use and thus did not need to be repeated. As the students had now reached the end of the BPharm2 academic year the Measure of Prior Academic Achievement was replaced with ZCL2 Academic Achievement. In addition a focus group discussion was held with a convenience sample of ZCL2 students in order to further enrich the data. The tests administered during the post-intervention phase were, therefore:

Raven's Standard Progressive Matrices;

Kolb's Study Style Inventory;

Pharmacology Vocabulary Test;

APAP English Skills Test;

ZCL2 Academic Achievement; and

Focus Group Discussion.

Raven's SPM, Kolb's Study Style Inventory, Pharmacology Vocabulary Test and the APAP English Skills Test were administered as in the pre-intervention phase (Section 5.1.1 to Section 5.1.4 respectively).

5.3.1. Pharmacology 2 (ZCL2) academic achievement

The November written examination mark for ZCL2 was taken as a measure of academic achievement in ZCL2. For the seven students who were not granted entry to the final examination (due to a class mark of < 40%) the class mark was used as the final mark

for ZCL2. The written November examination and not the final module mark was used as a marker of achievement as 33.3% of the final module mark was contributed by the class mark. The final written November examination contributed 66.7% towards the final module mark. The class mark is calculated from the marks obtained during the academic year for practical sessions, orals and theory tests. The final written November examination was, therefore, a truer reflection of knowledge at the end of the academic year. Pharmacy Department records were used to access the marks. As indicated, in Section 9 of this chapter, students had provided written informed consent permitting access to their student records for purposes of the research study. A student group may be considered to be a vulnerable population and it is essential that their rights to privacy and confidentiality are protected. Thus this study was scrutinised and approved by a university ethics committee prior to commencement of data collection.

5.3.2. Focus group discussion

Data pertaining to a participant's approach to studying ZCL2; attitude towards ZCL2, and whether the participant had adopted any coping tactics or adapted their approach to studying for Pharmacology compared to the other modules for which the participants were registered was gathered. Focus group methodology was selected to obtain this information as this methodology enabled the researcher: by posing several open ended questions for the participants to explore, to obtain the participants' beliefs, attitudes and opinions about the topics introduced via the open ended questions (Kitzinger, 1995; Simon, 1999). The advantage of using a focus group is that it allows the participants to feel more comfortable as they are supported by their peers (Beyea & Nicoll, 2000b) and the discussion is enriched by the participants bouncing ideas and thoughts off one another (Panyan, Hillman, & Liggett, 1997) allowing for an accumulation of rich, textured information (Rabiee, 2004).

The focus group discussion was held at a time convenient to the participants, a convenience sample of twelve ZCL2 students. As recommended by Beyea and Nicoll (2000c); Kitzinger (1995), and Simon (1999) the venue selected for the discussion was convenient (on campus thus allowing easy access by students), comfortable and allowed the participants to be seated in a circle around a table in clear view of each other. The session was recorded using an audio recorder and then transcribed (participants had provided written informed consent at the onset of the study). In addition an assistant moderator (a postgraduate student in the Pharmacy Department at NMMU) recorded notes by hand during the session. The assistant moderator was seated to the side of the group at a separate table and did not participate in the discussion (Krueger & Casey, 2000). On arrival participants were offered refreshments to assist in creating a welcoming and relaxed environment (Kitzinger, 1995). In addition Beyea and Nicoll (2000b) recommend the offering of refreshments as a way of optimising attendance. The duration of the session was one hour as suggested by Kitzinger (1995) and Simon (1999).

The researcher fulfilled the role of moderator for the session. The session commenced, as recommended by Krueger and Casey (2000), with the moderator: welcoming the group; providing an overview of the topic for the session; explaining the procedure; and asking the first question. Three main topics/open ended questions were presented for discussion during the session. The topics were: the participant's approach to studying ZCL2; the participant's attitude towards ZCL2; and whether the participant had adopted any coping tactics or adapted their approach to studying for ZCL2 compared to the other modules for which the participants were registered. The moderator encouraged participation of all participants and interaction between participants while guiding the discussion (Beyea & Nicoll, 2000c; Kitzinger, 1995; Krueger & Casey, 2000).

On completion of the focus group discussion the assistant moderator explained, to the moderator/researcher, the notes that were taken by the assistant moderator during the session. The recordings were transcribed and checked for accuracy. The transcripts were then analysed by the researcher, using Atlas.ti®, by coding of idea clusters and generation of dominant themes (Beyea & Nicoll, 2000a; Krueger & Casey, 2000). A sample of the coding was cross-checked by a suitably qualified second party and minimal variations were found.

5.4. Parallel data collection from comparator groups

Data was also collected from two comparator groups, ZCL303 (BPharm3) and ZCL401 (BPharm4), in a parallel data collection process (Figure 3.6). The comparator groups were used to interrogate the effect of academic advancement on the variables. The data collected from the comparator groups was obtained from application of:

Raven's Standard Progressive Matrices;

Kolb's Study Style Inventory;

Pharmacology Vocabulary Test;

APAP English Skills Test;

Language History Questionnaire;

Measure of BPharm1 Academic Achievement; and

ZCL2 Academic Achievement.

The methods used to collect the seven sets of data were applied in the same manner as to the ZCL2 group (Section 5.1. and Section 5.3). An intervention was not administered to the comparator groups, therefore, data was only collected at one point.

6. DATA ANALYSIS

Quantitative data (derived from Raven's SPM, Kolb Learning Style Inventory, Pharmacology Vocabulary Questionnaire, BPharm1 weighted average or ZCL2 Final Mark, and the Language History Questionnaire) was scored (where relevant) and then captured on a Microsoft Excel® spread sheet. Qualitative data obtained from the focus group discussions and the recordings of group discussions during SI sessions was transcribed from the voice recordings and then coded and analysed for dominant themes by the researcher or analysed for type of discourse respectively. On completion of the post-intervention phase of the study the ZCL2 pre-intervention data was then analysed and compared to the ZCL2 post-intervention data to ascertain the effect (if any) of the intervention. The data was also analysed in comparison to the data of the comparator groups (ZCL303 and ZCL401).

7. STATISTICAL ANALYSIS

Descriptive and inferential statistics were employed in the analysis and interpretation of data. Statistical analysis was undertaken in consultation with a Statistician from the Statistical Consulting Unit at the NMMU.

Descriptive statistics such as measures of central tendency (mean) and measures of dispersion (standard deviation) were used to assist in describing the data. Inferential statistical tests were applied to indicate the statistical probability of differences found. Test used were: the chi^2 test for analysis of incidence data; Student's paired/unpaired *t*-test for assessment of differences in sample means; analysis of variance (ANOVA) for assessment of difference in sample means across more than two variables with, when applicable, Scheffé's post-hoc test to provide specific information on which means were significantly different from each other; regression analysis for estimating the relationships amongst the variables; and Pearson's correlation coefficient (*r*) as a measure of the strength of the association

between two variables. Cohen's *d* was used to estimate an effect size as an indication of the practical significance of differences in the data when the Student's *t*-test or ANOVA were used. Statistical analysis was undertaken using Statistica® Version 10.

8. VALIDITY AND RELIABILITY OF DATA

It is expected that during the research process care is taken to ensure that the findings not only relate to the research question but reflect the true picture and that the process can be reproduced by another researcher. To this end it is essential that the two concepts of reliability and validity are considered. In a mixed methods study, such as this study, reliability and validity must be considered from both the quantitative as well as the qualitative perspective.

Reliability is a measure of the reproducibility of the data collection method, namely a measure of consistency. Validity is related to the accuracy of the data collection tool, in other words does the data collection tool provide the data that was sought (Babbie, 2010; Creswell, 2009)? Different approaches are required when examining validity and reliability of quantitative and qualitative data even though the basic concepts of validity and reliability remain the same whether the data is collected via quantitative or qualitative methodologies.

In terms of the quantitative data collection tools employed in this study the Raven's SPM and Kolb's LSI are standardised tests that have been used extensively and their reliability and validity have been documented (Kayes, 2005; Raven et al., 2000). The APAP English Skills Test has been validated for use in student placement at the NMMU and used extensively amongst the NMMU student and prospective-student population (Foxcroft et al., 2002). The APAP English skills test has also been used throughout the Eastern Cape Province (Watson, McSorley, Foxcroft, & Watson, 2004). The Pharmacology Vocabulary Questionnaire and the Language History Questionnaires were researcher-developed, purpose-

designed questionnaires. Both questionnaires were piloted in a sample of recently graduated pharmacists (postgraduate MPharm students) prior to use. During piloting the data collected appeared to be reliable and valid. Both questionnaires were administered to three different samples (ZCL2, ZCL303, and ZCL401 students). When the data from the three samples were examined the data were consistent and accurate with little variation. The Pharmacology Vocabulary Questionnaire was re-tested (administered prior to and at the end of the intervention) in the ZCL2 sample. The results provided further evidence of the reliability and validity of the instrument. Finally statistical analysis of the data was undertaken in consultation with a Statistician employed in the Statistical Consulting Unit at the NMMU to ensure a correct and rigorous approach to statistical analysis.

In the qualitative framework validity is interpreted as the researcher confirming the accuracy of the data by using certain techniques while reliability is taken to mean that the researcher's approach is consistent (Creswell, 2009). In other words in the qualitative framework validity and reliability are seen as trustworthiness, rigor, and quality (Golafshani, 2003).

Creswell (2009) suggested the use of several techniques for confirming reliability and validity. Reliability can be confirmed by documenting the procedures taken, checking transcripts for accurate transcription, creating lists of codes to prevent drift in definition of codes, and cross checking of coding. In this study reliability was confirmed by: following transcription, by a second party, the transcripts were checked for accuracy against the audio recordings by the researcher; the qualitative data were analysed using Atlas.ti® a software programme that generates lists of codes for use during coding thus minimising code-drift; and coding of a sample of transcripts was cross-checked by and independent party.

Validity is one of the strengths of qualitative research and can be confirmed by using approaches such as: using "rich, thick description to convey the findings: (Creswell, 2009, p. 191); spending prolonged time in the field; and triangulation (Creswell, 2009). In this study rich thick descriptions and quotations were provided by the qualitative data, the researcher had many years of experiences in teaching Pharmacology to BPharm students, the data collection period extended over six to seven months, and a triangulation design employing both qualitative and quantitative approaches was used.

9. ETHICAL CONSIDERATIONS

Ethical approval was applied for and granted by the Faculty Research, Technology and Innovation Committee of Education at NMMU (Ethical clearance reference number: H11-Edu-CRT-006) (Appendix D). Participation in the study was voluntary and full disclosure of the research aims was made to all participants. Participants supplied written informed consent prior to enrolment in the study (Appendix E). Participant confidentiality was maintained at all times and no participant identifiers were linked to published data. The study was carried out in accordance with the objectives of the *Declaration of Helsinki* (World Medical Association, 2008).

10. CHAPTER THREE SUMMARY

In this chapter the reader was introduced to research paradigms applied in the social sciences with a focus on the pragmatist paradigm, which was the paradigm adopted for this study. Further discussion elucidated common methodologies employed with focus on the application of mixed methods methodology and its sub-types. The setting for the study and sampling systems utilised were presented with information pertaining to the data collection methods and data collection tools used. Finally data analysis approaches used (including statistical analysis), validity and reliability, and ethical considerations were discussed.

CHAPTER FOUR
QUANTITATIVE RESULTS

1. INTRODUCTION

The results of the quantitative components of the study are presented in this chapter whilst interpretation and triangulation of quantitative and qualitative data (qualitative results are presented in Chapter 5) is done in Chapter Six. The demographic characteristics of the population, history of language use, as well as current language use, English reading comprehension, academic achievement, Ravens SPM, learning styles, and pharmacology vocabulary knowledge are presented in this chapter. Results are presented, where appropriate, within mean ± standard deviations and, for ease of reading, the large tables containing the demographic results (see Section 2 of this chapter) can be found in Appendix F.

2. DEMOGRAPHICS

The students registered for the BPharm programme at the NMMU served as the subjects for the study. The intervention study was run during the ZCL2 module (BPharm2 students). The ZCL2 students self-selected (by attending or not attending SI sessions) into an experimental sample (ZCL2Exp: n = 23) or a comparison sample (ZCL2Com: n = 97). The ZCL303 (n = 67) (BPharm3) and ZCL401 (n = 41) (BPharm4) students served as comparator samples to determine the effects of academic advancement. The numbers in each sample group varied slightly for the different data sets due to students not being present during the session when the specific set of data was collected or omitting the specific data from the data collection tool. Sample numbers were, therefore, reported with each set of results presented in this chapter.

In order to assess the effect of academic progression it was necessary to compare the ZCL2 sample prior to the intervention (in other words prior to self-sampling at the start of the intervention into the ZCL2Exp and ZCL2Com samples, see Figure 2.1) to the ZCL303 and ZCL401 samples. Therefore, the demographic data has been presented firstly as the three samples ZCL2, ZCL303, and ZCL401. The demographic characteristics of the samples (ZCL2 combined, ZCL303 and ZCL2) were reported in Table F.1.

During the intervention study the ZCL2 students were divided into the experimental and comparison groups. A self-sampling technique was used whereby the students who attended SI sessions (voluntary attendance) formed the intervention group and the students who did not attend SI sessions were designated the comparison group. The demographic data pertaining to the ZCL2Exp and ZCL2Com samples are presented in Table F.2. A full discussion of the implication of the results pertaining to the samples ZCL2Com and ZCL2Exp is presented in Chapter 6.

2.1. Gender

The three samples (ZCL2, ZCL303, and ZCL401) exhibited a similar trend in terms of gender distribution (p = .445) in that 40.83, 34.33, and 46.34 per cent respectively were males (Chi^2, df = 2, n = 228). In, 1970, in the population of South African registered pharmacists the gender distribution was 83.4% males to 16.6% females. There was a major swing in gender distribution over the next 18 years with the ratio being 59.2% males to 40.8% females in 1988. By 1998 the gender distribution was 50.9% males to 49.1% females and in 2010 the ratio had redistributed to 41% males to 59% females (South African Pharmacy Council, 2011).

The switch was even more dramatic when the gender distribution was examined in registered pharmacists under the age of 35. In 2010 of the 4356 registered pharmacist under

the age of 35 years 73.5% were female and 26.5% were male (South African Pharmacy Council, 2011). The shift toward the female gender in the samples used in this study was not as extensive. Of the total number of participants (*n* = 228), 39.91% were male and 60.09% were female (Table F.1). The higher percentage of males could be due to the fact that only 53% of the students were South African citizens and therefore 47% would probably not register with the South African Pharmacy Council (Table F.1). The movement towards female dominance in the Pharmacy workforce is occurring throughout the world but Africa is lagging behind Europe and the UK. In a study undertaken by the International Pharmaceutical Federation (FIP) in 40 countries the two extremes in terms of male to female ratio occurred in Uganda where only 20% of pharmacists were female and in the Czech Republic where 80% of pharmacists were female (Wuliji, 2009). Women constituted 50% or more of the pharmacist workforce in 26 of the 40 countries included in the study.

Gender distribution between the ZCL2Com and ZCL2Exp samples was similar (*p* = .774: Chi^2, *df* = 1, *n* = 120). In the ZCL2Com sample 59.79% (n=97) were female and in the ZCL2Exp sample 56.52% were female (Table F.2).

2.2. Age

The mean ages for the ZCL2 combined sample and the ZCL303 and ZCL401 samples were 23.09±4.49 years, 24.53±5.74 years, and 24.08±2.39 years respectively. There was no significant difference (*p* = .1176) in the mean age between the samples (ANOVA, *F* = 2.16, *n* = 228) possibly due to students repeating a module and the presence of mature students in all three years of the programme. However, there was a significant difference (*p* = .0001) in the frequency distribution of age in the three samples (Chi^2, *df* = 14, *n* = 228) (Table F.1). In the ZCL2 sample 14.93% of students were older than 25 years, 16.67% of ZCL303 students were older than 25 years and 24.33% of ZCL401 students were older than 25 years (Table F.1).

The mean age of the ZCL2Com (22.97±3.92 years) group did not differ significantly (p = .551) from the ZCL2Exp (23.62±6.57 years) group (Student's t-test: t –value = -0.60, n = 114). The frequency distribution of age from 19 years to 53 years was also similar (p = .098; Chi^2, df = 8, n = 118) (Table F.2).

2.3. Academic Programme

The BPharm programme at the NMMU is presented either as the four year BPharm degree or as the extended programme a five year BPharm programme. In the extended BPharm programme the first year of the four year degree is presented over two years with additional academic support modules.The majority of students were enrolled for the 4 year BPharm degree (80.7%; n=228) (Table F.1) and the frequency distribution between the 4 year BPharm programme and the Extended/Foundation programmes was similar (p = .350) in the three samples (ZCL2, ZCL303, and ZCL401) (Chi^2, df = 2, n = 228). The highest percentage of students enrolled for the Extended BPharm programme was in the ZCL2 cohort (21.67%) (Table F.1). Although a similar percentage (21.95%) of ZCL401 students are reflected in Table 4.1 as being enrolled for either the Extended BPharm programme or the Foundation programme, of these students only five (12.2%) were enrolled for the Extended BPharm degree. The remaining four students were enrolled in the Foundation programme prior to commencing the BPharm programme. The Extended BPharm programme commenced, in 2007, when the Foundation programme was discontinued.

Twenty two of the 23 students (95.65%) in the ZCL2Exp sample and 72 of the 97 students (74.23%) in the ZCL2Com sample were enrolled for the 4 year BPharm programme (Table 4.2). Thus of the 26 students in ZCL2 who were enrolled for the Extended BPharm programme, only one student attended SI sessions. Significantly more (p = .0249) Extended BPharm programme students fell into the ZCL2Com sample (Chi^2, df = 1, n = 120). This

finding needs further investigation as one would have expect the Extended BPharm students to have made greater use of the additional opportunity to conceptualise the work that is provided by SI. A possible reason for the poor attendance of SI sessions could be the increased workload in BPharm2 as compared with either of the first two years of the extended programme. The credit load for BPharm2 is 124 credits whereas the total credit-load for the first year of the Extended BPharm programme is 56 credits and for the second year 64 credits. Students moving from the second year of the extended BPharm might have difficulty coping with the increased workload and thus might not feel that they had time to attend the SI sessions although SI attendance would have been beneficial.

2.4. Citizenship

A significant difference (p = .0013) was noted in the distribution of citizenship in the three samples (ZCL2, ZCL303, and ZCL401) (Chi^2, df = 8, n = 228) (Table F.1). Only 50% of ZCL2 and 52.24% of ZCL3 students were South Africa citizens. In ZCL401 63.42% of students were South African citizens. The remaining students in ZCL2 and ZCL303 were predominantly citizens of a Southern African Development Community (SADEC) country (43.34% and 31.34% respectively) and in ZCL401 19% of students held citizenship of a SADEC country (Table F.1). Aside from one student with European Union citizenship, all students were citizens of a country in Africa. Although training pharmacists for the rest of Africa is of benefit to the continent and creates a cultural mix in the BPharm programme, which is advantageous in inculcating in the students an awareness of other cultures and practices, it does not contribute towards a reduction in the shortage of pharmacists in South Africa.

Citizenship of students attending SI sessions (the ZCL2Exp sample) was predominantly that of a SADEC country (78.26%, n=23) with only 21.75% possessing South

African citizenship (Table F.2). In the ZCL2Com sample 35.05% of students were citizens of a SADEC country and 56.70% (n=97) of students were South African citizens. This difference in distribution of citizenship was significant (p = .0024, Chi^2, df = 3, n = 120).

3. LANGUAGE USE

A total of 228 respondents completed the Language History Questionnaire. Some respondents did not complete all aspects of the questionnaire, therefore, the total sample for sections of the questionnaire varied (Tables F.3 to F.6 – see Appendix F). Results, as in Section 2, are reported in Table F.3 and Table F.4 for the three samples: ZCL2 (combined ZCL2Com and ZCL2Exp prior to self-sampling), ZCL303, and ZCL401 and in Table F.5 and Table F.6 for the sub-samples of ZCL2, namely ZCL2Com and ZCL2Exp.

The student group enrolled for Pharmacology (ZCL2, ZCL303, or ZCL401) was culturally diverse and multilingual with a total of 91 different languages or language combinations reported by the 228 respondents. As English is the medium of instruction for the Pharmacology modules the focus in the following sections (Section 3.1 to Section 3.6) will be on the extent of English usage within and outside of the academic environment.

3.1. Mother tongue

English was the mother tongue for only 40.79% of the population (Table 4.3). A similar (p = .253) percentage of respondents reported English as their mother tongue in the ZCL2, ZCL301 and ZCL401 samples (35.83%, 44.78% and 48.78% respectively) (Chi^2, df = 2, n = 228) (Table F.3). There was a significant difference (p = .0112) in the incidence of English as mother tongue between the ZCL2Com (41.24%, n = 97) and the ZCL2Exp (13.03%, n=23) samples (Chi^2, df = 1, n = 120) (Table F.5). Thus indicating that more students whose primary language was not English attended the SI sessions than student for whom English was the first language.

3.2. Medium of instruction at primary and secondary school

Less than 40% of the ZCL2, ZCL303 and ZCL401 students (36.67%, 40.30% and 31.71% respectively) received their primary and secondary schooling in an environment where English was the medium of instruction throughout the 12 years of schooling (Table F.3). Thus a similar distribution frequency (p = .849) was reported for use of English as the medium of instruction during the schooling years (Grade 1 to Grade 12) in the three groups (ZCL2, ZCL303 and ZCL401) (Chi^2, df = 6, n = 228).

When the ZCL2Com and ZCL2Exp samples were examined a significant difference (p = .0069) was noted in the distribution of the use of English as the medium of instruction during the 12 years of schooling between the ZCL2Com and the ZCL2Exp groups (Chi^2, df = 3, n = 120). In the ZCL2Com sample 42.27% (n=97) of students had not been exposed to English as the medium of instruction during the 12 years of schooling. In comparison in the ZCL2Exp group 52.17% (n = 23) of students were taught in both primary and secondary school in a language other than English (Table F.5).

3.3. Language use in the home environment

The use of English in the home environment was investigated by asking the respondents which language(s) they used to communicate with their immediate family members, in other words, mother, father, and siblings (Table F.3). Amongst the ZCL2 sample 26.67% did not use English at all in the home environment, in the ZCL303 sample 36.92% did not use English at home and amongst the ZCL401 students 31.71% did not use English at home (p = .107; Chi^2, df = 6, n = 226) (Table F.3).

It would seem that more students in the ZCL2 and ZCL303 samples used English to communicate with all of their immediate family members (all three of mother, father, and

siblings) (ZCL2: 56.67%, *n* = 120; ZCL303: 49.23%, *n* = 65) than reported English to be their mother tongue (ZCL2: 35.83%, *n* = 120; ZCL303: 44.78%, *n* = 67) (Table F.3).

When the ZCL2Com and ZCL2Exp groups were compared there was a significant difference (*p* = .035) between the number of students who used English as a medium of communication with family members in the home environment (Chi^2, *df* = 3, *n* = 120) (Table F.5). In the ZCL2Com group 50.52% (n=97) of the sample used English to communicate with all family members (all three of mother father and siblings) in comparison to 82.61% (n=23) in the ZCL2Exp group (Table F.5). There was also a lower reported incidence of use of English as mother tongue (ZCL2Com: 41.24%, *n* = 97; ZCL2Exp: 13.04%, *n* = 23) as compared to use of English with all family members in the home environment (ZCL2Com: 50.52%, *n* = 97; ZCL2Exp: 82.61%, *n* = 23) between the ZCL2Com and ZCL2Exp groups.

3.4. Language use for academic purposes

Respondents were asked to report the language they used for academically related activities (lecture presentation, informal group study, SI sessions, personal notes, reading for pharmacology, discussing pharmacology with peers, and studying). The majority of students (ZCL2: 94.92%, *n* = 120; ZCL303: 94.85%, *n* = 65; ZCL401: 95.18%, *n* = 41) reported that they used English for these academically associated activities for 90 to 100 per cent of the time (Table 4.4). There was no difference in the distribution of English use for academic purposes between the groups (*p* = .598; Chi^2, *df* = 6, *n* = 224) (Table F.4).

There was also no significant difference (*p* = .646) between the percentage of students who used English as the predominant language in the academic environment between the ZCL2Com and ZCL2Exp groups (English used 90 to 100 per cent: ZCL2Com = 94.74% (*n* = 95) of students; ZCL2Exp = 95.65% (*n* = 23) of students) (Chi^2, *df* = 3, *n* = 118) (Table F.6).

This is to be expected as all lectures are conducted in English and textbooks and lecture hand outs are published in English.

3.5. Non-academic language use on campus

The extent to which English was used for non-academic purposes on campus (social conversation with class mates, social conversation with non-BPharm friends, in library, and for administrative matters) displayed a different frequency distribution, between the ZCL2, ZCL303, and ZCL401 groups as well as between the ZCL2Com and ZCL2Exp groups, to the frequency distribution of the use of English for academic purposes (Tables F.4 and F.6). Less English was used for non-academic purposes than for academic purposes.

There was no significant difference (p = .280) between the groups for the amount of English used for non-academic purposes on campus (Chi^2, df = 10.0, n = 226) (Table F.4). In the ZCL2, ZCL303, and ZCL401 samples 45.00, 33.85, and 39.03 per cent respectively of students used English less than 75% of the time (Table F.4). A similar pattern was noted in the ZCL2Com and ZCL2Exp sub-samples (p = .564, Chi^2, df = 5, n = 120) (Table F.6). In the ZCL2Com group 46.39% of students used English less than 75% of the time on campus for non-academic purposes and 39.13% of ZCL2Exp students used English less than 75% of the time (Table F.6).

3.6. Language use off campus

Use of English as a means of communication displayed a similar pattern in the off campus environment (ZCL2 vs ZCL303 vs ZCL401: p = .357; Chi^2, df = 10, n = 227) and ZCL2Com vs ZCL2Exp: p = .756; Chi^2, df = 4, n = 120). In the ZCL2, ZCL303 and ZCL401 samples 44.16, 39.40 and 31.71 per cent respectively of students used English less than 75% of the time off campus (Table F.4). In the ZCL2Com and ZCL2Exp groups 45.36% and

44.16% of students used English as the medium of communication less than 75% of the time when off campus (Table F.6).

4. ENGLISH READING COMPREHENSION

The APAP English Skills Test was used to assess English reading comprehension (Chapter 3 Section 5.1.4).

4.1. Comparison of English reading comprehension in ZCL2, ZCL303, and ZCL401

The mean scores (/100), achieved by the students in ZCL2, ZCL303, and ZCL401, were 72.13±13.89, 77.13±12.29, and 76.30±11.72 respectively. There was a significant difference (p = .0253) between the groups (ANOVA, F = 3.74). When Scheffé's post-hoc test was applied to the data it was noted that the significant difference (p = .0417) was between the mean score for the ZCL2 students and that of the ZCL303 students.

On examination of the distribution of scores achieved in each of the three samples (ZCL2, ZCL303, and ZCL401) there was no significant difference in the frequency distribution of scores (p = .680; Chi^2, df = 12, n = 228). However, more students in ZCL2 (45.76%, n = 118) achieved a score of less than 70 than did students in ZCL303 (28.57%, n = 70) and ZCL401 (32.5%, n = 40) (Table 4.1).

Scores were categorised as either proficient, functional, expanding, or developing (Table 3.1). A score that was either in the proficient or functional category was achieved by 69.49% (n = 118) of the ZCL2 students (Table 4.8). A higher percentage of ZCL303 and ZCL401 students achieved scores which placed them in the proficient and functional categories (ZCL303: 81.43%, n = 70; ZCL401: 80%, n = 40). However, there was no significant difference in the distribution of scores in the three groups (ZCL2, ZCL303, and ZCL401) (p = .1097, Chi^2, df = 6, n = 228) (Table 4.2).

Table 4.1
Frequency distribution of English reading comprehension score (/100) in the ZCL2, ZCL303, and ZCL401 groups

English Reading Comprehension Score (/100)	Group							
	ZCL2		ZCL3		ZCL4		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
30 to 39	3	2.54	0	0.00	0	0.00	3	1.32
40 to 49	3	2.54	1	1.43	0	0.00	4	1.75
50 to 59	15	12.71	6	8.57	4	10.00	25	10.96
60 to 69	33	27.97	13	18.57	9	22.50	55	24.12
70 to 79	26	22.03	17	24.29	9	22.50	52	22.81
80 to 89	25	21.19	21	30.00	11	27.50	57	25.00
90 to 100	13	11.02	12	17.14	7	17.50	32	14.04
Total	118	100.00	70	100.00	40	100.00	228	100.00

$Chi^2(df = 12, n = 228) = 9.26; p = .6803$
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

Table 4.2
English reading comprehension category in the ZCL2, ZCL303, and ZCL401 samples

English Reading Comprehension Category	Group							
	ZCL2		ZCL303		ZCL401		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Developing	3	2.54	0	0.00	0	0.00	3	1.32
Expanding	33	27.97	13	18.57	8	20.00	54	23.68
Functional	64	54.24	35	50.00	23	57.50	122	53.51
Proficient	18	15.25	22	31.43	9	22.50	49	21.49
Total	118	100.00	70	100.00	40	100.00	228	100.00

$Chi^2(df = 6, n = 228) = 10.38; p = .1097.$
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.
Developing = score of 0 to 42. Expanding = score of 43 to 65. Functional = score of 66 to 85. Proficient = score of 86 to 100.

The ZCL2 and ZCL401 students completed the APAP English Skills Test in a similar time period. Of the ZCL2 students only 16.09% took 40 minutes or longer to complete the test and amongst the ZCL401 students 15% took longer than 40 minutes (Table 4.3). Longer than 40 minutes was required for 45.71% of ZCL303 students to complete the test.

Table 4.3
Frequency distribution of time taken to complete the English reading comprehension test in the ZCL2, ZCL303, and ZCL401 groups

English Reading Comprehension Time(min)	Group							
	ZCL2		ZCL3		ZCL4		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
15 to 19	0	0.00	1	1.43	2	5.00	3	1.32
20 to 24	8	6.78	1	1.43	5	12.50	14	6.14
25 to 29	37	31.36	10	14.29	9	22.50	56	24.56
30 to 34	46	38.98	12	17.14	5	12.50	63	27.63
35 to 39	8	6.78	14	20.00	13	32.50	35	15.35
40 to 44	7	5.93	13	18.57	3	7.50	23	10.09
45 to 49	6	5.08	7	10.00	2	5.00	15	6.58
50 to 54	6	5.08	4	5.71	0	0.00	10	4.39
55 to 59	0	0.00	7	10.00	1	2.50	8	3.51
60 to 64	0	0.00	1	1.43	0	0.00	1	0.44
Total	118	100.00	70	100.00	40	100.00	228	100.00

$Chi^2(df = 18, n = 228) = 68.29; p = .0000$.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

4.2. Comparison of English reading comprehension in ZCL2Com and ZCL2Exp

English reading comprehension was tested in the ZCL2Com and ZCL2Exp samples prior to and after the intervention (introduction of the didactical tool of exploratory talk). The mean scores (/100) achieved by the ZCL2Com sample prior to and after the intervention were 71.03±13.67 (n = 95) and 74.61±12.65 (n = 63) respectively (Table 4.4). In the experimental group (ZCL2Exp) the mean scores (/100) achieved were 76.68±14.15 (n =23) prior to the intervention and 78.63±13.78 (n = 20) after the intervention. There was no difference (p = .0796) in the mean score for English reading comprehension between the ZCL2Com and ZCL2Exp groups before the intervention (Student's t-test, t-value = -1.77, n = 117) or after the intervention (p = .2298; Student's t-test, t-value = -1.21, n = 83) (Table 4.4).

Table 4.4

Comparison of English reading comprehension mean scores pre- and post-intervention for the ZCL2Com and ZCL2Exp groups

Parameter	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com	ZCL2Exp	Δ*	*p*	ZCL2Com	ZCL2Exp	Δ*	*p*
n	95	23			63	20		
Mean	71.03	76.68	4.65	.0796	74.61	78.63	4.03	.2298
Standard Deviation	13.67	14.15			12.65	13.78		

Pre-intervention: Student's *t*-test (*t* = -1.77) *p* = .0796. Post-intervention: Student's *t*-test (*t* = -1.21) *p* = .2298.
Δ* = difference in means for ZCL2Com and ZCL2Exp; a positive value indicates that ZCL2Exp is greater than ZCL2Com and a negative value indicates that ZCL2Exp is smaller than ZCL2Com.
There was a significant improvement (*p* = .0002) in the ZCL2Com post-intervention score when compared to the group's pre-intervention score (Student's *t*-test, t-value = -3.89) (Table 4.5). The increase in score for the ZCL2 group was not significant (*p* = .061, Student's *t*-test, t-value = -1.99).

Table 4.5

Comparison of English reading comprehension scores achieved pre-intervention vs post-intervention for ZCL2Com and ZCL2Exp using Student's paired t-test

Parameter	Group							
	ZCL2Com				ZCL2Exp			
	Pre-Intervention	Post-Intervention	*t*	*p*	Pre-Intervention	Post-Intervention	*t*	*p*
n	62	62			20	20		
Mean	70.53	74.75	-3.89	.0002	76.62	78.63	-1.99	.0611
Standard Deviation	13.67	12.65			14.15	13.78		

ZCL2Com pre- vs post-intervention: Student's paired *t*-test (*t* = -3.89) *p* = .0002.
ZCL2Exp pre- vs post-intervention: Student's paired *t*-test (*t* = -1.99) *p* = .0611.
Prior to the intervention only 52.64% (*n* = 95) of ZCL2Com students and 60.87% (n=23) of ZCL2Exp students achieved a score of 70 or higher out of 100 (Table 4.6). After the intervention the scores of 57.14% (*n* = 63) and 70% (*n* = 20) of the ZCL2Com and ZCL2Exp students were 70 or higher.

Table 4.6

Frequency distribution of English reading comprehension score (/100) pre- and post-intervention in the ZCL2Com and ZCL2Exp samples

English Reading Comprehension Score (/100)	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
30 to 39	3	3.16	0	0.00	0	0.00	0	0.00
40 to 49	2	2.11	1	4.35	2	3.17	0	0.00
50 to 59	14	14.74	1	4.35	4	6.35	2	10.00
60 to 69	26	27.37	7	30.43	21	33.33	4	20.00
70 to 79	21	22.11	5	21.74	12	19.05	4	20.00
80 to 89	21	22.11	4	17.39	14	22.22	4	20.00
90 to 100	8	8.42	5	21.74	10	15.87	6	30.00
Total	95	100.00	23	100.00	63	100.00	20	100.00

Pre-Intervention ZCL2Com vs ZCL2Exp: $Chi^2(df = 6, n = 118) = 5.37$; $p = .4970$.
Post-Intervention ZCL2Com vs ZCL2Exp: $Chi^2(df = 5, n = 83) = 3.42$; $p = .6349$.
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group.

When the English reading comprehension scores achieved were analysed according to the four categories of proficient, functional, expanding, and developing it was found that prior to the intervention only 11.58% (*n* = 95) of the scores of the ZCL2Com and 30.43% (*n* = 23) of the scores of the ZCL2Exp students fell into the proficient category (Table 4.7).

Table 4.7
English reading comprehension category pre- and post-intervention in the ZCL2Com and ZCL2Exp samples

English Reading Comprehension Category	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Developing	3	3.16	0	0.00	0	0.00	0	0.00
Expanding	28	29.47	5	21.74	18	28.57	4	20.00
Functional	53	55.79	11	47.83	33	52.38	9	45.00
Proficient	11	11.58	7	30.43	12	19.05	7	35.00
Total	95	100.00	23	100.00	63	100.00	20	100.00

Pre-intervention ZCL2Com vs ZCL2Exp: $Chi^2(df = 3, n = 118) = 5.65$; $p = .1297$.
Post-intervention ZCL2Com vs ZCL2Exp: $Chi^2(df = 2, n = 83) = 2.27$; $p = .3211$.
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group.
Developing = score of 0 to 42. Expanding = score of 43 to 65. Functional = score of 66 to 85. Proficient = score of 86 to 100.

When re-tested on completion of the intervention period the percentage of students with scores in the proficient category had increased to 19.05% (*n* = 63) for ZCL2Com group and 35% (*n* = 20) for the ZCL2Exp group (Table 4.7). There were no significant differences in the distribution of categories achieved in ZCL2Com as compared to ZCL2Exp either before or after the intervention (Pre-intervention: $p = .1297$, Chi^2, $df = 3$, $n = 118$. Post-intervention: $p = .3211$, Chi^2, $df = 2$, $n = 83$) (Table 4.13).

The time taken to complete the questionnaire increased following the intervention. Prior to the intervention only 13.68% (*n* = 95) of ZCL2Com and 26.09% (*n* =2 3) of ZCL2Exp students took 40 minutes or longer to completer the test whereas following the intervention 27.87% (*n* = 61) and 40% (*n* = 20) of the ZCL2Com and ZCL2Exp samples respectively required 40 minutes or longer to complete the test (Table 4.8).

Table 4.8
Frequency distribution of time taken to complete the English reading comprehension test in the ZCL2Com and ZCL2Exp groups

English Reading Comprehension Time (min)	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
15 to 19	0	0.00	0	0.00	0	0.00	0	0.00
20 to 24	8	8.42	0	0.00	4	6.56	2	10.00
25 to 29	30	31.58	7	30.43	12	19.67	5	25.00
30 to 34	37	38.95	9	39.13	11	18.03	3	15.00
35 to 39	7	7.37	1	4.35	17	27.87	2	10.00
40 to 44	6	6.32	1	4.35	7	11.48	4	20.00
45 to 49	4	4.21	2	8.70	4	6.56	3	15.00
50 to 54	3	3.16	3	13.04	0	0.00	0	0.00
55 to 59	0	0.00	0	0.00	6	9.84	1	5.00
60 to 64	0	0.00	0	0.00	0	0.00	0	0.00
Total	95	100.00	23	100.00	61	100.00	20	100.00

Pre-Intervention ZCL2Com vs ZCL2Exp: $Chi^2(df = 6, n = 118) = 6.61$; $p = .3588$.
Post-Intervention ZCL2Com vs ZCL2Exp: $Chi^2(df = 6, n = 81) = 5.03$; $p = .5399$.
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group.

5. ACADEMIC ACHIEVEMENT

The weighted average of the students' BPharm1 marks was used as a measure of prior academic achievement. The marks achieved for the modules in the BPharm1 year were weighted relative to their credit value and the average mark calculated (Table 3.2). The weighted average for BPharm1 was designated as a measure of BPharm1 achievement. The mark obtained for the Pharmacology 2 (ZCL2) November written examination was taken as a measure of academic achievement in Pharmacology.

5.1. BPharm1 academic achievement

There was no significant difference ($p = .7947$) between the BPharm1 weighted averages for ZCL2, ZCL303, and ZCL401 (ANOVA, $F = 0.23$, $n = 235$) (Table 4.9). Thus in terms of previous academic achievement in the year prior to ZCL2 the three groups were similar.

Table 4.9
BPharm1 weighted means and standard deviations for the groups ZCL2, ZCL303, and ZCL401

BPharm1 weighted average	Group			
	ZCL2	ZCL303	ZCL401	Total
n	119	71	45	235
mean	66.14	65.52	65.01	65.73
SD	9.52	11.17	9.34	9.98

ANOVA (F = 0.23, n = 235); p = .7947.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

The distribution of BPharm1 weighted averages was also similar in the three groups (p = .967; Chi^2, df = 4, n = 235) (Table 4.10). Thus for comparison purposes the samples were similar in terms of prior academic achievement.

Table 4.10
Frequency distribution of BPharm1 weighted means in the ZCL2, ZCL303, and ZCL401 samples

BPharm1 weighted average (%)	Group							
	ZCL2		ZCL3		ZCL4		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
0 to 49	6	5.04	4	5.63	2	4.44	12	5.11
50 to 74	91	76.47	55	77.47	33	73.33	179	76.17
75 to 100	22	18.49	12	16.90	12	22.22	44	18.72
Total	119	100.00	71	100.00	45	100.00	235	100.00

$Chi^2(df = 4, n = 235) = 0.57$; p = .9667
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

There was a significant difference (p = .0042,) between the BPharm1 weighted averages for ZCL2Com and ZCL2Exp which was of large practical significance (Cohen's d = 0.68, Student's t-test, t-value = -2.92, n = 119). The difference in the means for BPharm1 weighted average between ZCL2Com and ZCL2Exp was 6.27% (Table 4.11).

Table 4.11
BPharm1 weighted means and standard deviations for ZCL2Com and ZCL2Exp samples

BPharm1 weighted average	Group		
	ZCL2Com	ZCL2Exp	Total
n	96	23	119
mean	64.92	71.19	66.14
SD	9.12	9.70	9.52

Student's *t*-test (*t* = -2.92, n = 119); *p* = .0042. Cohen's *d* = 0.68.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation..

The distribution of BPharm1 weighted averages differed significantly (*p* = .006) between the ZCL2Com and ZCL2Exp students with 30.43% of ZCL2Exp students achieving a mark of equal to or greater than 75% and only 15.63% of ZCL2Com students attaining marks greater than 75% (Chi^2, *df* = 1, *n* = 119) (Table 4.12). Thus the sample of second year pharmacology students (ZCL2Exp) who attended the SI sessions had a prior academic record that was superior to the prior academic record of the students who did not attend SI sessions (ZCL2Com).

Table 4.12
Frequency distribution of BPharm1 weighted means in the ZCL2Com and ZCL2Exp samples

BPharm1 weighted average (%)	Group					
	ZCL2Com		ZCL2Exp		Total	
	n	(%)	*n*	(%)	*n*	(%)
0 to 74	81	84.38	16	69.57	97	81.51
75 to 100	15	15.63	7	30.43	22	18.49
Total	96	100.00	23	100.00	119	100.00

Chi^2(*df* = 1, *n* = 119) = 7.56; *p* = .006.
ZCL2Com = ZCL2 comparison group. ZCL2Exp = ZCL2 experimental group.

5.2. Academic achievement in Pharmacology 2 (ZCL2)

Achievement in Pharmacology 2 was measured using the mark achieved in the November written examination paper. Pharmacology 2 is a year module and thus the November examination serves as summative assessment for the module. Pharmacology 2 is a prerequisite for ZCL303 thus students registered for the modules ZCL303 or ZCL401 must have passed the module ZCL2. Not all students registered for the module ZCL2 in 2011,

when data collection occurred, passed the module ZCL2 (obtained a final module mark of ≥ 50%), therefore, one would expect more students in the ZCL2 sample as compared to the ZCL303 and ZCL401 samples to obtain a mark of less than 50% in the written November examination. The majority of students who did not obtain a final mark of ≥ 50% would have re-registered for ZCL2 in 2012. It is important to note that the final module mark for ZCL2 is calculated from the mark achieved in the November written examination (66.67% of the final mark) and the class mark (33.33% of the final mark). Thus a student could achieve a mark of less than 50% in the written November paper for ZCL2 and still pass the module if the class mark was sufficient (see the students in ZCL303 with a ZCL2 November mark of less than 50% in Table 4.13).

Table 4.13
Frequency distribution of ZCL2 November exam marks in the ZCL2, ZCL303, and ZCL401 samples

ZCL2 Nov Exam (%)	Group							
	ZCL2		ZCL3		ZCL4		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
0 to 49	54	45.00	3	4.23	0	0.00	57	24.15
50 to 74	62	51.67	66	92.96	43	95.56	171	72.46
75 to 100	4	3.33	2	2.82	2	4.44	8	3.39
Total	120	100.00	71	100.00	45	100.00	236	100.00

$Chi^2(df = 4, n = 236) = 58.94$; $p < .00001$.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

The distribution of ZCL2 November exam marks in the ZCL303 and ZCL401 samples was similar with 92.96 and 95.56 per cent of ZCL303 and ZCL401 students respectively achieving a mark of between 50 and 75 per cent (Table 4.13). For the reasons described in the previous paragraph the distribution of marks in ZCL2 sample differed slightly with only 51.67% of students in ZCL2 achieving a mark of between 50 and 75 per cent (Table 4.19) ($p < .00001$, Chi^2, $df = 4$, $n = 236$) In the ZCL303 and ZCL401 samples the mean marks achieved for ZCL2 November examination were 59.07±8.14 and 60.80±6.91 per cent respectively (Table 4.20). The ZCL2 sample mean mark for the ZCL2 November

examination was 48.82±15.15% (Table 4.14) (p < .00001, ANOVA, F = 24.38; Scheffé's post-hoc test, p < .00001, ZCL2 vs ZCL303 Cohen's d = 0.79, ZCL2 vs ZCL401 Cohen's d = 0.89).

Table 4.14
November exam mark for ZCL2- mean and standard deviation for the ZCL2, ZCL303, and ZCL401 samples

ZCL2 Nov Exam (%)	Group			
	ZCL2	ZCL303	ZCL401	Total
n	120	71	45	236
mean	48.82	59.07	60.80	
SD	15.15	8.14	6.91	

ANOVA (F = 24.38, n = 236); p < .00001. Scheffé's post-test: ZCL2 p < .00001. ZCL2 vs ZCL303 Cohen's d = 0.79. ZCL2 vs ZCL401 Cohen's d = 0.89.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

The distribution of marks achieved in the November ZCL2 examination differed significantly (p = .002) between the ZCL2Com and ZCL2Exp groups (Chi^2, df = 2, n = 120) (Table 4.15). In the ZCL2Com sample only 49.48% of students achieved a mark of ≥ 50%. In contrast 78.26% of the ZCL2Exp sample achieved a mark of ≥ 50% (Table 4.15).

Table 4.15
Frequency distribution of marks achieved in the ZCL2 November examination by the ZCL2, ZCL303, and ZCL401 samples

ZCL2 Nov Exam (%)	Group					
	ZCL2Com		ZCL2Exp		Total	
	n	(%)	*n*	(%)	*n*	(%)
0 to 49	49	50.52	5	21.74	54	45.00
50 to 74	47	48.45	15	65.22	62	51.67
75 to 100	1	1.03	3	13.04	4	3.33
Total	97	100.00	23	100.00	120	100.00

Chi^2(d.f. = 2, n = 120) = 12.48; p = .002
ZCL2Com = ZCL2 comparison group. ZCL2Exp = ZCL2 experimental group.

The mean mark achieved by ZCL2Exp students (58.70±14.14%) was significantly higher (p = .0004) than the mark achieved by the ZCL2Com sample (46.47±14.48%, Student's t-test, t-value = -3.66, n = 120) (Table 4.16). The difference in mean mark achieved

by ZCL2Exp as compared to ZCL2Com was of large practical significance (Cohen's *d* = 0.85).

Table 4.16
November exam mark for ZCL2- mean and standard deviation for the ZCL2Com and ZCL2Exp samples

ZCL2 Nov Exam (%)	Group		
	ZCL2Com	ZCL2Exp	Total
n	97	23	120
mean	46.47	58.70	
SD	14.48	14.14	

Student's *t*-test, *t*-value = -3.66, *n* = 120; *p* = .0004. Cohen's *d* = 0.85.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

6. RAVEN'S STANDARD PROGRESSIVE MATRICES (SPM)

As discussed, in Section 6 of Chapter Two, Raven's SPM is a tool which has been demonstrated to measure a person's ability to derive new understanding from their current insights and understanding – to apply what is already known to a new situation or environment (Raven et al., 1998). The Raven's SPM has been referred to as a measure of a person's problem solving ability (Lynn et al., 2004). Raven's SPM was administered to the ZCL2Com and ZCL2Exp samples prior to and after the intervention. In a parallel data collection process Raven's SPM was also administered to the ZCL303 and ZCL401 samples (Figure 3.6).

6.1. Comparison of Raven's SPM in ZCL2, ZCL303, and ZCL401samples

The mean total scores (out of a total of 60) achieved by the ZCL2, ZCL303, and ZCL401 students were 48.70± 6.36, 50.12±1.31, 49.03±5.11 respectively. There was no significant difference (*p* = .310) between the groups for the mean total scores achieved for Raven's SPM (ANOVA, *F* = 1.18) (Table 4.17). The mean scores achieved for the five sets (A to E) of the Raven's SPM were in line with the expected scores per set as reported by Raven et al. (2000). For a total score of 48 the expected scores per set (out a maximum

possible score per set of 12) were reported by Raven et al. (2000) to be: set A = 12; set B = 11; set C = 9; set D = 10; and set E = 6 thus indicating the validity and reliability of the results obtained in this study.

Table 4.17
Scores achieved for the Raven's SPM in the ZCL2, ZCL303, and ZCL401 groups

Raven's SPM Score	Group							
	ZCL2		ZCL3		ZCL4		Total	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
Set A (/12)	11.36	1.02	11.34	1.36	11.05	1.20	11.30	1.15
Set B (/12)	11.21	1.26	11.38	0.95	11.30	0.76	11.27	1.1
Set C (/12)	9.56	1.85	10.05	1.39	9.90	1.66	9.76	1.71
Set D (/12)	9.91	1.67	10.30	1.23	10.03	1.31	10.06	1.51
Set E (/12)	6.67	2.36	6.97	10.03	6.75	2.26	6.76	2.31
Total (/60)	48.70	6.36	50.12	1.31	49.03	5.11	49.14	5.79
Sample size	117		58		40		215	

ANOVA for Set A: (F = 1.14, n = 215); p = .323. ANOVA for Set B: (F = 0.5, n = 215); p = .608. ANOVA for Set C: (F = 1.75, n = 215); p = .176. ANOVA for Set D: (F = 1.94, n = 215); p = .1.46. ANOVA for Set E: (F = 0.32, n = 215); p = .724. ANOVA for Total: (F = 1.18, n = 215); p = .310.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

The scores achieved on Raven's SPM can be reported relative to the percentage of a reference group of the same age who obtained lower or higher scores (Raven et al., 2000). The scores achieved by the samples in this study were compared to their age cohorts in the 1992 Smoothed British Norms for the Self-Administered Test Completed at Leisure (results obtained from a sample of the adult population of Dumfries) as presented in Table SPM8 in Raven Manual: Section 3: Standard Progressive Matrices (Raven et al., 2000). Therefore, the respondents in this study were classified, dependent on the score achieved, as achieving a grade from Grade I (score at or above the 95th percentile for people of the same age group) to Grade V (score at or below the 5th percentile for the age group) (Raven et al., 2000) (Table 4.18).

Table 4.18
Grades derived from Raven's SPM score. Adapted from Raven et al. (2000)

GRADE	PERCENTILE	SCORE*	COMMENT
GRADE I	At or above 95th	≥ 59	*Intellectually superior*, if a score lies at or above the 95th percentile for people of the same age group
GRADE II	At or above 75th and below 95th	≥ 57 to < 59	*Definitely above the average in intellectual capacity*, if a score lies at or above the 75th percentile. (It may be designated II+ if it is above the 90th percentile).
GRADE III	Between 25th and 75th	> 49 to < 57	*Intellectually average*. If a score lies between the 25th and 75th percentiles. (It may be designated as III+, if it is above the 50th percentile, and III-, if it is below the 50th percentile).
GRADE IV	At or below 25th but greater than 5th	> 39 to ≤ 49	*Definitely below average in intellectual capacity*, if a score lies at or below the 25th percentile. (It may be designated IV-, if it lies at or below the 10th percentile).
GRADE V	At or below 5th	0 to 39	*Intellectually impaired*, if a score lies at or below the 5th percentile for that age group.

* = Scores per Grade derived from the percentiles as determined from the Smoothed British Norm for the Self-Administered Test Completed at Leisure (Adults) from the 1992 standardisation carried out in the adult population of Dumfries, Scotland.

Score falling into Grades II to III (above the 25th percentile for the age group according to the standardised British norms of 1992) were achieved by 51.28% of ZCL2 students, 55.17% of ZCL303 students and 52.50% of ZCL401 students (Table 4.19). The implications of these findings will be discussed in Chapter Six. None of the students tested achieved a score equivalent to Grade I, that is, at or above the 95th percentile for the age group. There was no significant difference (p = .917) between the grades achieved by ZCL2, ZCL303, and ZCL401 (Chi^2, df = 6, n = 215) (Table 4.19).

Table 4.19
Raven's SPM Grade in the ZCL2, ZCL303, and ZCL401 samples

Raven's SPM Grade	Group							
	ZCL2		ZCL303		ZCL401		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
I	0	0.00	0	0.00	0	0.00	0	0.00
II	5	4.27	3	5.17	1	2.50	9	4.19
III	55	47.01	29	50.00	20	50.00	104	48.37
IV	50	42.74	25	43.10	17	42.50	92	42.79
V	7	5.98	1	1.72	2	5.00	10	4.65
Total	117	100.00	58	100.00	40	100.00	215	100.00

Chi²(*df* = 6, *n* = 215) = 2.03; *p* = .917.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.
Grade I = score of ≥ 59. Grade II = score of ≥ 57 to < 59. Grade III = score of > 49 to < 57. Grade IV = score of > 39 to ≤ 49. Grade V = score of 0 to 39.

6.2. Comparison of Raven's SPM in ZCL2Com and ZCL2Exp samples

Raven's SPM was administered to the ZCL2Com and ZCL2Exp samples prior to the intervention and repeated at the end of the intervention. On comparison of the mean scores achieved by ZCL2Com and ZCL2Exp prior to the intervention it was noted that there was no significant differences between the two samples (p = .997, Student's unpaired t-test, t-value = 0.00, n = 117) (Table 4.24). There was also no significant difference in the scores achieved by ZCL2Com and ZCL2Exp when tested after the intervention (p = .4015, Student's unpaired t-test, t-value = 0.84, n =.115) (Table 4.20).

The scores achieved by the ZCL2Com and ZCL2Exp groups were also compared to the 1992 British norms and assigned a grade as described by Raven et al. (2000). Prior to the intervention 50.00% of ZCL2Com students and 56.52% of ZCL2Exp students had scores which assigned them to Grade III or Grade II (no students achieved a grade of I prior to the intervention) (Table 4.21).

Table 4.20
Scores achieved for the Raven's SPM, pre- and post-intervention, in the ZCL2Com and ZCL2Exp samples

Raven's SPM Score	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	mean	SD	mean	SD	mean	SD	mean	SD
Set A (/12)	11.32	0.67	11.52	0.67	11.48	0.95	11.35	1.40
Set B (/12)	11.20	1.00	11.22	1.00	11.37	1.10	10.87	1.74
Set C (/12)	9.56	1.97	9.57	1.97	9.85	1.79	9.91	1.35
Set D (/12)	9.84	1.70	10.17	1.70	9.86	1.71	9.70	2.05
Set E (/12)	6.78	2.58	6.22	2.58	6.51	2.49	6.04	2.95
Total (/60)	48.70	6.13	48.70	6.13	49.07	5.86	47.87	6.98
Sample size	94		23		92		23	

Pre-intervention ZCL2 Exp vs ZCL2Com (n = 117) Student's t-test: Set A: t-value =0.85, p =.3960; Set B: t-value = 0.05, p = .9588; Set C: t-value = 0.00, p = .9975; Set D: t-value = 0.86, p = .3933; Set E: t-value =1.02, p = .3104; Total: t-value = 0.00, p =. 9965.
Post-intervention ZCL2 Exp vs ZCL2Com (n = 115) Student's t-test: Set A: t-value = 0.53, p = .5975; Set B: t-value = 1.72, p = .0885; Set C: t-value = 0.16, p = .8706; Set D: t-value = 0.39, p = .6959; Set E: t-value = 0.78, p = .4393; Total: t-value = 0.84, p = .4015.
ZCL2Com pre-intervention vs ZCL2Com post-intervention (n = 186) Student's t-test: Set A: t-value = 2.15, p = .0340; Set B: t-value = 2.50, p = .0143; Set C: t-value = 1.86, p = .0657; Set D: t-value = 0.48, p = .6309; Set E: t-value =1.64, p = .1052; Total: t-value = 1.44, p = .1537.
ZCL2Exp pre-intervention vs ZCL2Exp post-intervention (n = 46) Student's t-test: Set A: t-value = 0.64, p = .5285; Set B: t-value = 1.25, p = .2247; Set C: t-value = 1.12, p = .2768; Set D: t-value = 1.63, p = .1180; Set E: t-value = 0.35, p = .7280; Total: t-value = 1.15, p = .2610.
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group.

Table 4.21
Raven's SPM Grade pre- and post-intervention in the ZCL2Com and ZCL2Exp samples

Raven's SPM Grade	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
I	0	0.00	0	0.00	1	1.10	0	0.00
II	4	4.26	1	4.35	2	2.20	0	0.00
III	43	45.74	12	52.17	46	50.55	12	52.17
IV	43	45.74	7	30.43	38	41.76	8	34.78
V	4	4.26	3	13.04	5	5.49	3	13.04
Total	94	100.00	23	100.00	92	100.00	23	100.00

Pre-intervention ZCL2 Exp vs ZCL2Com: $Chi^2(df = 3, n = 117) = 3.56$; p = .3128. Post-intervention ZCL2 Exp vs ZCL2Com: $Chi^2(df = 4, n = 115) = 2.49$; p = .6457.
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group.
Grade I = score of ≥ 59. Grade II = score of ≥ 57 to < 59. Grade III = score of > 49 to < 57. Grade IV = score of > 39 to ≤ 49. Grade V = score of 0 to 39.

Following the intervention 53.85% of ZCL2Com students received a grade from Grade III to Grade I and 52.1% of ZCL2Exp students achieved a level of Grade III (no

students in the ZCL2Exp group achieved Grade II or Grade I post-intervention) (Table 4.21). There was no difference in distribution of ZCL2Com students and ZCL2Exp students prior to (p = .313) after (p = .646) the intervention (Chi^2 pre-intervention, df = 3, n = 117; Chi^2 post intervention, df = 4, n = 115).

The change in scores achieved by the ZCL2Com and the ZCL2Exp samples were investigated by examining the relevant pre-intervention score and comparing it to the relevant post-intervention score (Table 4.22).

Table 4.22
Difference in scores achieved for the Raven's SPM, pre- and post-intervention in the ZCL2Com and ZCL2Exp samples

Raven's SPM Score	Group							
	Score gain/loss (post minus pre)				Weighted difference* (%)			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
Set A (/12)	0.21	0.94	-0.17	1.30	21.63	41.46	13.90	41.61
Set B (/12)	0.25	0.93	-0.35	1.34	23.14	41.97	12.08	40.00
Set C (/12)	0.31	1.59	0.35	1.50	21.04	38.21	17.56	32.11
Set D (/12)	0.08	1.54	-0.48	1.41	17.39	37.58	3.60	33.49
Set E (/12)	-0.31	1.81	-0.17	2.37	-1.81	31.38	-0.32	37.25
Total (/60)	0.54	3.54	-0.83	3.43	11.64	20.32	4.18	15.54
Sample size	89		23		92		23	

Score gain/loss (post-pre): ZCL2 Exp vs ZCL2Com (n = 112) Student's *t*-test: Set A: t-value = 1.63, p = .1070; Set B: t-value = 2.48, p = .0147; Set C: t = 0.09, p = .9283; Set D: t-value = 1.57, p = .1187; Set E: t-value = 0.31, p = .7567; Total: t-value = 1.66, p = .0997.
Weighted diff (%): ZCL2 Exp vs ZCL2Com (n = 115) Student's *t*-test: Set A: t-value = 0.80, p = .4274; Set B: t-value = 1.14, p = .2578; Set C: t-value = 0.40, p = .6897; Set D: t = 1.60, p = .1120; Set E: t-value = 0.20, p = .8453; Total: t-value = 1.64, p = .1038
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group. *SD* = standard deviation.
* = weighted difference % = (score gain/maximum score-initial score) x100.

As the complexity of the sets of matrices in Raven's SPM increase from Set A to Set E a change in score should be examined relative to the region in which the gain/loss was achieved. In the Raven's SPM the "differences in the item difficulties are different at different points in the scale (for example smaller at the bottom end than at the top)…" (Raven et al., 2000, p. SPM47). Thus any gain in score should be calculated relative to the total possible gain for the specific section.

According to Raven et al. (2000) "When it is desired to assess changes within individuals over time or in response to an intervention …it is necessary to employ a Rasch homogenous test…" (p. SPM50). Sophisticated computer programmes have been written to allow for comparison of scores in individuals pre and post an intervention. An example is the ProGAMMA® programme (Raven et al., 2000). The researcher did not have access to these programmes and therefore, for the purposes of this study, a simple mathematical formula was derived to allow for more valid comparison of score gains. The score gain achieved (difference in score achieved when re-tested, for example, in the post-intervention period in this study) was divided by the difference between the maximum possible score for the section and the initial score (pre-intervention testing) and then multiplied by 100 to derive the *weighted difference* as a percentage. This mathematical derivation made allowance for the difference in difficulty in the matrices in Set E as compared to the initial sets such as Sets A and B, and allowed for a comparison of score gains across the matrices (from Set A to Set E). The implications of any changes in scores will be discussed further in Chapter Six.

7. LEARNING STYLES

Kolb's Learning Style Inventory was administered to assess the students' learning styles. The Inventory was administered to the ZCL2Com and ZCL2Exp samples pre- and post-intervention. The Inventory was also administered to the ZCL303 and ZCL401 samples in a parallel data collection process (Figure 3.6).

According to Kolb (1985) there are two processes involved in learning. These processes are the initial acquisition or perception of the information followed by the second process which is the application or processing of the information gained in the first step. For both the perception of information and the processing of information there are two diametrically opposed approaches along the continuum of each process (Chapter Two,

Section 7). Information is perceived either by experiencing the concept (concrete experience CE) or by conceptual and analytical thinking (abstract conceptualisation AC) and information is processed/transformed by either reflecting or considering the task (reflective observation RO) or by active trial and error (active experimentation AE). Each individual has a preference for one of the diametrically opposed approaches along each of the continuums of grasping and transforming information (Kolb, 1981). Kolb's Learning Style Inventory assesses the individuals preference for each of the diametrically opposed pairs (assigning a score between 1 and 48 for each concept in the opposing pairs) deriving an overarching study style for the individual which is classified either as accommodator, diverger, assimilator, or converger. Therefore, not only the final study style but the degree of preference for the diametrically opposing approaches will be reported.

7.1. Learning styles in the ZCL2, ZCL303, and ZCL401 samples

The distribution of students in the ZCL2, ZCL303 and ZCL401 samples between the four learning styles was not significantly different (p = .147, Chi^2, df = 6, n = 206) (Table 4.29). In the ZCL2 and ZCL303 samples the predominant study style was that of assimilator (51.75% and 60.38% respectively of students in the sample) while in the ZCL401 group there was distribution between assimilator (35.90%) and converger (35.90%) learning styles (Table 4.23).

On closer examination of the preferences for each of the diametrically opposed processes on each of the grasping and transforming continuums of the learning process it was determined that for concrete experience (CE) and abstract conceptualisation (AC) there was no significant difference (CE: p = .461, ANOVA, F = 0.78. AC: p = .282, ANOVA, F = 1.27. n = 206) in the mean scores of each in the ZCL2, ZCL303 and ZCL401 samples (Table 4.30).

Table 4.23
Frequency distribution of Learning Styles in the ZCL2, ZCL303, and ZCL401 samples

Kolb LSI Study Style	Group							
	ZCL2		ZCL303		ZCL401		Total	
	n	%	*n*	%	*n*	%	*n*	%
Accomodator	12	10.53	1	1.89	4	10.26	17	8.25
Assimilator	59	51.75	32	60.38	14	35.90	105	50.97
Converger	25	21.93	10	18.87	14	35.90	49	23.79
Diverger	18	15.79	10	18.87	7	17.95	35	16.99
Total	114	100.00	53	100.00	39	100.00	206	100.00

Chi^2 (*df* = 6, *n* = 206) = 9.52, *p* = .147).
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group.

There was a significant difference (*p* = .008) in the scores achieved for active experimentation (AE) by the ZCL2, ZCL303 and ZCL401 students (ANOVA, *F* = 4.95). Post-hoc testing (Scheffé's test) revealed that the significant difference was between ZCL303 and ZCL401 (*p* = .035) and ZCL2 (*p* = .018). The difference in scores achieved for reflective observation (RO) was close to significance (*p* = .059. ANOVA, *F* = 2.87) (Table 4.24). The parameters active experimentation (AE) and reflective observation (RO) are related as they are on opposing ends of the continuum for processing of knowledge.

Table 4.24
Scores for the four concepts in Kolb's LSI in ZCL2, ZCL303, and ZCL401 samples

Kolb's LSI Scores (/48)	Group							
	ZCL2		ZCL3		ZCL4		Total	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
Concrete Experience CE	22.86	6.13	22.35	5.24	23.85	5.48	22.91	5.78
Abstract Conceptualisation AC	33.50	6.74	35.35	6.98	34.15	7.95	34.11	7.05
Active Experimentation AE	33.21	5.22	30.67	6.05	33.62	4.85	32.62	5.49
Reflective Observation RO	30.42	6.50	31.64	6.33	28.38	6,69	30.36	6.55
Sample size	114		55		39		206	

ANOVA (n = 206): CE: *F* = 0.78, *p* = .4614; AC: *F*=1.27, *p*=.2820; AE: *F*=4.95, *p*=.0080; RO: *F*=2.87, *p*=.0589
Scheffé's post-hoc test for AE: ZCL3 differs from ZCL2 (*p* = .0176) and from ZCL4 (*p*= .0350)
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

7.2. Learning styles in the ZCL2Com and ZCL2Exp samples

Initially, prior to the intervention the predominant study style in the ZCL2Com sample was that of assimilator (48.35% of students). Assimilator was also the predominant study style in the ZCL2Exp sample but a greater percentage of students in the ZCL2Exp sample demonstrated this study style (65.22%) compared to the percentage of students in the ZCL2Com sample (48.35%) (Table 4.25). There was no significant difference (p = .371) in the distribution of the four learning styles in the ZCL2Com sample as compared to the ZCL2Exp sample prior to the intervention (Chi^2, df = 3, n = 114) (Table 4.25).

After the intervention the distribution of learning styles in the ZCL2Com sample shifted towards an increase in the percentage of students demonstrating the converger learning style (40.22%) as compared to the assimilator style (34.78%) (Table 4.25). In the ZCL2Exp sample the predominant learning style following the intervention was both the assimilator (40.91% of students) and the converger (40.91% of students) learning styles (Table 4.25).

Table 4.25
Frequency distribution of Learning Styles in the ZCL2Com and ZCL2Exp samples

Kolb LSI Study Style	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Accomodator	11	12.09	1	4.35	9	9.78	3	13.64
Assimilator	44	48.35	15	65.22	32	34.78	9	40.91
Converger	22	24.18	3	13.04	37	40.22	9	40.91
Diverger	14	15.38	4	17.39	14	15.22	1	4.55
Sample size	91	100	23	100	92	100	22	100

Pre-intervention ZCL2Com vs ZCL2Exp: Chi^2 (df = 3, n = 114) = 3.14; p = .3708. Post-intervention ZCL2Com vs ZCL2Exp: Chi^2(df = 3, n = 114) = 1.97; p = .5777. ZCL2Com = ZCL2 comparison group. ZCL2Exp = ZCL2 experimental group. *SD* = standard deviation

Between the ZCL2Com and ZCL2Exp samples prior to the intervention there was a slight difference in the mean scores which was significant for concrete experience (CE) (p = .018, Student's unpaired t-test, t-value = 2.0). For abstract conceptualisation (AC) (p = .162,

Student's unpaired *t*-test, *t*-value = 1.4, *n* = 114), active experimentation (AE) (*p* = .268, Student's unpaired *t*-test, *t*-value = 1.11) and reflective observation (RO) (*p* = .139, Student's *t*-test, *t*-value =1.49) there was no significant difference in the values pre-intervention (Table 4.26). Post-Intervention there was also a significant difference (*p* = .034) in scores for concrete experience (CE) between ZCL2Com and ZCL2Exp (Student's unpaired *t*-test, *t*-value = 2.15).

When the pre- and post-intervention scores for ZCL2Com were compared significant changes, of small practical significance, were noted. There was an increase in the score for abstract conceptualisation (AC) (*p* = .008, Student's *t*-test, *t*-value = 2.72, Cohen's *d* = 0.29) and a decrease in the score for reflective observation (RO) (*p* = .023, Student's *t*-test, *t*-value = 2.31, Cohen's *d* = 0.25). For the ZCL2Exp group there was a significant increase (*p* = .007) in mean scores for active experimentation (AE) which was of medium practical significance (Cohen's *d* = 0.65, Student's *t*-test, *t*-value = 3.00) (Table 4.26).

Table 4.26
Scores for the four concepts in Kolb's LSI in the ZCL2Com and ZCL2Exp samples

Kolb's LSI (/48)	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
Concrete Experience CE	23.54	6.30	20.17	4.60	23.68	6.45	20.59	4.02
Abstract Conceptualisation AC	33.05	6.62	35.26	7.09	34.86	6.57	34.36	6.14
Active Experimentation AE	33.48	5.32	32.13	4.73	33.12	6.47	35.36	6.21
Reflective Observation RO	29.97	6.65	32.22	5.66	28.34	6.49	29.68	6.56
Sample size	91		23		92		22	

Pre-intervention: ZCL2Com vs ZCL2Exp (*n* = 114): Student's unpaired *t*-test; CE: *t*-value = 2.40, *p* = .0179, Cohen's *d* = 0.56; AC: *t*-value = 1.40, *p* = .1620; AE: *t*-value = 1.11, *p* = .2683; RO: t-value = 1.49, *p* = .1386.
Post-intervention ZCL2Com vs ZCL2Exp (*n* = 114): Student's unpaired *t*-test: CE: t-value = 2.15, *p* = .0338, Cohen's *d* = 0.51; AC: *t*-value = 0.32, *p* = .7487; AE: *t*-value = 1.47, *p* = .1438; RO: *t*-value = 0.87, *p*= .3851.
ZCL2Com pre-intervention vs ZCL2Com post-intervention (*n* =182): Student's *t*-test: CE: *t*-value = 0.32, *p* = .7524; AC: *t*-value = 2.72, *p* = .0078, Cohen's *d* = 0.29; AE: *t*-value = 0.70, *p* = .4853; RO: *t*-value = 2.31. *p* = .0234, Cohen's d = 0.25.
ZCL2Exp pre-intervention vs ZCL2Exp post-intervention (*n* = 44): Student's *t*-test: CE: *t*-value = 0.75, *p* = .4632; AC: *t*-value = 0.52, *p* = .6083; AE: *t*-value = 3.00, *p* = .0068, Cohen's *d* = 0.65; RO: *t*-value = 1.55, *p* = .1364.
ZCL2Com = ZCL2 comparison group. ZCL2 Exp = ZCL2 experimental group. *SD* = standard deviation.

8. PHARMACOLOGY VOCABULARY KNOWLEDGE

The Pharmacology Vocabulary Questionnaire presented 50 words in isolation (Part A) and 32 of the 50 words were then presented in context (Part B) to the respondents who were asked to provide a definition of the word and to state whether they did not know the word, had never seen the word, the word was familiar, or knew the word (Chapter Three, Section 5.1.3 and Appendix B).

8.1. Pharmacology vocabulary knowledge in the ZCL2, ZCL303, and ZCL401 samples

The mean score achieved for the Pharmacology Vocabulary Questionnaire was significantly lower, with a large practical significance, in the ZCL2 sample (50.85±10.95) than in the ZCL303 (61.26±9.16; ANOVA with Scheffé's post-hoc test $p < .00001$, Cohen's $d = 1.00$) and ZCL401 (62.36±11.19; ANOVA with Scheffé's post-hoc test $p < .00001$, Cohen's $d = 1.05$) samples (Table 4.33). There was a smaller difference between the scores for Part A, when words were presented in isolation, than for the scores for Part B, when the words were presented in context (in a paragraph), in the ZCL2 sample (Part A: 49.37±11.01, Part B: 52.32±13.34) than in the ZCL3 (Part A: 56.37±11.00, Part B: 66.15±9.84) and ZCL401 (Part A: 57.80±12.36, Part B: 66.92±12.77) samples possibly resulting from the ZCL2 students having a lower level of pharmacological knowledge and, therefore, unable to derive additional meaning from the contextualisation (Table 4.27).

Surprisingly the ZCL2 sample completed the questionnaire in a significantly shorter time period (34.94±8.36 minutes) than the ZCL303 and ZCL401 samples (47.28±6.87 minutes and 41.51±6.16 minutes respectively: ANOVA, $F = 50.51$, $p < .00001$) (Table 4.34). This difference in time taken to complete the questionnaire was of large practical significance and could possibly have been due to the ZCL2 students having a smaller knowledge base and, therefore, not spending as much time as the ZCL303 and ZCL401 students trying to deduce

the meaning of the words (ZCL2 vs ZCL301 Cohen's *d* = 1.56 and ZCL2 vs ZCL401 Cohen's *d* = 0.84) (Table 4.28).

Table 4.27
Pharmacology vocabulary scores for ZCL2, ZCL303, and ZCL401

Pharmacology Vocabulary Score (/100)	Group					
	ZCL2		ZCL3		ZCL4	
	mean	*SD*	mean	*SD*	mean	*SD*
Words in isolation (Part A)	49.37	11.01	56.37	11.00	57.80	12.36
Words in context (Part B)	52.32	13.34	66.15	9.84	66.92	12.77
Part A + Part B	50.85	10.95	61.26	9.16	62.36	11.19
Sample size	117		54		41	

Part A: ANOVA (F = 12.16, n = 212); p = .0000; Part B: ANOVA (F = 34.03, n = 212); p = .0000;
Part A + Part B: ANOVA (F = 27.92, n = 212); p = .0000.
Part A: Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p = .0010; Cohen's d = 0.64) and from ZCL4 (p = .0003; Cohen's d = 0.74)
Part B: Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p = .0000; Cohen's d = 1.12) and from ZCL4 (p = .0000; Cohen's d = 1.11)
Part A + Part B: Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p = .0000; Cohen's d = 1.00) and from ZCL4 (p = .0000; Cohen's d = 1.05)
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

Table 4.28
Time taken to complete the Pharmacology Vocabulary Questionnaire by ZCL2, ZCL303, and ZCL401

Pharmacology Vocabulary Time taken to complete (minutes)	Group					
	ZCL2		ZCL3		ZCL4	
	mean	*SD*	mean	*SD*	mean	*SD*
Words in isolation (Part A)	21.23	6.34	28.93	4.68	28.95	6.23
Words in context (Part B)	13.71	3.80	18.35	3.81	12.56	3.62
Part A + Part B	34.94	8.36	47.28	6.87	41.51	6.16
Sample size	117		54		41	

Part A: ANOVA (F = 44.08, n = 212); p = .0000; Part B: ANOVA (F = 35.97, n=212); p=.0000;
Part A + Part B: ANOVA (F = 50.51, n=212); p=.0000.
Part A: Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000; Cohen's d=1.31) and from ZCL4 (p=.0000; Cohen's d=1.22)
Part B: Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000; Cohen's d=1.22) and ZCL3 differs significantly from ZCL4 (p=.0000; Cohen's d=1.55)
Part A + Part B: Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000; Cohen's d=1.56) and from ZCL4 (p=.0000; Cohen's d=0.84), and ZCL3 differs significantly from ZCL4 (p=.0015; Cohen's d=0.88)
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

The student's actual vocabulary knowledge was significantly lower than their self-perceived Pharmacology vocabulary knowledge. Pharmacology2 students felt that they knew 65.93±25.05% of the words in Part A (Table 4.29) compared to an actual knowledge of

49.37±11.01% of words that were correct (Table 4.27) in Part A of the questionnaire ($p < .0001$, Student's *t*-test, *t*-value = -7.28, $n = 117$). This pattern was also displayed by the ZCL303 students (self-perceived knowledge: I know word = 80.48±20.63%; actual knowledge = 56.37±11.00%) ($p < .0001$, Student's *t*-test, *t*-value = -7.87, $n = 54$) and ZCL401 (self-perceived knowledge: I know word = 86.05±15.24%; actual knowledge = 57.80±12.36%) ($p < .0001$, Student's *t*-test, *t*-value = -11.98, $n = 41$) (Tables 4.27 and 4.29). A similar miss-match between actual Pharmacology vocabulary knowledge and self-perceived knowledge was reported by Diaz-Gilbert (2005).

Table 4.29
Self-perceived knowledge, of words presented in isolation in the Pharmacology Vocabulary Questionnaire Part A, for ZCL2, ZCL303, and ZCL401 samples

Pharmacology Vocabulary Part A Words in isolation	Group								
	ZCL2			ZCL303			ZCL401		
	n	mean	*SD*	n	mean	*SD*	*n*	mean	*SD*
Do not know the word (/50)	91	4.43	2.78	35	2.34	1.47	18	2.28	1.23
Have never seen the word (/50)	55	2.51	1.64	16	1.75	1.00	10	1.60	0.84
Word is familiar (/50)	112	11.34	9.96	53	7.58	9.66	35	5.09	6.28
I know word (/50)	114	33.83	10.90	53	41.00	8.76	41	43.02	7.62
Do not know the word + Have never seen word (%)	117	12.36	9.93	54	4.63	3.98	41	5.27	9.59
Word is familiar + I know word (%)	117	87.64	9.93	54	95.37	3.98	41	94.73	9.59
Word is familiar (%)	117	21.71	20.03	54	14.89	19.24	41	8.68	12.14
I know word (%)	117	65.93	24.05	54	80.48	20.63	41	86.05	15.24

ANOVA (Do not know the word (/50)): ($F = 13.22$, n = 144; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0001, Cohen's d=0.84) and from ZCL4 (p=.0027, Cohen's d=0.83)
ANOVA (Have never seen the word (/50)): ($F = 2.78$, n = 81; $p = .0682$)
ANOVA (Word is familiar (/50)): ($F = 7.11$, n = 200; $p = .0010$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL4 (p=.0030, Cohen's d=0.38)
ANOVA (I know word (/50)): ($F = 17.82$, n = 208; $p = .0000$): Scheffé's post-hoc test - ZCL2 differs significantly from ZCL3 (p=.0001, Cohen's d=0.70) and from ZCL4 (p=.0000, Cohen's d=0.91)
ANOVA (Do not know the word + Have never seen word (%)): ($F = 19.14$, n = 212; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000, Cohen's d=0.91) and from ZCL4 (p=.0001, Cohen's d=0.72)
ANOVA (Word is familiar + I know word (%)): ($F = 19.14$, n = 212; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000, Cohen's d=0.91) and from ZCL4 (p=.0001, Cohen's d=0.72)
ANOVA (Word is familiar (%)): ($F = 8.16$, n = 212; $p = .0004$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL4 (p=.0007, Cohen's d=0.71)
ANOVA (I know word (%)): ($F = 16.67$, n = 212; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0004, Cohen's d=0.63) and from ZCL4 (p=.0000, Cohen's d=0.91)
ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. SD = standard deviation.

When the words were presented in context (Part B), although students scored higher in terms of actual knowledge than they did when the words were presented in isolation, there

was still a miss-match between self-perceived and actual knowledge. Actual knowledge of words in context for ZCL2, ZCL303, and ZCL401 was 52.32±13.34%, 66.15±9.84%, and 66.92±12.77% respectively (Table 4.27). Self-perceived knowledge scores for ZCL2, ZCL303, and ZCL401 were 70.35±26.55%, 86.75±22.72%, and 91.46±12.54% respectively (Table 4.30). The actual knowledge was significantly lower ($p < .0001$) than the self-perceived knowledge when the words were presented in context (Student's *t*-test, *t*-value for ZCL2 = -7.25, for ZCL303 = -6.11, for ZCL401 = -11.56 and *n* for ZCL2 = 117, for ZCL303 = 54, for ZCL401 = 41).

Table 4.30
Self-perceived knowledge, of words presented in context in the Pharmacology Vocabulary Questionnaire Part B, for ZCL2, ZCL303, and ZCL401 samples

Pharmacology Vocabulary Part B Words in context	Group								
	ZCL2			ZCL303			ZCL401		
	n	mean	*SD*	*n*	mean	*SD*	*n*	mean	*SD*
Do not know the word (/32)	74	3.03	2.41	23	1.39	0.58	19	1.42	0.96
Have never seen the word (/32)	21	1.67	1.11	4	1.25	0.50	3	1.67	0.58
Word is familiar (/32)	95	7.45	7.40	38	4.61	8.13	20	3.00	4.82
I know word (/32)	112	23.52	7.18	53	28.28	6.23	41	29.27	4.01
Do not know the word + Have never seen word (%)	117	10.74	11.31	54	3.13	4.89	41	3.96	5.32
Word is familiar + I know word (%)	117	89.26	11.31	54	96.88	4.89	41	96.04	5.32
Word is familiar (%)	117	18.9	22.75	54	10.13	22.23	41	4.57	11.42
I know word (%)	117	70.35	26.55	54	86.75	22.72	41	91.46	12.54

ANOVA (Do not know the word /50): ($F = 8.89$, $n = 116$; $p = .0003$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0035, Cohen's d=0.77) and from ZCL4 (p=.0090, Cohen's d=0.0.73)
ANOVA (Have never seen the word /50): ($F = 0.285$, $n = 28$; $p = .7542$)
ANOVA (Word is familiar /50): ($F = 4.198$, $n = 153$; $p = .0168$): Scheffé's post-hoc test – unable to differentiate
ANOVA (I know word /50): ($F = 16.95$, $n = 206$; $p = .0000$): Scheffé's post-hoc test - ZCL2 differs significantly from ZCL3 (p=.0000, Cohen's d=0.69) and from ZCL4 (p=.0000, Cohen's d=0.89)
ANOVA (Do not know the word + Have never seen word %): ($F = 16.79$, $n = 212$; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000, Cohen's d=0.78) and from ZCL4 (p=.0003, Cohen's d=0.67)
ANOVA (Word is familiar + I know word %): ($F = 16.79$, $n = 212$; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0000, Cohen's d=0.78) and from ZCL4 (p=.0003, Cohen's d=0.69)
ANOVA (Word is familiar %): ($F = 8.31$, $n = 212$; $p = .0003$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 ($p = .041$, Cohen's d = 0.39) and from ZCL4 (p=.001, Cohen's d=0.70)
ANOVA (I know word %): ($F = 16.59$, $n = 212$; $p = .0000$): Scheffé's post-hoc test – ZCL2 differs significantly from ZCL3 (p=.0002, Cohen's d=0.65) and from ZCL4 (p=.0000, Cohen's d =0.89)
ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. SD = standard deviation.

Amongst the ZCL2 students only 13 of the 32 words presented in context were understood by > 60% of the students (Table 4.31). The Pharmacology vocabulary knowledge

improved with academic progression and amongst the ZCL303 and ZCL401 students, 21 of the 32 words were understood correctly by > 60% of the students (Table 4.31).

Table 4.31
Comparison of understanding when words were presented in isolation or in context for ZCL2, ZCL303, and ZCL401. Δ B-A = score gain/loss when word was presented in context

Word	ZCL2			ZCL303			ZCL401			ZCL2+ZCL3+ZCL4		
	Part A (%)	Part B (%)	Δ B-A	Part A (%)	Part B (%)	Δ B-A	Part A (%)	Part B (%)	Δ B-A	Part A (%)	Part B (%)	Δ B-A
acute	12.82	17.95	5.13	0.00	18.52	18.52	2.44	17.07	14.63	7.55	17.92	10.38
attack	17.09	44.44	27.35	35.19	77.78	42.59	43.90	68.29	24.39	26.89	57.55	30.66
chronic	60.68	69.23	8.55	94.44	98.15	3.70	95.12	90.24	-4.88	75.94	80.66	4.72
clinical	33.33	40.17	6.84	50.00	27.78	-22.22	58.54	43.90	-14.63	42.45	37.74	-4.72
compartments	88.89	81.20	-7.69	79.63	100.00	20.37	90.24	87.80	-2.44	86.79	87.26	0.47
concurrent	27.35	26.50	-0.85	81.48	87.04	5.56	85.37	90.24	4.88	52.36	54.25	1.89
controlled	39.32	76.92	37.61	75.93	98.15	22.22	60.98	92.68	31.71	52.83	85.38	32.55
counsel	74.36	77.78	3.42	94.44	88.89	-5.56	100.00	95.12	-4.88	84.43	83.96	-0.47
counteract	68.38	91.45	23.08	70.37	94.44	24.07	75.61	87.80	12.20	70.28	91.51	21.23
depression	30.77	48.72	17.95	12.96	44.44	31.48	60.98	51.22	-9.76	32.08	48.11	16.04
diurnal	4.27	5.98	1.71	9.26	14.81	5.56	12.20	14.63	2.44	7.08	9.91	2.83
epigastric	23.08	11.11	-11.97	7.41	9.26	1.85	34.15	24.39	-9.76	21.23	13.21	-8.02
failure	44.44	86.32	41.88	33.33	92.59	59.26	51.22	87.80	36.59	42.92	88.21	45.28
flushed	32.48	40.17	7.69	68.52	70.37	1.85	51.22	63.41	12.20	45.28	52.36	7.08
gnawing	2.56	10.26	7.69	7.41	18.52	11.11	14.63	14.63	0.00	6.13	13.21	7.08
interaction	82.91	41.03	-41.88	68.52	66.67	-1.85	53.66	53.66	0.00	73.58	50.00	-23.58
intermittent	5.13	16.24	11.11	24.07	44.44	20.37	29.27	53.66	24.39	14.62	30.66	16.04
maintenance	84.62	50.43	-4.19	62.96	77.78	14.81	73.17	82.93	9.76	76.89	63.68	-13.21
motility	89.74	93.16	3.42	75.93	92.59	16.67	70.73	85.37	14.63	82.55	91.51	8.96
nausea	85.47	80.34	-5.13	85.19	96.30	11.11	85.37	90.24	4.88	85.38	86.32	0.94
output	10.26	69.23	58.97	14.81	83.33	68.52	36.59	87.80	51.22	16.51	76.42	59.91
precipitate	73.50	53.85	-19.66	62.96	75.93	12.96	56.10	70.73	14.63	67.45	62.74	-4.72
predisposed	33.33	52.99	19.66	70.37	55.56	-14.81	53.66	58.54	4.88	46.70	54.72	8.02
productive	10.26	50.43	40.17	29.63	79.63	50.00	31.71	75.61	43.90	19.34	62.74	43.40
puffiness	64.10	77.78	13.68	76.36	83.33	6.97	73.17	78.05	4.88	69.01	79.25	10.23
rebound	9.40	11.11	1.71	11.11	14.81	3.70	7.32	21.95	14.63	9.43	14.15	4.72
secondary	21.37	19.66	-1.71	53.70	44.44	-9.26	56.10	70.73	14.63	36.32	35.85	-0.47
slow-release	52.14	47.01	-5.13	55.56	62.96	7.41	70.73	82.93	12.20	56.60	58.02	1.42
steady	86.32	82.91	-3.42	72.22	75.93	3.70	75.61	80.49	4.88	80.66	80.66	0.00
subsequent	50.43	51.28	0.85	70.37	75.93	5.56	73.17	78.05	4.88	59.91	62.74	2.83
suffered	67.52	76.92	9.40	72.22	92.59	20.37	70.73	90.24	19.51	69.34	83.49	14.15
vomiting	76.07	69.23	-6.84	66.67	53.70	-12.96	43.90	51.22	7.32	67.45	61.79	-5.66

Amongst the words that were not understood by the students were words that could be considered to be general vocabulary and not specialised pharmacological vocabulary. Examples of these words are *subsequent* (understood by 59.9%), *concurrent* (52.36%), *predisposed* (46.70%), and *intermittent* (14.62%) (Table 4.31). Some of the errors occurred because the students confused words that sounded alike. Examples were *motility* defined as death because it sounded like *mortality*, the word *concurrent* confused with *recurrent*,

diurnal was defined as at night as it sounded like *nocturnal*. Some words were confused because they were similar in morphology. Examples were the confusion between *predisposed* and *pre-exposed* as well as between *diurnal* and *diuretic*. Lastly problems arose when the students tried to literally translate the word according to its constituent parts. An example of this was *predisposed* which was defined as *previously disposed of*. These are common errors amongst EAL speakers and similar errors have been reported in a group of Pharmacy students in the USA by Diaz-Gilbert (2004). Pharmacology vocabulary knowledge will be discussed further in Chapter Six.

8.2. Pharmacology vocabulary knowledge in the ZCL2Com and ZCL2Exp samples

The ZCL2Com and ZCL2Exp samples were re-administered the questionnaire on conclusion of the intervention period. Pharmacological vocabulary knowledge increased significantly, with moderate practical significance, in both samples after the intervention (ZCL2Com: pre-intervention = 49.85±10.31, post-intervention = 57.22±10.36 $p < .00001$, Cohen's d = 0.68; ZCL2Exp: pre-intervention = 57.22±10.36, post-intervention = 60.00±13.01, $p = .0006$, Cohen's d = 0.71) (Table 4.32).

However, there was no significant difference (Part A: $p = .425$. Part B: $p = .220$. Part A + Part B: $p = .277$) between the experimental and comparison samples' scores post intervention (Student's unpaired t-test, t-values = 0.80 for Part A, 1.23 for Part B and 1.09 for Part A + Part B) (Table 4.32).

Table 4.32
Pharmacology vocabulary scores for ZCL2Com and ZCL2Exp

Pharmacology Vocabulary Score (/100)	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
Words in isolation (Part A)	48.30	10.50	53.74	12.17	53.93	10.56	56.00	12.96
Words in context (Part B)	51.40	12.89	56.11	14.76	60.50	11.64	63.99	14.13
Part A + Part B	49.85	10.31	54.93	12.72	57.22	10.36	60.00	13.01
Sample size	94		23		92		23	

Pre-intervention: ZCL2Com vs ZCL2Exp: Student's unpaired *t*-test (*n*=117): Part A: *t*-value=2.16, *p*=.0330, Cohen's *d*=0.50; Part B: *t*-value=1.53, *p*=.1291; Part A + Part B: *t*-value=2.02, *p*=.0458, Cohen's *d*=0.47.
Post-intervention ZCL2Com vs ZCL2Exp : Student's unpaired *t*-test (*n*=115): Part A: *t*-value=0.80, *p*=.4250; Part B: *t*-value=1.23, p=.2200; Part A + Part B: *t*-value=1.09, *p*=.2769.
ZCL2Com pre-intervention vs ZCL2Com post-intervention: Student's *t*-test (*n*=184): Part A: *t*-value = 6.48, *p*=.0000, Cohen's *d*=0.68; Part B: *t*-value=7.74, *p*=.0000, Cohen's *d*=0.81; Part A + Part B: *t*-value= 8.60, *p*=.0000, Cohen's *d*=0.90.
ZCL2Exp pre-intervention vs ZCL2Exp post-intervention: Student's *t*-test (*n*=46): Part A: *t*-value=1.24, *p*=.2291; Part B: *t*-value=4.01, *p*=.0006, Cohen's *d*=0.84; Part A + Part B: *t*-value=3.42, *p*=.0025, Cohen's *d*=0.71.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

The questionnaire was completed in a similar time period by the ZCL2Com and ZCL2Exp groups prior to the intervention (34.44±7.92 minutes and 37.00±9.89 minutes respectively) and at the end of the intervention (31.43±6.49 minutes and 31.39±8.14 minutes respectively). After the intervention the students in both groups completed the questionnaire in a significantly shorter time period than in the pre-intervention period (ZCL2Com: 31.43±6.49 minutes, Student's *t*-test, $p = .0001$. Cohen's $d = 0.43$; ZCL2Exp: 31.39±8.14 minutes, Student's *t*-test, $p = .003$. Cohen's $d = 0.69$) (Table 4.33). The decrease in the time taken to complete the questionnaire was of medium practical significance (ZCL2Com: Cohen's $d = 0.43$; ZCL2Exp: Cohen's $d = 0.69$) and was probably due to an increased pharmacological knowledge as compared to the pre-intervention period.

The ZCL2Com and ZCL2Exp groups demonstrated similar patterns in terms of self-perceived versus actual pharmacology vocabulary knowledge. Prior to the intervention the ZCL2Com and ZCL2Exp samples felt that they knew 65.68±24.28% and 66.96±23.62% respectively of the words in Part A (Table 4.34). Actual knowledge was significantly lower at

48.30±10.50% (ZCL2Com) (p < .0001, Student's t-test, t-value = -6.70, n = 94) and 53.93±12.72% (ZCL2Exp) (p < .0001, Student's t-test, t-value = -6.70, n = 94) (Table 4.32). The pattern during the post-intervention period for Part A was similar with self-perceived knowledge being 73.63±25.39% (ZCL2Com) and 72.09±26.65% (ZCL2Exp) which was significantly higher than actual knowledge at 53.93.22±10.56% (ZCL2Com) (p < .0001, Student's t-test, t-value = -6.96, n = 92) and 56.09±12.96% (ZCL2Exp) (p = .0007, Student's t-test, t-value = -2.97, n = 23) (Tables 4.32 and 4.34).

When the words were presented in context (Part B) there was a significantly lower (p = .0001) actual knowledge of the meaning of the words in the ZCL2Com group (Student's t-test, t-value = -4.21, n = 92) but in the ZCL2Exp group the actual score did not differ significantly (p = .18) from the self-perceived scores knowledge of the meaning of the word (Student's t-test, t-value = -1.38, n = 23) (Table 4.32 and Table 4.35).

Table 4.33
Time taken to complete the Pharmacology Vocabulary Questionnaire by ZCL2Com and ZCL2Exp

Pharmacology Vocabulary Time taken to complete (minutes)	Group							
	Pre-Intervention				Post-Intervention			
	ZCL2Com		ZCL2Exp		ZCL2Com		ZCL2Exp	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
Words in isolation (PartA	20.99	6.20	22.22	6.95	19.90	4.96	18.26	6.09
Words in context (Part B)	13.45	3.52	14.78	4.74	11.53	3.39	13.13	4.04
Part A + Part B	34.44	7.92	37.00	9.89	31.43	6.49	31.39	8.14
Sample size	94		23		92		23	

Pre-intervention: ZCL2 Exp vs ZCL2Com: Student's unpaired t-test (n=117): Part A: t-value=0.83, p=.4076; Part B: t-value= 1.52, p=.1315; Part A + Part B: t-value=1.32, p=.1887.
Post-intervention ZCL2 Exp vs ZCL2Com: Student's unpaired t-test (n=115): Part A: t-value=1.35, p=.1784; Part B: t-value= 1.94, p=.0545; Part A + Part B: t-value=0.03, p=.9783.
ZCL2Com pre-intervention vs ZCL2Com post-intervention: Student's t-test (n=184): Part A: t-value=1.82, p=.0727; Part B:t-value=4.38, p=.0000, Cohen's d=0.46; Part A + Part B: t-value=4.09, p=.0001, Cohen's d=0.43.
ZCL2Exp pre-intervention vs ZCL2Exp post-intervention: Student's t-test (n=46): Part A: t-value=3.76, p=.0011, Cohen's d=0.79; Part B: t-value=1.44, p=.1649; Part A + Part B: t-value=3.32, p=.0031, Cohen's d=0.69.
ZCL2 = ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. *SD* = standard deviation.

Table 4.34

Self-perceived knowledge, of words presented in isolation in the Pharmacology Vocabulary Questionnaire Part A, for ZCL2Com and ZCL2Exp samples

Pharmacology Vocabulary	Group											
	Pre-Intervention						Post-Intervention					
Part A Words in isolation	ZCL2Com			ZCL2Exp			ZCL2Com			ZCL2Exp		
	n	mean	*SD*	*n*	mean	*SD*	*n*	mean	*SD*	*n*	mean	*SD*
Do not know the word (/50)	73	4.56	2.91	18	3.89	2.17	61	3.44	2.47	18	3.11	1.91
Have never seen the word (/50)	45	2.47	1.67	10	2.70	1.57	30	1.90	1.06	5	1.20	0.45
Word is familiar (/50)	90	11.22	10.25	22	11.82	8.88	85	10.61	11.83	20	12.20	12.32
I know word (/50)	92	33.55	11.24	22	35.00	9.50	91	37.22	12.15	23	36.04	13.32
Do not know the word + Have never seen word (%)	94	12.83	10.34	23	10.43	7.95	92	6.76	6.36	23	6.70	5.58
Word is familiar + I know word (%)	94	87.17	10.34	23	89.57	7.95	92	93.24	6.36	23	93.30	5.58
Word is familiar (%)	94	21.49	20.57	23	22.61	18.03	92	19.61	23.43	23	21.22	24.40
I know word (%)	94	65.68	24.28	23	66.96	23.62	92	73.63	25.39	23	72.09	26.65

ZCL2Com pre vs post: (Do not know the word /50): Student's *t*-test (*t*-value = 4.37, *n* = 53; *p* = .0000), Cohen's *d*=0.60. (Have never seen the word /50) Student's *t*-test (*t*-value = 3.50, *n* = 18; *p* = .0028), Cohen's *d*=0.82. (Word is familiar /50): Student's *t*-test (*t*-value = 1.06, *n* = 81; *p* = .292) (I know word /50): Student's *t*-test (*t*-value = 3.95, *n* = 88; *p* = .0002). (Do not know the word + Have never seen word %): Student's *t*-test (*t*-value = 6.02, *n* = 91; *p* = .0000), Cohen's *d*=0.63. (Word is familiar + I know word %): Student's *t*-test (*t*-value = 6.02, *n* = 91; *p* = .0000), Cohen's *d*=0.63. (Word is familiar %): Student's *t*-test (*t*-value = 1.38, *n* = 91; *p* = .1712). (I know word %): Student's *t*-test (*t*-value = 4.10, *n* = 91; *p* = .0000), Cohen's *d*=0.43 .

ZCL2Exp pre vs post: (Do not know the word /50): Student's *t*-test (*t*-value = 1.07, *n* = 15; *p* = .2993). (Have never seen the word /50): Student's *t*-test (*t*-value = 2.0, *n* = 3; *p* = .1835). (Word is familiar /50): Student's *t*-test (*t*-value = 0.083, *n* = 20; *p* = .934). (I know word /50): Student's *t*-test (*t*-value = *1.33*, *n* = 22; *p* = .1973) (Do not know the word + Have never seen word (%): Student's *t*-test (*t*-value = 2.46, *n* = 23; *p* = .0222), Cohen's *d*=0.51. (Word is familiar + I know word %): Student's *t*-test (*t*-value = 2.46, *n* = 23; *p* = .0222), Cohen's *d*=0.51. (Word is familiar %): Student's *t*-test (*t*-value = 0.415, *n* = 23; *p* = 0.6821). (I know word %): Student's *t*-test (*t*-value = 1.37, *n* = 23; *p* = .1816).

ZCL2Com vs ZCL2Exp pre-intervention: (Do not know the word /50): Student's *t*-test (*t*-value = 0.92, *n* = 73; *p* = .1744). (Have never seen the word /50): Student's *t*-test (*t*-value = 0.40, *n* = 45; *p* = .8948). (Word is familiar /50): Student's *t*-test (*t*-value = *0.25*, n = 90; *p* = .460). (I know word /50): Student's *t*-test (*t*-value = 0.56, *n* = 92, *p* = .3838). (Do not know the word + Have never seen word %): Student's *t*-test (*t*-value = 1.037, *n* = 94; *p* = .161). (Word is familiar + I know word %): Student's *t*-test (*t*-value = 1.037, *n* = 94; *p* = .1601), Cohen's *d*=0.51. (Word is familiar %): Student's *t*-test (*t*-value = 0.239, *n* = 94; *p* = .4902). (I know word %): Student's *t*-test (*t*-value = 0.227, *n* = 94; *p* = .9254).

ZCL2Com vs ZCL2Exp post-intervention: (Do not know the word /50): Student's *t*-test (*t*-value = 0.524, *n* = 61; *p* = .2333). (Have never seen the word /50): Student's *t*-test (*t*-value = 1.438, *n* = 30; *p* = .1035). (Word is familiar /50): Student's *t*-test (*t*-value = 0.536, *n* = 85; *p* = .7629). (I know word /50): Student's *t*-test (*t*-value = 0.4067, n = 91 *p* = .3838). (Do not know the word + Have never seen word %): Student's *t*-test (*t*-value = 0.045, *n* = 92; *p* = .4939). (Word is familiar + I know word %): Student's *t*-test (*t*-value = 0.045, n = 92; *p* = .4939). (Word is familiar %): Student's *t*-test (*t*-value = 0.292, *n* = 92; *p* = .7574). (I know word %): Student's *t*-test (*t*-value = 0.2582, *n* = 92; *p* = .7206.

ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator GROUP. SD = standard deviation.

Table 4.35

Self-perceived knowledge, of words presented in context in the Pharmacology Vocabulary Questionnaire Part B, for ZCL2Com and ZCL2Exp samples

Pharmacology Vocabulary	Group											
	Pre-Intervention						Post-Intervention					
Part B Words in context	ZCL2Com			ZCL2Exp			ZCL2Com			ZCL2Exp		
	n	mean	*SD*	*n*	mean	*SD*	*n*	mean	*SD*	*n*	mean	*SD*
Do not know the word (/50)	59	3.08	2.43	15	2.80	2.39	47	2.53	2.18	12	2.25	1.22
Have never seen the word (/50)	20	1.70	1.13	1	1.00		17	1.29	0.77	2	1.00	0.00
Word is familiar (/50)	77	7.42	7.52	18	7.61	7.11	64	8.27	9.30	18	8.67	8.93
I know word (/50)	90	23.39	7.24	22	24.05	7.08	87	24.92	7.44	21	25.38	7.24
Do not know the word + Have never seen word (%)	94	11.04	11.25	23	9.51	11.75	92	8.39	10.84	23	6.39	7.21
Word is familiar + I know word (%)	94	88.96	11.25	23	90.49	11.75	92	91.61	10.84	23	93.61	7.21
Word is familiar (%)	94	18.98	23.06	23	18.61	21.97	92	17.97	26.97	23	21.20	27.05
I know word (%)	94	69.98	26.65	23	71.88	26.70	92	73.64	28.73	23	72.42	31.43

ZCL2Com pre vs post: (Do not know the word /50): Student's *t*-test (*t*-value = 6.59, *n* = 59; *p* = .0000), Cohen's *d*=0.86. (Have never seen the word /50): Student's *t*-test (*t*-value = 2.77, *n* = 20; *p* = .0121), Cohen's *d*=0.62. (Word is familiar /50): Student's *t*-test (*t*-value = 7.49, *n* = 77; *p* = .0000), Cohen's *d* = 0.85. (I know word /50): Student's *t*-test (*t*-value = 29.33, *n* = 90; *p* = .0000), Cohen's *d* = 3.09. (Do not know the word + Have never seen word %): Student's *t*-test (*t*-value = 8.65, *n* = 94; *p* = .0000), Cohen's *d*=0.89. (Word is familiar + I know word %): Student's *t*-test (*t*-value = 75.8, *n* = 94; *p* = .0000), Cohen's *d*=7.82. (Word is familiar %): Student's *t*-test (*t*-value = 7.56, *n* = 94; *p* = .0000), Cohen's *d* = 0.78. (I know word %): Student's *t*-test (*t*-value = 25.10, *n* = 94; *p* = .0000), Cohen's *d*=2.59.

ZCL2Exp pre vs post: (Do not know the word /50): Student's *t*-test (*t*-value = 0.00, *n* = 9; *p* = 1). (Have never seen the word /50): Student's *t-test* (*t*-value = _, *n* = 1 *p* = _) (Word is familiar (50): Student's *t*-test (*t*-value = 0.59, *n* = 16; *p* = .565) (I know word /50): Student's *t*-test (*t*-value = 0.391, *n* = 21; *p* = .700) . (Do not know the word + Have never seen word %): Student's *t*-test (*t*-value = 1.49, *n* = 23; *p* = .151). (Word is familiar + I know word %): Student's *t*-test (*t*-value = 1.49, *n* = 23; *p* = .151). (Word is familiar %): Student's *t*-test (*t*-value = 0.603, *n* = 23; *p* = 0.552). (I know word %): Student's *t*-test (*t*-value = 0.138, *n* = 23; *p* = .892)

ZCL2Com vs ZCL2Exp pre-intervention: (Do not know the word /50): Student's *t*-test (*t*-value = 0.41, *n* = 74; *p* = .685). (Have never seen the word /50): Student's *t*-test (*t*-value = 0.61, *n* = 21; *p* = .552). (Word is familiar /50): Student's *t*-test (*t*-value = 0.10, n = 95; *p* = .920). (I know word /50): Student's *t*-test (*t*-value = 0.38, = 112, *p* = .703). (Do not know the word + Have never seen word (%): Student's *t*-test (*t*-value = 0.578 *n* = 117; *p* = .564). (Word is familiar + I know word (%): Student's *t*-test (*t*-value = 0.578, *n* = 117; *p* = .564). (Word is familiar %): Student's *t*-test (*t*-value = 0.69, *n* = 119; *p* = .944). (I know word %): Student's *t*-test (*t*-value = 0.306, *n* = 119; *p* = .7604.

ZCL2Com vs ZCL2Exp post-intervention: (Do not know the word /50): Student's *t*-test (*t*-value = 0.428, *n* = 59; *p* = .670). (Have never seen the word /50): Student's *t*-test (*t*-value = 0.526, *n* = 19; *p* = .606). (Word is familiar /50): Student's *t*-test (*t*-value = 0.163, *n* = 82; *p* = .871). (I know word /50): Student's *t*-test (*t*-value = 0.256, n = 108, *p* = .798). (Do not know the word + Have never seen word %): Student's *t*-test (*t*-value = 0.84, n = 115; *p* = .403). (Word is familiar + I know word %): Student's *t*-test (*t*-value = 0.84, n = 115; *p* = .403). (Word is familiar %): Student's *t*-test (*t*-value = 0.513, *n* = 115; *p* = .609). (I know word %): Student's *t*-test (*t*-value = 0.179, *n* = 115; *p* = .858.

ZCL2 combined (ZCL2 comparison group plus ZCL2 experimental group). ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. SD = standard deviation.

Eight of the top ten words (presented in context, Part B) correctly defined by each of the ZCL2Com and ZCL2Exp groups prior to and after the intervention were the same words. The words were compartments, controlled, counsel, counteract, failure, motility, nausea, and puffiness (Table 4.36).

Table 4.36
Comparison of understanding when words were presented in isolation or in context for ZCL2Com and ZCL2Exp. Δ B-A = score gain/loss when the word was presented in context

Word	Pre-Intervention						Post-Intervention					
	ZCL2Com			ZCL2Exp			ZCL2Com			ZCL2Exp		
	Part A (%)	Part B (%)	Δ B-A	Part A (%)	Part B (%)	Δ B-A	Part A (%)	Part B (%)	Δ B-A	Part A (%)	Part B (%)	Δ B-A
acute	9.57	15.96	6.38	26.09	26.09	0.00	8.70	23.91	15.22	8.70	17.39	8.70
attack	17.02	45.74	28.72	17.39	39.13	21.74	40.22	58.70	18.48	34.78	52.17	17.39
chronic	56.38	69.15	12.77	78.26	69.57	-8.70	71.74	73.91	2.17	91.30	95.65	4.35
clinical	29.79	38.30	8.51	47.83	47.83	0.00	69.57	56.52	-13.04	65.22	69.57	4.35
compartments	87.23	80.85	-6.38	95.65	82.61	-13.04	93.48	88.04	-5.43	86.96	91.30	4.35
concurrent	23.40	22.34	-1.06	43.48	43.48	0.00	32.61	34.78	2.17	43.48	47.83	4.35
controlled	41.49	78.72	37.23	30.43	69.57	39.13	73.91	88.04	14.13	82.61	86.96	4.35
counsel	75.53	76.60	1.06	69.57	82.61	13.04	89.13	94.57	5.43	95.65	100.00	4.35
counteract	69.15	90.43	21.28	65.22	95.65	30.43	78.26	84.78	6.52	73.91	91.30	17.39
depression	26.60	52.13	25.53	47.83	34.78	-13.04	29.35	67.39	38.04	21.74	56.52	34.78
diurnal	3.19	5.32	2.13	8.70	8.70	0.00	11.83	4.35	-7.48	8.70	21.74	13.04
epigastric	21.28	10.64	-10.64	30.43	13.04	-17.39	25.81	22.83	-2.98	13.04	21.74	8.70
failure	44.68	85.11	40.43	43.48	91.30	47.83	56.99	86.96	29.97	65.22	95.65	30.43
flushed	32.98	40.43	7.45	30.43	39.13	8.70	59.14	57.61	-1.53	60.87	69.57	8.70
gnawing	2.13	8.51	6.38	4.35	17.39	13.04	1.08	9.78	8.71	13.04	26.09	13.04
interaction	81.91	37.23	-44.68	86.96	56.52	-30.43	82.80	84.78	1.99	73.91	69.57	-4.35
intermittent	2.13	12.77	10.64	17.39	30.43	13.04	81.72	27.17	-54.55	73.91	26.09	-47.83
maintenance	82.98	51.06	-31.91	91.30	47.83	-43.48	9.68	65.22	55.54	13.04	60.87	47.83
motility	89.36	91.49	2.13	91.30	100.00	8.70	74.19	86.96	12.76	73.91	91.30	17.39
nausea	84.04	78.72	-5.32	91.30	86.96	-4.35	86.02	90.22	4.20	95.65	100.00	4.35
output	9.57	64.89	55.32	13.04	86.96	73.91	13.98	71.74	57.76	17.39	69.57	52.17
precipitate	70.21	56.38	-13.83	86.96	43.48	-43.48	59.14	68.48	9.34	60.87	69.57	8.70
predisposed	31.91	52.13	20.21	39.13	56.52	17.39	36.56	47.83	11.27	52.17	52.17	0.00
productive	9.57	46.81	37.23	13.04	65.22	52.17	17.20	54.35	37.14	43.48	69.57	26.09
puffiness	64.89	80.85	15.96	60.87	65.22	4.35	70.97	85.87	14.90	65.22	73.91	8.70
rebound	9.57	11.70	2.13	8.70	8.70	0.00	8.60	18.48	9.88	13.04	21.74	8.70
secondary	21.28	18.09	-3.19	21.74	26.09	4.35	24.73	17.39	-7.34	39.13	47.83	8.70
slow-release	55.32	45.74	-9.57	39.13	52.17	13.04	67.74	71.74	4.00	86.96	52.17	-34.78
steady	85.11	81.91	-3.19	91.30	86.96	-4.35	79.57	77.17	-2.40	91.30	86.96	-4.35
subsequent	50.00	48.94	-1.06	52.17	60.87	8.70	56.99	59.78	2.79	56.52	69.57	13.04
suffered	68.09	75.53	7.45	65.22	82.61	17.39	40.86	79.35	38.49	34.78	69.57	34.78
vomiting	74.47	67.02	-7.45	82.61	78.26	-4.35	66.67	80.43	13.77	60.87	73.91	13.04

Of the ten words that were the least well understood (when the words were presented in context, Part B) nine of the words were the same for both groups prior to and after the intervention. These words were acute, attack, depression, diurnal, epigastric, gnawing, intermittent, rebound, and secondary. This is concerning as it means that by the end of the

academic year (October) the ZCL2 students (varying from 95 to 50 per cent of the group) did not understand the meaning of these words which are commonly used in the context of Pharmacology (Table 4.36). Failure to understand the meaning of words used to contextualise and phrase the questions in a Pharmacology examination paper will lead to the student being unable to answer the question correctly and achieving a low grade that does not reflect their knowledge level.

9. CHAPTER FOUR SUMMARY

The extensive quantitative results from the study have been presented in Chapter Four. The relevant inferential statistical tests were applied in order to assess whether any differences between data sets were of statistical and/or practical significance. The data sets for the various variables have been presented in tabular form to allow the reader to gain a full understanding of the findings. Only relevant subsets of data were discussed in the text. The data will be interpreted and triangulated with the qualitative data in Chapter Six.

CHAPTER FIVE
QUALITATIVE RESULTS

1. INTRODUCTION

The results of the qualitative components of the study are presented in this chapter. There were two areas of the research project which generated qualitative data. These were data generated during interviews with focus groups held with samples of the ZCL2, ZCL303 and ZCL401 students, and data generated during recording of ZCL2 student group discussions during SI sessions at the start of and at the end of the intervention period.

The data collected during the focus group sessions (via audio recordings) were transcribed (Appendix G) and then analysed for dominant themes using Atlas.ti®. The results of the analysis will be presented in this chapter. All direct quotations from the transcriptions are presented in italic font. The recordings of the student group discussions during SI sessions were transcribed (Appendix H) and then analysed for type of talk. These findings are also presented in this chapter and, where direct quotations from the transcriptions are used, the quotation are presented in italic font.

2. FOCUS GROUP DISCUSSIONS

As mentioned above, focus group interviews were held with Pharmacology students in each of the three academic years of the BPharm programme in which Pharmacology modules (ZCL2, ZCL303, and ZCL401) are presented. The focus groups were held in order to obtain richer and more in depth data pertaining to the students' attitude(s) towards Pharmacology, their approach to studying Pharmacology, and to determine whether they had adapted their approach to studying Pharmacology as they progressed in the BPharm degree or

when compared to their approach to other modules in the BPharm programme. In other words the researcher wished to explore and understand more fully the study experiences of students progressing through the Pharmacology modules not only from the academic achievement aspect (see quantitative data in Chapter 4) but also from a more personal affective perspective.

2.1. Conducting the focus groups

Three separate focus groups were conducted. A focus group session was held for students from each of the Pharmacology modules ZCL2, ZCL303 and ZCL401. Krueger and Casey (2000) suggest a group size for focus group discussions of between six to nine participants while Johnson and Christensen (2004) propose that up to 12 participants would be acceptable, the groups sizes used for the focus groups were 12 participants for the ZCL2 group, 10 participants for the ZCL303 group, and 5 participants in the ZCL401 group.

The audio recording of each session was transcribed and then coded with the assistance of Atlas.ti®. In order to maintain confidentiality an alpha-numerical code was assigned to each student who participated in the focus group sessions and this code was appended to the end of each quotation/extract from the transcripts. The code consisted of the three letters representing the module Pharmacology (ZCL) followed by a numeral indicating the year of study (2, 3, or 4) followed, after a colon, by a numeral assigned to the student at the focus group session. For example the 4th student in the ZCL303 focus group session was assigned the code ZCL3:4.

2.2. Analysis of focus group discussion

Following coding of the transcripts using Atlas.ti® the main themes that emerged from the discussions were:

- Preconceived ideas about Pharmacology as a discipline;

- Current attitude towards Pharmacology;
- Language of Pharmacology;
- Approach to studying Pharmacology;
- Discussing Pharmacology with peers / group discussion; and
- Shifts in approach / attitude with academic advancement.

2.2.1. Preconceived ideas about Pharmacology as a discipline

In the four year BPharm degree at NMMU the second year of the programme has become known as the threshold year. More students seem to encounter academic difficulties during BPharm2 than any of the other years of the programme. Three of the modules prove to be more demanding than the others. The modules concerned are the Pharmacology, Pharmaceutics and Chemistry modules. Consequently there is much talk directed at the nascent second year students by the more senior students concerning the difficulties to be encountered during the second year of the BPharm degree. Pharmacology has apparently been labelled as one of the problematic modules and Pharmacy Department personnel are aware that horror stories circulate on an annual basis at the start of each academic year. Although one student mentioned that they had not heard anything specifically about ZCL2:

> *I don't remember anybody telling me about Pharmacology before I went into second-year, mostly just people saying that second year itself was tough. They didn't single out Pharmacology (ZCL3:4)*

The reported negativity of senior students was supported by ZCL2 student comments during the focus group session:

> *...before we started last semester, because I have some third-year friends and they really scaring us about Pharmacology, how difficult it is (ZCL2:11)*

> *...when you get into something you have your preconceived you know opinion just like when you said "did you hear something when you were taking into*

second year" and so on. We were told how challenging second year would be for all of us and all that (ZCL2:2)

Of course we heard a lot of stories sometimes from lecturers and then from second years and senior students saying that Pharmacology it's a scary subject, it's challenging, this and that. (ZCL2:1)

Student ZCL4:1 stated that the stories told by the more senior students about the difficulty level of Pharmacology had a profound effect on her during second year:

Coming into Pharmacology, I was enthusiastic and I really loved the subject, but people were like "no it's so hard, and it's difficult and people fail it" and was all this negativity towards Pharmacology, which gives you this initial stress and now you start worrying, even though the thing makes perfect sense when you go through it, you have this mental block . . . "It's hard and I'm going to fail" and people say it's this and that. Yeah that was a big challenge for me. Just listening to people and friends . . . Bad advice. (ZCL4:1)

This comment was supported by a student (Student ZCL3:1) who attended the ZCL303 focus group discussion:

Actually I don't think it's a good idea to listen to any of the people from other years, because they just totally derail you (ZCL3:1)

This preconception, inculcated by the senior students, that Pharmacology is difficult predetermined many students' attitudes towards ZCL2:

I think that most of us, our attitude towards Pharmacology was moulded by listening to people who have done the years. They will tell you "no this thing is so difficult" and once you are there you sort of, you've got this fear, you will fail this thing (ZCL3:3)

When I first started, when I finished my first year and started my second year there was a lot, a lot of information I got from people who had moved on, about Pharmacology. It was horror story upon horror story about how difficult… How you really, really, if you make it through second year, yoh, yoh, its…… You done, you might as well go and graduate because it..... So it

became a self-fulfilling prophecy because you got into second year thinking yoh, it's difficult. When I'm studying for Pharmacology, then, in second year I'm thinking okay there is a very high possibility, the percentage, the chances of me not passing this is in the 90s, the 90th percentile, so it becomes a self-fulfilling…… It cripples you (ZCL3:1)

Statements by some second year students revealed that they did not want to seek insight into a Pharmacology query from senior student due to the negative perceptions they spread:

Senior students I think they were quite creepy about Pharmacology and everything and I think, I don't know if it's I let's say I need like to ask someone a question I wouldn't think about now the second year student as you know, you'd prefer someone who has experience you know but I'd rather ask someone that also doesn't understand. Then you can just work things out. I don't really have confidence in the senior students. They are not quite encouraging so I just keep my distance yah (ZCL2:10).

I don't think it's a good idea to get advice from other students about, especially about Pharmacology. If you have a problem rather consult the lecturers, because at least they not going to demotivate you and tell you "oh no you just going to fail anyway" (ZCL3:1)

I think that most of us, our attitude towards Pharmacology was moulded by listening to people who have done the years. They will tell you "no this thing is so difficult" and once you are there you sort of, you've got this fear, you will fail this thing and it makes it unenjoyable (ZCL3:3)

In contrast to the above there are many students who described how the negativity of the senior students acted as a stimulus to work harder and to prove that they would be amongst those that passed:

But it kind of depends as well, for some people like just telling them it's going to be difficult like it just gives them another approach. Then they say "no, then I'm going to concentrate more on this subject, in terms of the other subjects

they try to neglect. And then Pharmacology they say "no Pharmacology is like a difficult subject so let me try and work harder on it" and like, like I would take it as a challenge. (ZCL4:5)

I think that the initial stress is important to actually know that "okay this is a difficult subject, let me rather tackle it like more in depth and then get it going". And then as soon as you know how you doing it and then to just the way you want to do it. (ZCL4:5)

...tell you "oh no you just going to fail anyway", you know. It's actually improved my own attitude towards the studying as well as the thing, of the course itself (ZCL3:1)

I found that in second year because I had like "the fear", that I went into the year, I've got three Pharmacology textbooks and I refer to every single one of them and make notes, and I absolutely killed myself by working that hard to not fail (ZCL3:7)

Other students thought that if some people (including those who were spreading the horror stories) could pass then why couldn't they:

They were just saying Pharmacology is difficult and challenging and I said "okay most people passed it". So it's possible for me to pass it, and secondly for me it's exciting because the attitude that you take is very, very important especially when you study it so for me it's actually an exciting subject (ZCL2:1).

I killed myself studying, and I told myself you know what if other people can just do it there's no way in hell I'm going to just let other people demotivate me and tell me that no it's so hard, blah blah blah, you just going to fail and things like that (ZCL3:1)

2.2.2. Current attitude towards Pharmacology

Although, as discussed in the previous section (Section 2.2.1), there were negative perceptions about Pharmacology created by the more senior students there were still many

students who enjoyed Pharmacology and found Pharmacology to be a fascinating discipline and were quite passionate about the discipline of Pharmacology:

> *Pharmacology to me is where my passion is. That is the section the subject that I want to know more. It excites me to know just like you saying how drug works, when it interacts with the human body. So I am eager to know more (ZCL2:2)*

> *I actually view it as an exciting subject because we are now, I mean I've heard a lot about drugs even before I started Pharmacy but now here I am in this Pharmacy class and am actually studying the way those drugs work in my body, so for me it's sort of exciting, you know and it makes me….The reason why it gets me excited is because I'm actually gaining something, a knowledge that, it's like so many people that the drugs but they don't know how they function they don't know how, what happens really after taking a drug. So I just excited you know imagining taking the drug and then it goes into the liver metabolism and then absorption (laughter) yah seriously looking at it (ZCL2:1)*

> *Yah Pharmacology. (Laughter).Umm….I think I can say Pharmacology is a beautiful subject but it doesn't get its deserved time from students. I think it deserves much more. If it were from me I think I would be doing Pharmacology only because I mean it's amazing, beautiful (ZCL2:10)*

> *It is easily my favourite subject to learn, mostly because the sections we doing this year are specifically interesting to me. Like all of the CNS stuff we do and the opioids and things like that (ZCL3:4)*

In contrast several students stated that they did not enjoy Pharmacology. This was often linked to difficulties experienced with understanding the material and poor academic achievement:

> *I don't enjoy learning that because I don't understand it. The language in the textbooks for those chapters, are just….And the chapters along, and it's over my head (ZCL3:7)*

The thing with me, Pharmacology and I just don't gel. And because of that I hate it, I hate learning it. I make my notes and make cards, I make this and I make that, I can't learn it. And if I learn a section, I learn it and then I'll think okay I know that, and then I learn the next section and if I think back to the first section I can't remember anything. And like then I like I fail every test. So there is no motivation I suppose (ZCL3:8)

So applying Pharmacology to me is totally difficult really I have to say. It's like I can't add one and one and make two out of it. It has to be something straight and forward that is how, that is the problem I have realised I have with Pharmacology. Though I thought it was just going to be a very fun subject on knowing the body and knowing that drugs and how they work, but it has proven so far to be a challenge to me compared to you know the calculator subjects, chemistry and others. So that's what I have realised (ZCL2:8).

As mentioned by student ZCL3:5 students found it hard to be positive when the input in terms of studying failed to match up with good test results:

I think it's also very demotivating if you like take all the time, study for two or three weeks, non-stop, have no life, and then you go and fail it (ZCL3:5).

Still other students were ambivalent about Pharmacology as although they enjoyed and found the material presented interesting their academic achievement in the module was not at the level they would have liked to attain:

...first of all I would say Pharmacology to me is a subject that I like very much and uhh and I wouldn't say so far that I really enjoyed it the way I would love to or maybe my performance in it.(ZCL2:2)

Academic advancement coupled with an improved understanding of the subject matter seemed to generate a more positive attitude towards Pharmacology:

I think from second year I didn't…., it was like a new subject we hadn't done any of it yet so I found it quite hard to learn and then I didn't really learn it that well, and then now in third-year I understood it a lot better, and I enjoy it

so my learning got a lot better towards it. Like I enjoy learning for Pharmacology (ZCL3:6)

Improved academic achievement in a student (ZCL2:4) who was repeating the module after failing the previous year also resulted in an improved attitude towards Pharmacology:

So now like the attitude towards studying Pharmacology. Firstly it built up with a fall. I failed and then I went back asked Mrs Boschmans and I spoke to her and she gave me a study plan, I mean she advised me to set out a study and I went that. For me, I improved in the tests and all … Yah and so the attitude changed (ZCL2:4)

Several students provided reasons for their positive attitude towards Pharmacology. The reasons varied from the altruistic:

So you grasp the value of Pharmacology because when the patients come to you, they come to you with hope; they have no hope. They come to you and they sick and they want information and you can take your knowledge of Pharmacology and you can say you know Corenza and that's phenylephedrine. All the stuff and you know it runs through your mind you don't say it out loud. You say yeah it will help you, but you confident. You know there's a lot of pharmacists liking my workplace there is a lot of people who didn't have the opportunity to study Pharmacy so they don't have that knowledge, so then you appreciate it more and that plays a major role in your attitude towards Pharmacology as well because to look at it we very few, especially like me for living in South Africa (ZCL2:4).

To financial/job related reasons:

There's a lot of job opportunities in Pharmacy so that plays a major role in my like Pharmacology, my attitude comes from there, the money and everything (ZCL2:4)

To a benefit derived from Pharmacology being the development of a good work ethic:

> *It keeps you disciplined, yah, and I think it does bring in a kind of ethic, like work ethic, that orientates you towards a way that….I don't know how to say it, it's, but its a way, it just orientates you towards a more, you know you have to get to work done, and there's no other option you know, so you had to take the work done you know, that's the bottom line (ZCL3:9).*

The positive attitudes of the ZCL401 students were linked to the experiential learning that takes place during the ZCL401 programme. The students could see the direct link between participating in hospital rounds and ward Pharmacy during the ZCL401 module and an advantageous ability to function effectively in the workplace after graduation:

> *I think that's just what the hospital program, that's what creates the interest for us to maybe then think of a clinical sort of role because now we understand what it's about and if you good at applying stuff like that, then you know it could be like a possible career thing for you if you haven't sort of been applying that before you go into the workplace, you get to a clinical setting and you like "I can't do this" (ZCL4:3)*

> *I think if you are looking at a person who would want to go into clinical Pharmacology, to go to an institution like that, you would be massively disadvantaged, I feel, because then you would have to then go to hospital and then learn all that stuff, and now where we have done it, had the opportunity, we'd be so much more prepared to go into that sort of line of work and we'd be prepared . . . . (ZCL4:3)*

The ZCL303 students, who were the group who engaged most actively during their focus group session, in comparison to the ZCL2 and ZCL401 students, generated an interesting discussion about the NMMU Pharmacy students' perception that the standard of Pharmacology at NMMU was higher than the standard at other universities.

> *The other thing that makes me mad is that other universities like for example Rhodes they only start Pharmacology in third-year others like Wits, they have multiple choice for their exam questions, that really, really makes me mad*

because it feels like we not going to ever be on the same level. They just going to have like a skimp knowledge of you know that Pharmacology, and we are expected like really, which is a good thing I'm not saying it's a bad thing.. (ZCL3:2)

…really it just makes me really, really upset that those people have it easy, it's a breeze, it's a walk in the park. Pharmacology for them just 1,2,3,4 oh that's just it, you know (ZCL3:2).

I have a friend from University X, the play basketball with. She was telling me that like when..... It's just ridiculous I was studying for my second test during one of the games, so she was telling me that like all the topics that we did for example this year, they squeeze it all into six months to try and get all the work done. It's just ridiculous because they just like scratching on the surface. You speak about something and they have absolutely no idea what you're talking about (ZCL3:1)

The response of the other ZCL303 participants in the focus group was one of pride:

That's why we rated the best in the country.... (ZCL3:7)

Instead of giving us a BPharm um give us an APharm (ZCL3:4)

An A class Pharm (ZCL3:9)

2.2.3. Language of Pharmacology

On first encountering a technical discipline such as Pharmacology a student is required to not only understand the concepts embedded in the discipline but must also understand the language of the discipline. Thus Pharmacology requires the acquisition of many technical/scientific terms (Yuksel & Mercanoglu, 2010). Discussion that emerged during the focus group sessions illustrated that, at least initially, the students viewed Pharmacology as a foreign language:

When you start off in second year things seem a bit foreign (ZCL4:1)

So if you try to understand what is going on there and you don't understand the language of pharmacology, now you just lost between the two buildings. (ZCL4:4)

Facilitator: So basically you're saying it was like a new language.

Yes definitely (students concurring) (ZCL3:All) and sometimes it still is, you learn new things every day (ZCL3:3)

It's like going to study in Cuba, then you first have to learn how to speak for a year and then study in Spanish (ZCL3:2)

In order to cope with the acquisition of the language of Pharmacology during ZCL2 students actively collected vocabulary:

in second year I made like a list of like if it started with Hypo then it's too little or hyper then it's too much and stuff like that .....(ZCL3:7)

There seemed to be a general practice of looking up the meanings of words in order to better understand the material:

If I come across a word or side effect I don't know then I immediately look at up and write it down, but like I don't always remember them (ZCL3:7)

Students also realised that Pharmacology is a very technical discipline where the meaning of words is crucial to gaining understanding and knowledge:

Because like to me it's very precise wording that does…, (ZCL3:5)

However, there was agreement that experiential placement in community Pharmacy did help in acquisition of the language of Pharmacology because the student was exposed to some aspects of the language of Pharmacology in a context. The contextualisation assisted in the gaining of knowledge:

It also the words you come across, for me it's like I been working in Pharmacy for a while so those words sort of will stick with me much better but in second year especially, when you start using all these drug names you think "oh my

word" I'll never remember all these names and that's also the scare factor when it comes to pharmacology is the language that you talking (ZCL3:3).

Yah unless you've worked in Pharmacy you never going to come across some of those words, because even in retail they use retail names and not the generic names or active ingredient names (ZCL3:3).

Working definitely helps though (ZCL3:6).

There is a lot of stuff I remember from working, like I just remember . . . . (ZCL3:5)

Another aspect with which students encountered difficulties was making sense of the side effect profiles of the various pharmacological agents. This required the acquisition of the required vocabulary so that learning side effects was not simple parrot learning of words whose meanings were not known to the student:

I think differently in the beginning, with all the names, with all the different side-effects. Like the lecturer will just .....all these side-effects you don't know what they are, I know now but..... (ZCL3:6)

The students realised that acquisition of the language of Pharmacology was an essential tool required so that a fuller understanding of the discipline of Pharmacology could be achieved. They suggested that the acquisition of the language was the key to fuller understanding and discussed how useful a course on medical terminology would be:

Also another thing that puts us at a disadvantage is the subject matter, most of those words are derived from those languages, and it's easier to understand or to work out what something means if you have that Latin background (ZCL3:1)

I think that would help a lot if we were provided with a small course with the suffixes and prefixes... (ZCL3:4)

Facilitator: Do you think it would help to have medical terminology.

Lots of students concurring. Definitely. Definitely. Just a semester or term course (ZCL3:1&3)

2.2.4. Approach to studying Pharmacology

The ZCL2, ZCL303, and ZCL401 students demonstrated a variety of learning styles when assessed using Kolb's LSI (Table 4.29). One would not, therefore, expect to find uniform approaches to studying Pharmacology. Different learning styles tend to prefer different study methods. Divergers prefer working in groups and using their imagination to solve problems, assimilators prefer lectures and referring to text books, convergers prefer learning through practical experience and accommodators prefer to work in teams involved in learning through practical application (Smith, 2001). Some of the students participating in the focus group discussions preferred writing notes/summaries and using the text books for additional material:

...all I do for studying is basically do is write it down and the more I rewrite it the more I know it. I mean this whole year basically after the lecture I go and just rewrite it. I have a full. . I'm trying to think . . Those big black books, I've got a full one of those with just pharmacology, just summaries (ZCL3:4)

...this year I tried to focus on the notes more, and if I don't understand something I will go to the textbooks then, and try and figure out how it's done, or what the notes is saying(ZCL3:4)

I don't use mind maps. I just take the notes, I put it down and then I read, I read the stuff from the slides and then you've I don't understand something or I think that the lecturer emphasised something in class then I go back to the textbook and look at it. If there's anything extra that needs to be put in I put it there and get on you know, there's just so much work and you don't want to spend so much time on one slide and at the end of it you don't get a question from it in the test and whatever you have not looked at, you get a question (ZCL3:9)

…what I do is then I take the notes, the slides that we given and then I'll take my Rang and Dale and my Katzung and I will try and make the concept a bit bigger than what the lecture slides give, you know add more to it you know and then I summarise I have my own books that I summarise in because I find it very difficult to study from you know looking at notes and then looking at other you know class notes that are handwritten and then to textbooks and SAMF as well. So I'm try and get it all into one and then I rather study from that and I find it much easier because I don't know I remember things better when I have my own way of structuring things that pretty much how I go about it. And then sheer number of times that I read over it is just how I learn. I know some people say things or speak it out not for me I just read it, learn it. That's how I go about it. (ZCL2:5)

Other students preferred a more visual approach and used mind maps and/or diagrams:

I think that for pharmacology mind maps are really really really helpful, from second year, third year, and now. Mind maps are like lifesavers.(ZCL4:1)

My problem initially was in second year was mind maps. It was a foreign concept to me. I struggled in second year I think because of that. Third-year I have been using mind maps and my marks improved dramatically (ZCL3:3)

Like to make it more visual. Like everyone says, like I have mind maps on my wall….It helps a lot (ZCL3:6)

I put all the important things like the mind maps on my cupboard and probably like two days before I'll just read that repeat it over and then it gets in my head. mind maps for me was a total foreign concept. When it was introduced to us I tried to use it for other subject but it doesn't sort of gel with them, but with pharmacology it's mainly there to help you, because everything is nicely summarised and you sort of understand. With my mind maps I'll even go further I put the mechanism of action in there, small but at least I can understand so when I look at the mind map I have all my classes plus my mechanism of action and if there is space I'll put in side-effects and drug interactions as well (ZCL3:3).

I like my visual things, so I will normally draw diagrams, especially when it comes to mechanism of action, and try to incorporate the physiology of it as well, to make me understand how the drugs work a little bit better (ZCL3:3)

...I put all the important things like the mind maps on my cupboard and probably like two days before I'll just read that repeat it over and then it gets in my head (ZCL3:6)

Auditory stimulation was the preferred approach of another set of students:

...being in class helped me so much because even if I haven't read and the question comes and I remember the lecturer saying how it happens, I intend to recall much better than when I read it and try to explain to myself (ZCL2:8)

...my strongest point is when I listen in the lecture and when I go home like I didn't understand that and then I go over it (ZCL2:3)

I mostly rely on listening in the lectures and asking questions like maybe when my friends are discussing and all that, then I listen (ZCL2:3)

But another thing I realise, there is some lectures I actually enjoy. If I enjoy that lecture I will listen in class, and if explain about, I'll remember it much better. In the exam I'll even be thinking, no but you know she actually said this, and this, and this. You know what I mean, like it helps with my recall better (ZCL3:2)

Application of the theory either during practical sessions, at a clinical site, or during experiential placements was favoured by still other students:

I found that working in the Pharmacy, having to do our hours from second year. That for me was a really big help because you get to apply what you learn in the lecture is when you go and work. At the Pharmacy that I'm working I'm lucky because I work a short evening shift, so I can work during the week while I'll be going to lectures during the day. When you see the drug class that you doing in the lectures and you see it in practice, it sticks a lot more than just learning it out of the textbook. (ZCL4:2)

The rounds are actually is so effective that once you've seen a condition in hospital, even if you never go back to studying it, you remember it. Even for the open book we had recently, I was speaking with another classmate and she was telling me how just from her round at EDH she could remember the whole section on psychosis and she . . The hospital rounds actually just helped her answer that question perfectly because you know she had seen the patient, she had seen the scripts, she had seen how the conditions are managed and so, yeah, once again it just helps you, it sticks a whole lot more when you actually seen it or been there or if you . . . (ZCL4:1)

...the practical I think they really help because it gives you a time to go through your work, and do the mind maps and answer the questions and the application questions and they are very helpful (ZCL2:12). Yeah, I think that's my experience. (ZCL2:12)

...ummmm I think in pharmacology . . . This program that we had to work the externship, I think it's really helped, because when you actually go to the Pharmacy setting and you actually see the drugs and you actually see that this one is used for this, and then you think about class and what you doing, it actually helps. So, yah, I think it was a very good idea because now you actually know the drugs, you learnt the new drugs and you can, you even know the new trade names and all that and it actually helps you to know that this drug is for this (ZCL2:12)

Another study technique used by students was flash cards. A flash card is an index card with the drug name written on the one side and relevant information pertaining to the drug on the reverse side. The information would typically include pharmacological class, mechanism of action, clinical uses, side effects, and contraindications. The student would use the flash cards to test their knowledge. The added advantage being able to shuffle the cards so that the drug names are presented out of context:

...flashcards helps in a way because if you don't understand something. The way you study flashcards because you are jumbling all the different sections. When you study you study and sort of in the test you try to remember what

comes after each other. With a flashcard system you can learn something about SSRI's and the next flashcard is something about SNRI's for instance. In that way the stuff sticks much better (ZCL3:3)

And I also make flashcards (ZCL3: 1&2 at the same time)

Although there were several study methods preferred by the individuals the majority believed that the key to Pharmacology was understanding the material. This understanding started with the pathophysiology of the specific condition and continued into understanding the mechanism of action and side effects:

Okay I prefer to kind of grab the concept of it, rather than cramming. I have to be able to logically understand why this drug is used, to be able to remember its name and how it works. I can't just remember facts. So that's how I prefer to study, so in other words I can't cram, so I have to start way beforehand, yeah . . . That's all I can think of for now. (ZCL4:2)

With pharmacology you have to do a lot more understanding than actually parrot fashion, because there is no way that you can study pharmacology parrot fashion, it's just not going to work. Specifically when you working as a pharmacist once you qualified, you going to have to remember all this knowledge, so you can't remember your list of five reasons why this and that, so you have to . . . You have to understand why it would cause that, so you can think up maybe the possible side-effects, because you understand the underlying reason or how it works. Yeah with pharmaceutics you can't do that. (ZCL4:2)

...the second semester of second year, I decided no you've got to understand, like the mechanism of action, to work out adverse effects and things like that. So I can sit in a test and I can think mechanisms of action and I can make up side-effects, well not make up, but I can work out side-effects in my head (ZCL3:7)

The extent to which text books were used varied amongst the students. Some students preferred using more than one text book as the two books often explained a concept from a

different perspective which made it easier for the students to master the concept, while some students seldom used text books:

> *I only got to the textbook for mechanisms or if I don't understand what the notes say (ZCL3:5)*
>
> *Some books explain some other things in a different way, they give you a different perspective on this (ZCL3:1)*
>
> *...so that I can at least write notes on what Katzung is saying and what Rang and Dale is saying on the same topic (ZCL2:7)*

During the ZCL303 focus group session an animated discussion developed on the hierarchy of the recommended text books:

> *I think Katzung, the language in Katzung is more scientific then the language in Rang and Dale, but I prefer, if I don't understand something I will go to Rang and Dale first and then go to Katzung and see how it does (ZCL3:9).*
>
> *Katzung is very upper-class, Rang and Dale very middle class and Lippincott is a lower class…."We've made little pictures for you" (ZCL3:4)*
>
> *That's what I like about Lippincott! (ZCL3:1)*
>
> *I've never looked at it (ZCL3:9)*
>
> *It's worth it yeah. (ZCL3:1)*

One of the ZCL2 focus group participants echoed the ZCL303 discussion from a different perspective:

> *The way I studied…… The textbooks Rang and Dale and Katzung, and they are too big, They contain a lot of stuff. So for me most of the time I'm lazy to read those. So I actually settled Lippincott that's the one that I use most during my study times (ZCL2:1).*

Participants mentioned that they used different study methods for Pharmacology compared to the other disciples in the curriculum. Their premise was based on the fact that

for Pharmacology they had to understand the material and could not simply rote learn the material:

> *Definitely (a number of students concur) because whatever my studying skills are for pharmacology I can't translate them into any other module and vice versa. For the previous pharmaceutics..... The previous test pharmaceutics, to be quite frank I think I studied for two days. I think the day before and the day of the test which is not healthy, it worked out well, but you cannot do that for pharmacology, you cannot do that, but even a week before, for me I need a minimum of a month, at least to start (ZCL3:1)*

> *Yes I think it's something that physically forced onto you, you have to do it for pharmacology. You study differently for chemistry then what you do for pharmacology (ZCL3:3)*

> *It works differently, with pharmacology you have to understand, with pharmaceutics you just have to remember, because yah so don't really have to understand anything (ZCL3:6)*

> *There is no I can't study pharmacology the same way we study probably any subject that carries less weight, and expect the same result, so I have to give it more time. So for me this semester I decided that I'm going to change the way I study. I'm going to give pharmacology more time because it's the only way I can know it more and improve my performance (ZCL2:2)*

> *But now I have to change it because it's not working. Yah I need more time for the subject because this is vast, because in a lecture you cover so much, and so much information given. You need time to go through that again and again, to digest that information. It's not like that in other subjects. There are some subjects I can lie on my bed, cover my hand-outs and read, yes!, And then go and write it and pass, and I will still remember. I can take just a topic in pharmacology and spend two hours trying to reason out how does this really happen, you know. So that's where the difference comes (ZCL2:2)*

> *Okay my other approach with pharmacology it's that I . . . . I don't read it the same way that I read say chemistry, because in chemistry I feel like we have*

many past papers, so I can just read like go through my notes like use my notes as reference sometimes. Just go through them once or twice and then if I am like able to do so many papers, and then I go to, get to see what questions they ask and how to approach them. Yah I feel more confident. But in pharmacology since we don't really have question papers. So You actually have to read your work and understand it because yah because I feel like subjects like chemistry most the time, like (name) said you read just to let pass. Yeah that's usually most people's approach. So you just do as many past papers as you can, because you know when you do that, you go to the exam and it'll probably just going to be the same thing. But in pharmacology it's a bit tricky because you have to know the stuff, yah (ZCL2:12).

Time issues and time constraints were a constant issue and many students stated that if they had more time to devote to Pharmacology their achievement in Pharmacology would improve:

...for this year, in my case, I spent more time trying to enjoy hospitals because I can't like back out of the reading of pharmacology. So maybe if that is integrated before like second or third year then people would just like know how to manage their time and stuff. Probably for me that was a bit of a hassle, managing the time and going to hospitals and coming back home and trying to open textbooks in the learning and then we have other modules to prepare for. Portfolios and etc. So it was a bit of a juggle. (ZCL4:4)

Well how I study pharmacology is I have set times otherwise it becomes very difficult to try and fit something in you know we all say there is not enough time for everything it's quite true so I've made times when I study pharmacology. I'll study on a Monday night, a Wednesday night and Friday night and those are obviously the days we have pharmacology (ZCL2:5)

...you feel like that you would have learnt more, it's just that you didn't have time for it. You would have learnt more but you have to consider; okay you definitely have to put time for everything else but you feel like yes you understood the stuff…… that….That you would have understood it better if you would have probably structured your time better or something (ZCL2:12)

...you want more time. (ZCL2:12)

...pharmacology is a beautiful subject but it doesn't get its deserved time from students. I think it deserves much more. If it were from me I think I would be doing pharmacology only because I mean it's amazing, beautiful (ZCL2:10)

2.2.5. Discussing pharmacology with peers - group discussions

Peer group discussion, implementing the didactical approach of exploratory talk, was introduced during SI sessions for the ZCL2 students. Thus, not surprisingly, the topic of group discussion arose predominantly during the focus group session with the ZCL2 students. Students were greatly in favour of discussing Pharmacology with their peers:

But the thing I found you know that to be most useful, is usually group discussions and also SI (ZCL2:1)

I think pharmacology, for me a good way of approaching it is like a lot and a lot of questions. It helps and a lot of good discussion, it helps (ZCL2:10)

...the thing is like discussions. Discussions really, it has been very beneficial to study in groups. When you study and ask questions and discuss it, that's when you realise "oh I didn't even know this". Or I didn't even know I can understand this. So study groups have been very, very beneficial and if more students in the class would really understand that that is useful, I believe they are going to exploit that opportunity. Because pharmacology to me is not a subject that you just sit down and read and read. It's something that is interactive. The times I spent in the SI I can actually tell myself that I learn better than when I was not able to attend it (ZCL2:2)

...really help because you can be reading day in day out but once you just have like one discussion with your friends, you figure that you actually knew the stuff when you actually say it out and it actually sticks in your head better than just constantly reading all the time (ZCL2:12)

now we started group discussions with two of my friends, we have group discussions….And It's helping me a lot because it encourages me to read, now I'm realising that it's not that I can't remember things if I read them a week

before it's just that I didn't know I can actually remember. So the group discussion is actually helping me (ZCL2:11)

I prefer the new way of doing SI. The discussions work much better you learn a lot during the discussions. (ZCL2:8)

Some of the ZCL303 students also commented on the benefits of group/peer discussions:

I have a couple of friends including (name), and we just sit and discuss. We discuss any possible questions that like the examiner could ask us (ZCL3:2). We try and get into the lecturers head and see… Okay what could she really ask us on this. You wouldn't believe how much it actually helps. It helps quite a lot (ZCL3:2)

2.2.6. Shifts in approach and attitude with academic advancement

Having reached the second semester of the fourth year of the BPharm programme it was not unexpected that it was during the focus group sessions with the ZCL401 students that comments about how the approach to Pharmacology changed with academic progression arose. Students felt that the clinical exposure experienced during ZCL401 allowed them to see the bigger picture and suddenly everything made sense:

But now in fourth year like everything is coming together and I'm thinking " but I didn't understand this in second year". Now it's like "ag it's so easy". Yeah because now things just . . . the puzzle is complete and all the pieces fit. In second year it was like random pieces and it was like "okay". (ZCL4:1)

so this year with hospital hours it was more like easier for me to understand the pharmacology because everything just falls in place. It makes sense to me now. . . (ZCL4:4)

…pharmacology came together for me this year was looking at the patho with and DiPiro like just made it so easy this year. (ZCL4:3)

This year, like I said it's a lot of integration and everything just comes together and makes a whole lot more sense. When you go physically to the

sites and hospitals and even when you are studying things fit because now, you see we did hypertension in second year but now we are doing arrhythmias in fourth-year, but then drug classes, beta-blockers, calcium channel blockers, they all fit together, we can see "oh this is for this and also this and everything is so connected but in second year it was very abstract, everything was standing on its own, (ZCL4:1)

you like bring everything together, like it's an overall picture, instead of like just chapters in small boxes, you like put everything together, so this links how to this other chapter, oh this it's used in that other chapter as well, so why is that. So it brings everything together, like now I can see the overall picture of why we studied everything. But in second year and fourth-year it was just like we did not say how this is second year work, we are not going to be asked about that that's third-year work, that's antibiotics, that's got nothing to do with other medication but it's not actually that. A patient is treated with everything possible to treat conditions. It's not about treating only a disease it's about treating a patient with all the medication that we know. (ZCL4:5)

However, some ZCL401 students felt that their approach to ZCL4 had not changed and that they used similar study methods in ZCL401 to those they had used in ZCL2:

No, I don't think it changed because it was more or less the same, you need to learn in advance.(ZCL4:4)

Second to third year we were a bit more mature like we know when, where you like lag behind and then you like try to focus on these areas. Like how to study. But in terms of the studying it's just the same thing.(ZCL4:5)

2.3. Summary – focus group discussions

Valuable information on the lived experiences of pharmacology students was obtained from analysis of the focus group discussions. The more dominant themes that emerged from analysis of the focus group discussions were:

- Students entered ZCL2 with a preconceived negative opinion of pharmacology which derived from the more senior students. This affected the student's attitude

to ZCL2 in one of two ways, either the students believed that it was impossible to pass ZCL2 and almost gave up before starting the module or the student rose to the challenge with the desire to prove that they could conquer ZCL2;

- There was conflict between the perceived difficulty level of pharmacology and the students' interest and fascination with the subject matter of the disciple. By the time the students reached the ZCL401 module in which there is extensive experiential learning the majority of students had a positive attitude towards pharmacology and voiced enjoyment in the module;
- All students reported that pharmacology was a discipline with a specific language: "So if you try to understand what is going on there and you don't understand the language of pharmacology, now you just lost between the two buildings." (ZCL4:4). This lead to students in the module ZCL2 actively collecting vocabulary as a means of coping with the language of pharmacology;
- A variety of study methods were employed by students but, according to the students, the key approach, no matter the study method employed, was to understand the material. Success in pharmacology could not be achieved using rote or parrot learning. The use of mind maps when studying and revising pharmacology was a common method. This approach is a technique which is actively taught to the ZCL2 students during practical sessions thus it was rewarding to see that the use of mind maps was continued throughout the three modules;
- The ZCL2 students were strongly in favour of the use of group discussions as an approach to learning and understanding pharmacology; and
- The ZCL401 students who were completing the third year module of pharmacology in the BPharm programme voiced the opinion that they were now

able to see the big picture in terms of pharmacology, everything had fallen into place, and that they now had a better understanding of the study material. A fuller and more meaningful understanding of the module was achieved with academic progression.

3. EXPLORATORY TALK

The introduction of exploratory talk during the SI sessions was the intervention employed in this study. Prior to the intervention the SI sessions were conducted in a typical lecture format with the SI Leader (a senior student) standing in front of the class explaining various concepts and answering questions. The lecture format is not the approach recommended by the SI division but since SI sessions have been presented for ZCL2 this has been the approach adopted by the SI Leaders. As the SI Leaders are senior students registered for the BPharm degree they do not have any teaching experience and find it less demanding to use this approach. It is after all the predominant didactical method they would have experienced as Pharmacy students.

Prior to the start of the intervention period the researcher, with the assistance of an academic staff member from the Education Faculty who is experienced in the use and introduction of the didactical approach using exploratory talk to nurture learning, introduced the SI Leaders to the concept and a suggested approach to employing exploratory talk during SI sessions.

At the start of the intervention period the researcher and the SI Leaders briefly introduced the students to the concept and practice of exploratory talk and initiated group discussion amongst the participants. The students were encouraged to use exploratory talk during the sessions. The intervention study ran from May to early October 2011.

3.1. Recording group discussion during SI sessions

After initiating group discussions at the start of the intervention period a five minute segment of group discussion from four groups of ZCL2 students present at the SI session was recorded. Thus a total of four audio recordings were made. These recordings were labelled *Group Discussion May 2011 Group 1, Group Discussion May 2011 Group 2, Group Discussion May 2011 Group 3, and Group Discussion May 2011 Group 4.* The recordings were subsequently transcribed (Appendix H). Recordings of group discussions were also taken at the end of the intervention period in October. Five minute sections of group discussion were recorded from six groups. A high level of background noise present during the first two recordings raised concerns about audibility of the recorded material so a total of six recordings were made to ensure that four could be transcribed. However, all recording made in October were audible and therefore, all six recordings were transcribed. These recordings were labelled *Group Discussion Oct 2011 Group 1, Group Discussion Oct 2011 Group 2, Group Discussion Oct 2011 Group 3, Group Discussion Oct 2011 Group 5, Group Discussion Oct 2011 Group 5, and Group Discussion Oct 2011 Group 6.* The recordings of the group discussions were transcribed (Appendix H). For purposes of transcription and to ensure confidentiality the participants within a group were identified with an alpha-numerical during transcription. The code consisted of three letters (INT for the initial recordings at the start of the intervention period in May and END for the recordings at the end of the intervention period in October) followed by the group number and terminated after a colon with the numeral assigned to the participant during transcription. For example the 3rd student to speak during the recording of Group 2 during the October recording session would have been coded as END2:3.

The student groups formed during SI sessions for discussion purposes were fluid and did not contain the same students at each session. Attendance of SI was on a voluntary basis

and thus not all students attended the sessions and not all of those who did attend attended every session. Therefore, the groups recorded at the start of the intervention period did not contain the same students as the groups recorded at the end of the intervention period.

3.2. Analysis of group discussions for type of talk

The last three minutes of each transcript was analysed for the type of talk. The initial two minutes of each recording was not analysed to allow the students to become used to the presence of the microphone and thus prevent bias.

In order to ascertain whether the type of talk employed by the students had changed at the end of the intervention period when compared to the type of talk used at the start of the intervention period the transcripts were analysed to determine whether the communication could be defined as:

- Disputational talk;
- Cumulative talk; or
- Exploratory talk.

Following analysis of a transcript for types of discourse presented an overall classification for type of discourse was assigned to the recording. The classification was assigned by determining the dominant category of discourse present. As qualitative methodologies were employed quantification was not applied. To illustrate the type of talk that occurred portions of the transcripts are presented in italic font in the left hand column, while a description of the activity and analysis of the discourse is presented in the right hand column.

3.2.1. Group discussion at the start of the intervention period

There is a scarcity of literature on the analysis of language used by university students during peer discussions. However, Attwood et al. (2010) did investigate language use for type of talk in psychology classrooms across all levels of the degree programme. Unlike the current study students were not coached on the different types of talk or encouraged to use a particular type of talk prior to the analysis. The findings of the Attwood et al. (2010) study were that discussions that occurred in the first and second year psychology classrooms were mostly disputational or cumulative and at the fourth year level the discussion that was encountered was exploratory in nature (Attwood et al., 2010). In the current study the target group were second year students. As mentioned, in Section 3.1, the ZCL2 students had been briefly introduced to the desired type of talk (exploratory talk) prior to the initial recording session at the start of the intervention.

Of the four recordings made the discussion amongst the group members in Group 1 was mainly exploratory in nature while the discussion amongst the members of Groups 2, 3, and 4 was cumulative in nature.

In the transcript from *Group Discussion May 2011 Group 1* there is evidence of substantiated statements, corroboration and seeking for group consensus indicating use of exploratory talk:

Student 3: So do we agree that cycloplegia, do we agree that cycloplegia is the weakening of contraction, because one of the, some are thinking cycloplegia is weakening of contraction, some are thinking its loss of accommodation, caused by weakening of contraction. (INT1:3)	Seeking group affirmation
Student 4: No, okay, okay let's check which one comes first. Let's just explain what accommodation is. (INT1:4)	Agreeing but looking for additional proof.

Student 3: What is accommodation? (INT1:3)	
Student 4: Okay I don't know what accommodation is but I don't really know how to explain. (INT1:4)	
Student 2: To change like your, to see near objects and far objects. (INT1:2)	Proffering information
Student 4: So is it the change of the diameter of the iris right? (INT1:4)	Confirming but querying at the same time
Student 3: Yah. (INT1:3)	
Student 3: The diameter of the lens . . . so that you can see near objects. (INT1:3)	Further information provided
Student 4: And where the ciliary muscles are located, if we having this, this as the lens . . . (INT1:4)	
Student 3: The ciliary muscles are located at the two ends. (INT1:3)	
Student 3: So this is the ciliary muscles right, so when they contract it means they pull the lens, so then accommodation occurs, right. So if these are weakened it means accommodation is . . . . . What? Is not achieved. So what comes first, it's the weakening, before the accommodation. (INT1:3)	Building on the discussion by providing additional information
Student 4: So what is cycloplegia. (INT1:4)	
Student 3: It's the weakening . . . . . No, it's the loss of, it's the final thing, it's the loss of accommodation, caused by weakening. (INT1:3)	Substantiation – providing evidence
Student 2: If we are not sure I think we can just say it is the weakening of the contraction of the ciliary muscles, which results in loss of accommodation. What you think? (INT1:2)	Confirming but querying at the same time
Student 1: Yah, but then what does the question say? (INT1:1)	
Student 3: I think we are kind of deviating here, we've read from the textbook. It explained to us what the weakening of the ciliary muscle is, and after that it just mentions the name of the disease called cycloplegia, so any other thing, like not being able to have a proper accommodation, maybe most people that we look at as maybe being longsighted and the one very close they cannot see that's a different thing altogether. (INT1:3)	Confirming and elaboration

Student 4: So what I am just thinking is cycloplegia is the same as this weakening, then antimuscarinics cause cycloplegia, which results in loss of accommodation. (INT1:4) *Student 5: So it is the cause and then the result. (INT1:5)* *Student 3: There is the cause , the condition, then the . . . (INT1:3)* *Student 5: There is the cause and the result. (INT1:5)* *Student 3: So we think cycloplegia is the weakening . . . (INT1:3)*	Obtaining group consensus

Members of Group 1 (INT1:1, INT1:2, INT1:3, INT1:4, and INT1:5) were discussing the effects of parasympathomimetics and muscarinic antagonists on visual accommodation. During the session recorded the group members queried one another's statements, provided substantiating evidence (whether it was correct or not), and sought consensus in their communication as a group. Mercer (1996) defined exploratory talk as occurring when participants "…engage critically but constructively with each other's ideas… Statements and suggestions are offered for joint consideration." Although group members might dispute the correctness of another member's opinion "… challenges are justified and alternative hypothesis offered." (Mercer, 1996). Thus the talk amongst the members of Group 1 (INT1:1 to INT1:5) could clearly be classified. as exploratory talk.

In contrast the discussions between the participants of the remaining three groups recorded (Group 2, Group 3, and Group 4) were mainly cumulative in nature. The participants accepted in an uncritical manner the statements of their colleagues. "Partners used talk to construct a 'common knowledge' by accumulation. Cumulative talk is characterized by repetitions, confirmations and elaborations…" (Mercer, 1996).

Group 3 (*Group Discussion May 2011 Group 3*) during a discussion on the effect of the parasympathetic system on the eye used repetition and confirmations to build "common knowledge by accumulation" (Mercer, 1996):

Student 2: Parasympathetic. . . (INT3:2)	Repetition
Student 4: Yah. (INT3:4)	Confirmation
Student 2: . . .But you can see that. (INT3:2)	Confirmation
Student 4: Yah. (INT3:4)	Confirmation
Student 2: Increase parasympathetic . . . (INT3:2)	Repetition
Student 4: Yah. (INT3:4)	Confirmation
Student 2: Increase parasympathetic effect. . . (INT3:2)	Repetition
Student 2: You are trying to diagnose that and treat it. (INT3:2)	
Student 3: You're trying to treat that . . . (INT3:4)	Repetition
Student 2: You are trying to diagnose. . . (INT3:2)	Repetition

A similar pattern emerged when the discourses between members of Group 2 and Group 4 were analysed. The recordings were made when Group 2 (*Group Discussion May 2011 Group 2*) members were discussing antihistamines and Group 4 (*Group Discussion May 2011 Group 4*) members were discussing the use of a pharmacological agent to differentiation between myasthenia gravis and a cholinergic crisis.

Student 2: Antihistamine is released by the cells of the body, by the cells in the blood, by the mast cells.(INT2:2)	
Student 3: By the eosinophils, or something like that in the blood. (INT2:3)	Elaboration
Student 1: And like antihistamines would like prevent it, so . . . (INT2:1)	Confirmation
Student 2: But I think the relationship between allergy and depression, and being down and stuff like that . . (INT2:2)	

Student 2: Is that the problem? Is that the problem you had? (INT4:2)	
Student 3: What is it? What are you trying to diagnose? (INT4:3)	Repetition
Student 5: I'm trying to diagnose whether it's cholinergic crisis	

or myasthenia. (INT4:5)	Confirmation
Student 2: Okay. (INT4:2)	
Student 2: Yah. (INT4:2)	Repetition
Student 2: I think there we . . . (INT4:2)	
Student 5: Because they are not to send symptoms. (INT4:5)	Confirmation
Student 2: Yah. (INT4:2)	Repetition and
Student 1: So we are diagnosing if the patient has cholinergic crisis or myasthenia gravis. (INT4:1)	elaboration
Student3: We are trying to diagnose the two, yah. (INT4:3)	Confirmation
Student 3: Between the two, we are confused between the two as a pharmacist. So the only way to find out is to use this info. (INT4:3)	Repetition and elaboration

Thus at the start of the intervention period cumulative talk was the predominant mode of discourse amongst the ZCL2 students attending SI sessions. Sustained periods of exploratory talk was only found in one of the four groups (Group 1).

3.2.2. Group discussion at the end of the intervention period

At the end of the intervention period (October 2011) five minute audio recordings were made of discussion occurring amongst groups of ZCL2 students who attended a SI session. Recordings were made of six groups (*Group Discussion Oct 2011 Group 1, Group Discussion Oct 2011 Group 2, Group Discussion Oct 2011 Group 3, Group Discussion Oct 2011 Group 4, Group Discussion Oct 2011 Group 5, and Group Discussion Oct 2011 Group 6)*. Following analysis it was discovered that during two of the recordings (*Group Discussion Oct 2011 Group 1 and Group Discussion Oct 2011 Group 4*) the SI Leader interrupted the student discourse and directed the discussion by providing explanations of the discussion points. These two recordings were, therefore, excluded from the analysis as it was not possible to analyse the discourse amongst group members. This does, however, illustrate an important point. It is essential that the lecturer – in this case the SI Leader – understands the

principles involved in mentoring a higher level of discourse amongst the students. In addition the SI Leader should have been enabled or provided with the prerequisite skills to ensure that he/she could have directed the group discussion in the correct direction without reverting to lecturing mode. By providing the answer to the discussion point the SI Leader removed the need for any further discourse amongst the students. Although the SI Leader was trained at the start of the intervention period the reversion to lecturing mode indicated that additional/ongoing training or mentoring must be provided in order to sustain the correct practice.

Following analysis of the transcribed discourse from Groups 2, 3, 5, and 6 it was apparent that the amount of exploratory talk utilised by the ZCL2 students attending SI sessions had increased in comparison to the discourses recorded at the start of the intervention period. Detailed analysis of three of the four transcripts is provided. Discourse in the fourth transcript followed a similar pattern with the predominant mode of discourse being exploratory talk.

During the recording of discourse amongst group members in Group 2 (*Group Discussion Oct 2011 Group 2*) the discussion initially consisted of cumulative talk:

Student 2: Slow-release theophylline and . . . Are contra-indicated for less than five years. (END2:2)	
Student 3: Oh less than five years. (END2:3)	Repetition and confirmation
Student 2: I think, I think they can take the leukotriene inhibitors. (END2:2)	
Student 1: So leukotriene inhibitors right? (END2:1)	Repetition and confirmation

Thereafter the discussion amongst members of Group 2 (*Group Discussion Oct 2011 Group 2*) switched to exploratory talk for the remainder of the recorded section of group discussion:

Student 2: *And there is this trick about administering, when administering an inhaler. That process . . . . Remember the process? (END2:2)*	
Student 1: *Extend their lead, tilt your head backwards, at a 45° angle, exhale, and as you inhale, you pump the thing, and then you inhale with it, and then you hold your breath for . . . (END2:1)*	Building on discussion by providing additional information
Student 2: *10 seconds? (END2:2)*	Additional information
Student 1: *10 seconds .. . (END2:1)*	Confirmation
Student 2: *For the particles to settle . . . .(END2:2)*	Additional information
Student 1: *.. And then you exhale . And then you wait for . .. (END2:1)*	Additional information
Student 2: *15 minutes (END2:2)*	
Student 1: *5 minutes and then do it again. (END2:1)*	Challenged and added
Student 2: *Wait, so you have to wait and do it two or three times, two or three more times . . .(END2:2)*	Queried
Student 1: *But you need to give two puffs, you can't. . .(END2:1)*	
Student 2: *You don't do two puffs immediately? (END2:2)*	Queried
Student 1: *No, like no it needs to be 1, 2, 3, hold it. (END2:1)*	Explanation
Student 4: *Because it's just going to be a waste. (END2:4)*	Justification
Student 3: *Why must you hold your breath? (END2:3)*	Queried
Student 1: *Because when you inhale, not, you don't, like only 10%, 10 or 20% of thing gets to . . .. 10 or 20% of what you inhale gets to the , . . yah , that's 10 or 20% if you use . . .(END2:1)*	Justification
Student 4: *. . . 90% (END2:4)*	
Student 1: *That's 10 to 20% if you use a good technique, so there are always probabilities that you might not use. (END2:1)*	Additional information
Student 3: *Less . . . (END2:3)*	
Student 1: *Yah, that's where you must use a good technique. (END2:1)*	
Student 4: *You say only 20, 10 to 20% will go to .. .(END2:4)*	Queried
Student 1: *If you use a good technique, a very good technique*	Justified

only 10 to 20% might get into the lungs . .(END2:1)	
<u>Student 4:</u> *. . . Lungs, But what will happen to the other .. .(END2:4)*	Queried
<u>Student 1:</u> *Normally it will stick to the mouth, it might stick to the mouth or some of it might be . . . (END2:1)*	Additional information
<u>Student 3:</u> *. . . Or GIT (END2:3)*	Additional information
<u>Student 1:</u> *Or GIT, or some of them you actually exhale, because that is why you say wait for 10 seconds for some of the small particles . . . Some Of them will settle onto the site, but not all of them, because you actually exhale and exhale some of them like when you exhale you exhale some out the mouth. (END2:1)*	Additional information

Group Three (*Group Discussion Oct 2011 Group 5*) used exploratory talk throughout the recorded section of discussion:

<u>Student 2:</u> *. . . . And when that happens on the leukotrienes you know there are also branches there, when leukotrienes is activated, there is a branch going to this leucocyte, what chemotaxines and bronchoconstriction and vasodilation the effects, so if you block that leukotrienes these whole things are going to be blocked too . . . (END3:2)*	
Student3: You don't have them, yah. (END3:3)	Confirmation
Student 1: So how do you answer it now, what are the outcomes. (END3:1)	Queried
<u>Student 2:</u> *But they won't be . . .(END3:2)*	
<u>Student 3:</u> *the outcomes , isn't it . . . .(END3:3)*	
<u>Student 3:</u> *The outcome of leukotrienes, isn't it the ones that are involved . . . . (END3:3)*	Additional information
<u>Student 1:</u> *What's the mechanism of action like at the end you say what happens, so are these the processes that cause bronchoconstriction, or are they the outcomes of this leucocyte chemotaxis, as you know there are three parts in the mechanism of action, the deviation or the blocking and then the process, and*	Additional information

. . (END3:1)	
<u>Student 1:</u> *Then the results . . . (END3:1)*	Confirmation
<u>Student 2:</u> *. . . . Then the result, yah. So now here . . . (END3:2).*	Additional information
<u>Student 2:</u> *. . . This here it is what you do and this is what happens. You do this, If you block this one . . .(END3:2)*	Queried
<u>Student 3 :</u> *. . . . The leukotriene? . . . (END3:3)*	Additional information
<u>Student 2:</u> *Okay you block leukotrienes and then you inhibit this leucocyte chemotaxis, so the recruitment and activation of inflammatory cells, they are going to inhibit . . . (END3:2)*	Queried
<u>Student 1:</u> *. . . They block? (END3:1)*	Additional information
<u>Student 2 .</u> *. . . Yah, because this is the one that recruits and activates inflammatory cells and for bronchoconstriction decreased lumen of bronchi, bronchioles, it like . . If you, if you . . (END3:2)*	Queried
<u>Student 1:</u> *Which one is being blocked, and in bronchoconstriction what have you blocked? (END3:1)*	Additional information and consensus
<u>Student 2:</u> *You have . . . this one is responsible for decreasing the lumen of bronchi and bronchioles, so if you block this effect it's not going to happen, and then under vasodilation, the fluid exudation an increased, you are blocking this again. (END3:2)*	

Group 6 (*Group Discussion Oct 2011 Group 6*) also employed exploratory talk with continual building of a collective knowledge:

<u>Student 2:</u> *Yah we did it in diuretics. And then this is use of mannitol for cerebral oedema. It's . . . Mannitol is a osmotic something . . .(END6:2)*	
<u>Student 1:</u> *Diuretic . . . . .(END6:1)*	Additional information
<u>Student 2:</u> *It's a diuretic . . ..(END6:2)*	
<u>Student 1:</u> *Yah .(END6:1)*	
<u>Student 2:</u> *What's the class? A osmotic . . . aah . . . But then it like, mannitol it's not absorbed in the brain, it then causes water to move out from the brain cells into the system, so it's like that*	Additional information

excess water by the oedema is going to move out of it. .(END6:2) *<u>Student 1:</u> Okay, so the excess water is going to . . . ..(END6:1)* *<u>Student 2:</u> Going to move out from the cells into the system like the potassium salts and then it's going to be transported back to the kidneys to be excreted out . . . .(END6:2)* *<u>Student 1:</u> Then it will be eliminated, taken out, so that's how it causes the diuretics. .(END6:1)* *<u>Student 2:</u> Yes it reduces the oedema, because of oedema essentially is accumulation of excess water in cells. .(END6:2)*	Additional information Additional information Additional information Additional information

As previously stated detailed analysis of discourse in Group 5 (Group *Discussion Oct 2011 Group 5*) is not provided as it followed similar patterns to the previous examples. Groups 5 predominantly used exploratory talk during the recorded group discourse.

3.3. Summary – exploratory talk

At the end of the intervention period there was extensive use of exploratory talk amongst ZCL2 students involved in group discussions during SI Sessions. Initially at the start of the intervention period there was only one group in which discussion occurred at a higher level, namely exploratory talk was employed. In the remaining three recorded discussion sessions discourse was cumulative in nature. The extensive use of cumulative talk prior to the intervention is in line with the findings of Attwood et al. (2010) who reported that at the second year level discussion amongst psychology students was mainly cumulative in nature. However, in the current study the ZCL2 students had elevated their level of discourse to exploratory talk at the end of the intervention period, a level of discourse only reported by Attwood et al. (2010) amongst fourth year psychology students. The increased amount of exploratory talk used during group discussions indicated that the intervention had been successful in nurturing the use of exploratory talk to reason and solve problems, amongst ZCL2 students.

4. CHAPTER FIVE SUMMARY

The qualitative results were presented in this chapter. The data derived from the focus group sessions have provided rich information and insight into the lived experiences of Pharmacology students at the NMMU.

Discourse analysis of the recordings of group discussions held during the intervention period indicated that the level of discourse was elevated in the recordings from the end of the intervention period as opposed to the recordings made at the start of the intervention. The amount of time spent employing exploratory talk was greater during the group discussion at the end of the intervention in comparison to the start of the intervention when cumulative talk dominated many of the group discussions recorded.

These findings will be triangulated with the quantitative data (presented in Chapter Four) during discussion of results in Chapter Six to provide additional insight into the findings.

CHAPTER SIX
DISCUSSION OF RESULTS

1. INTRODUCTION

The results of the study have been presented in Chapter Four (quantitative results) and Chapter Five (qualitative results). In this chapter the implications of the findings are discussed. The approach used is to integrate the qualitative and quantitative results in the discussion.

At the commencement of this study a research question and several research sub-questions were postulated. The research question was:

Is achievement in Pharmacology at the Nelson Mandela Metropolitan University a factor of language proficiency and language use?

The research sub-questions that required investigation in order to evaluate the research question were:

- Are the initial findings of differences in achievement between second-year Pharmacy students in terms of their home language (Boschmans & McCartney, 2005) still apparent in the current cohort of second-year students?
- Do English skills correlate with achievement in Pharmacology 2 (ZCL2)?
- Do English skills and Pharmacology vocabulary knowledge differ between EFL Pharmacology students and EAL Pharmacology students?
- Does a students' first language, if it is not the language of instruction, impact on learning styles (assessed using Kolb's LSI)?

- How do EAL students, as compared to EFL students, approach studying Pharmacology, what are their attitudes towards Pharmacology and what, if any, coping skills have they developed in order to master the material presented in the Pharmacology module?
- Will the introduction of the dialogic practice of exploratory talk increase reasoning, English skills and achievement in Pharmacology in students?

The results will now be discussed in relation to each of the research sub-questions in order to consider and respond to the main research question of the study.

2. RESEARCH SUB-QUESTIONS

2.1. Sub-question one: Are the initial findings of differences in achievement between second year Pharmacy students in terms of their home language still apparent in the current cohort of second-year students?

Boschmans and McCartney (2005) reported that at the NMMU there was a significant difference (p = .024, Student's t-test) in achievement in ZCL2 by EFL students (51.8±17.5%; n=31) compared to EAL students (44.3±16.2%; n=68). The 2005 study was undertaken as there was concern amongst the staff at the NMMU about achievement in ZCL2 specifically in terms of whether the language of presentation of lectures and the medium for notes and text books (English) not being the students' home language impacted on achievement.

Pharmacology 2 is one of the threshold subjects in BPharm2 in that it is a module that the students perceive as difficult and the pass rate for ZCL2 has been of concern to the staff in the Pharmacy Department at the NMMU. The pass rate in 2004, when the study by Boschmans and McCartney (2005) was undertaken, was 62.22% whereas the pass rate in 2011, when the data for this study was collected, was 66.27% (Figure 6.1). Only in 2003, 2007 and 2009 was the pass rate for ZCL2 greater than 70%. The low pass rate for ZCL2 was

partly the stimulus for this research: to investigate possible reasons why the pass rate for ZCL2 remains below 75%.

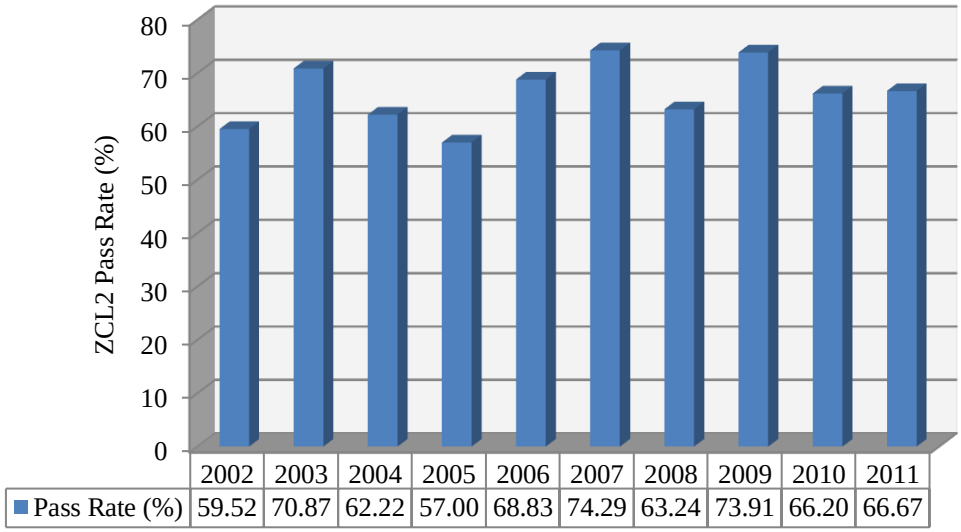
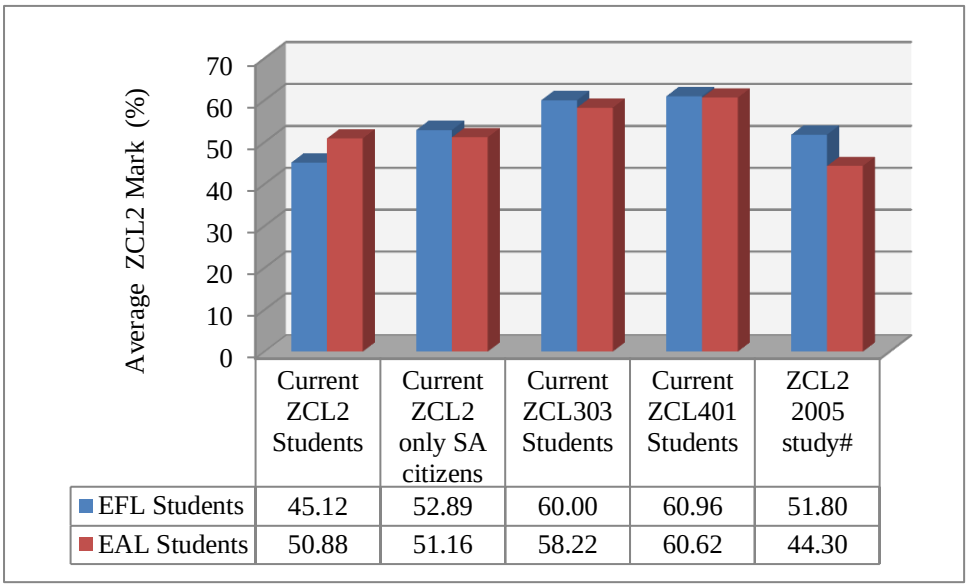


Figure 6.1 Pass rates for ZCL2 from 2002 to 2011

Amongst the ZCL2 students in this study, 55% achieved ≥ 50% for the November written examination in ZCL2 with only 3.33% achieving a distinction (≥ 75%) (Table 4.13). The marker of achievement in ZCL2 used in this study was the November ZCL2 written examination. The final mark for ZCL2 (used in calculating the pass rates depicted in Figure 6.1) includes a 33.3% contribution from the class mark for the module, therefore, a direct comparison of ZCL2 pass rate as reported in Figure 6.1 with the percentage of students achieving a mark of ≥ 50% for ZCL2 (November written exam), is not possible.

When achievement of the ZCL2 EFL and EAL students (in this study) was examined it was found that the EFL students achieved a mean mark of 45.12±15.18% and EAL students a mean mark of 50.88±14.83% (Table 6.2). The mean mark for the EAL students was significantly higher (p = .045) than the mean mark of the EFL students (Student's unpaired t-test, n = 120, t-value = 2.03). The higher mean mark achieved by EAL students was of medium practical significance (Cohen's d = 0.39). Therefore, in the current ZCL2 group,

English as mother tongue did not relate to greater achievement in ZCL2 in terms of the mean mark achieved by the EFL group as compared to the EAL group. Interestingly if only the ZCL2 students with South African citizenship are selected for analysis a different picture emerges. There is no significant difference (p = .899) in the marks achieved for ZCL2 by the EFL group (44.63±14.67%) and the EAL group of students (45.13±15.68%) (Figure 6.2). This switch between a significantly higher mark achieved for ZCL2 by EAL as compared to EFL when the marks of all ZCL2 students are compared to no statistically significant difference in the marks achieved by EAL and EFL students when only the marks of SA citizens are analysed could be due to the calibre of non-South African student who enrols for the BPharm degree at the NMMU. The non-South African students generally either have good entry grades and/or are more mature students who are highly motivated to succeed.



	Current ZCL2 Students	Current ZCL2 only SA citizens	Current ZCL303 Students	Current ZCL401 Students	ZCL2 2005 study#
EFL Students	45.12	52.89	60.00	60.96	51.80
EAL Students	50.88	51.16	58.22	60.62	44.30

Figure 6.2 The average ZCL2 mark (%) achieved by EFL and EAL students in the current ZCL2 (EFL n = 43, EAL n = 77), ZCL303 (EFL n = 34, EAL n = 37) and ZCL401 (EFL n = 24, EAL n = 21) and ZCL2 only SA citizens (EFL n = 62, EAL n = 58) cohorts. EFL = English first language. EAL = English additional language. # = data derived from the study by Boschmans and McCartney (2005) (EFL n = 31, EAL n = 68).

The relationship between ZCL2 marks and English first language for the current ZCL303 and ZCL401 students was also analysed. The relationship was analysed in an

attempt to discern whether there had been a progressive improvement in marks amongst EAL students as compared to EFL students over time.

Amongst the ZCL3 students (for whom data pertaining to mother tongue was available) the average mark achieved for ZCL2 was 59.07±8.14%. The average mark obtained by the EFL students was 60.00±9.14% and the average mark achieved by the EAL students was 58.22±7.12%. There was no significant difference (p = .36) between the marks for ZCL2 achieved by the EFL ZCL303 students and the EAL ZCL303 students (Student's unpaired t-test, t-value = -0.9, n = 71).

A similar pattern was presented by the ZCL401 students. The average mark for ZCL2 achieved by the ZCL401 students was 60.80±6.91%. The average ZCL2 mark for the ZCL401 EFL students was 60.96±7.81% which was not significantly different (p = .872) from the average mark of 60.62±5.90% achieved by the EAL ZCL401 students (Student's unpaired t-test, t-value = -0.16, n = 45).

The influence on ZCL2 marks of: language used as medium of instruction during schooling; language used in the home environment; language used on campus for academic purposes; language used on campus for social purposes; and language used off campus was also examined.

In order to assess the effect on ZCL2 marks of language used as medium of instruction during schooling the students were divided into two groups. The groups were:

- Group A = English was not used at all as the medium of instruction in either primary or secondary school or English was used as the medium of instruction during primary school but not during secondary school; and

- Group B = English was used as the medium of instruction during secondary school but not during primary school or English was used as the medium of instruction during both primary and secondary school.

There was no significant difference (p = .805) between the mean marks achieved by the students in the two groups (Student's unpaired t-test, t-value = -0.25, n = 120). Thus language used as medium of instruction during schooling did not significantly affect achievement in ZCL2.

The correlations between marks achieved for ZCL2 and the extent of English used was not significant (p > .05) for communication on campus for academic purposes (r =.08), on campus for social purposes (r = -.025), or for communication off campus (r = .007).

In order to assess the effect on ZCL2 marks of the extent to which English was used in the home environment the students were divided into four groups:

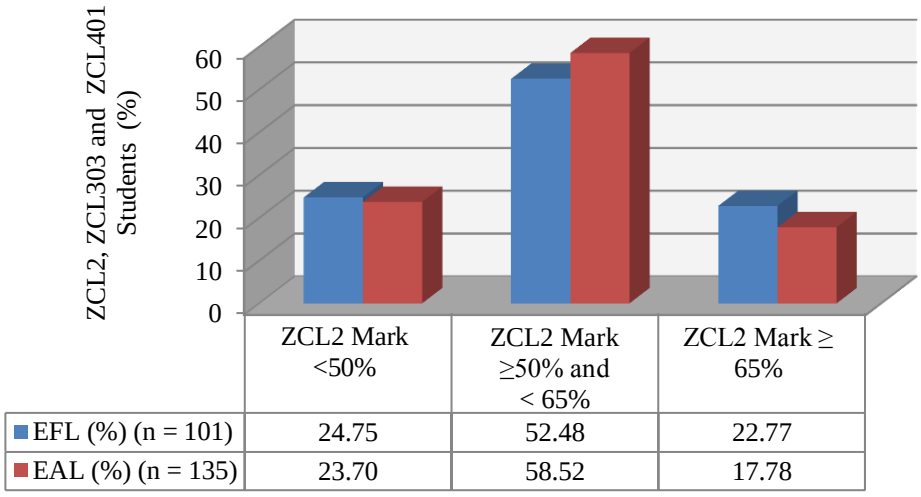
- Group 0: English used to communicate with none of mother, father or siblings;
- Group 1: English used to communicate with one of mother, father or siblings;
- Group 2: English used to communicate with two of mother, father or siblings; and
- Group 3: English used to communicate with all of mother, father or siblings;

There was no significant relationship (p = .59) between the mean scores obtained for ZCL2 by members of each of the four groups (ANOVA, F = 0.64).

In comparison to the 2005 data (Boschmans & McCartney, 2005) the effect of English as first language on achievement in ZCL2 (mark achieved in the November written examination) would, therefore, seem to be reversed in the current cohort with the EAL students achieving a significantly higher average mark. However, when only the South

African students are considered there is no significant difference in the marks achieved by the EFL and EAL students in the current ZCL2 cohort.

Although the current cohort of ZCL2 EAL students did have a significantly higher mean score for ZCL2 than the EFL students when the ZCL2 marks achieved over the last three years (pooled ZCL2 marks for ZCL2, ZCL303, and ZCL401) were examined it became apparent that there was a lower percentage of EAL students (17.78%) represented amongst the students who attained a mark of ≥ 65% than the percentage of EFL students (22.77%) represented in this mark category Figure (6.3). A similar percentage of EFL (24.75%) and EAL (23.70%) students attained a mark of < 50%. While the percentage of EAL students (58.82%) in the mark category of ≥ 50% but < 65% was higher than that of EFL students (52.48%) (Chi^2, *df* = 2, *p* = .432).



	ZCL2 Mark <50%	ZCL2 Mark ≥50% and < 65%	ZCL2 Mark ≥ 65%
EFL (%) (n = 101)	24.75	52.48	22.77
EAL (%) (n = 135)	23.70	58.52	17.78

Figure 6.3 Percentage of EFL and EAL students who achieved a mark for the ZCL2 November written examination of < 50%, ≥ 50% but < 65%, and ≥ 65%. EFL = English first language. EAL = English additional language.

2.1.1. Summary - Objective One

The situation as reported in 2005 by Boschmans and McCartney (2005) was reversed in the current cohort of ZCL2 students. The EAL students achieved an average mark (50.88±14.83%) which was significantly higher (*p* = .045) than that of the EFL students

(45.12±15.18%) (Students unpaired *t*-test, *t*-value = 2.03, *n* = 120). The trend when only the South African students were analysed differed with the marks of the EFL and the EAL students being similar (no statistically significant difference, *p* = .899). There is, however, still cause for concern as when the number of students achieving marks of ≥ 65% for ZCL2 amongst the combined ZCL2, ZCL303, and ZCL401 students was interrogated, the findings indicated that there was a higher percentage of EFL than EAL students amongst this group of high achieving students.

2.2. Sub-question two: Do English skills correlate with achievement in Pharmacology 2 (ZCL2)?

Poor English language skills have been be linked to a variance of up to 20% in academic performance between white and black students at the University of Cape Town. The greater achievement by white students was reported across all faculties (Madiba, 2010b). When students fail to understand the language or terminology used in a discipline they resort to memorisation without understanding (Shembe, 2002). This stratagem can lead to inadequate performance and students failing the course and eventually withdrawing from the degree programme. Students themselves believe that poor language skills are responsible for poor academic performance at university level (Steenkamp et al., 2009). This phenomenon of poor language skills contributing to poor academic achievement has also been reported amongst Pharmacy students. Ninety per cent of PharmD students interrogated during a study by Diaz-Gilbert (2005) stated that they were aware of weaknesses in their vocabulary and writing skills. During the BPharm degree offered at the NMMU a student must, in the discipline of Pharmacology, refer to and extract information from several technical textbooks in order to master the material presented during the modules. *Pharmacotherapy; A Pathophysiological Approach* (DiPiro et al., 2011), one of the text books prescribed for the Pharmacology modules at the NMMU, has a Gunning FOG Index for readability of 18.1

(Roberts et al., 1994). A readability score of greater than 16 on the Gunning FOG scale is considered to be very difficult to read, it is comparable to reading a legal document.

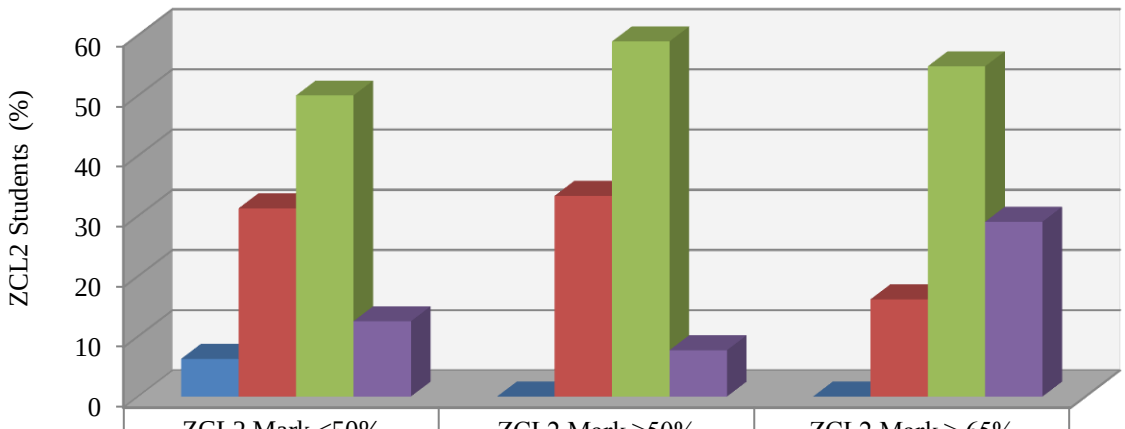
Therefore, in this study it was considered relevant to investigate the relationship between scores on the English Skills Test as a measure of English reading comprehension (Section 5.1.4, Chapter Three) and achievement in ZCL2. There was a significant difference (p = .025) between the mean scores (/100) achieved by the ZCL2 (72.13±13.89), ZCL303 (77.13±12.29), and ZCL401 (76.30±11.72) students (ANOVA, F = 3.74). When Scheffé's post-hoc test was applied the significant difference was noted to occur between the ZCL2 and ZCL303 scores (p = .042).

The scores were also categorised as developing (score of 0 to 42), expanding (score of 43 to 65), functional (a score of 66 to 85), or proficient (a score of 86 to 100) (Table 3.1). An English reading comprehension score that fell into the category of proficient would be at the desired level for a BPharm student in 2nd year or higher. At the level of proficient (a score of 86 to 100) a person would be able to understand passages that were relatively complex and dealt with academic subject matter. A student who achieved a score in the category of functional (a score of 66 to 85) would experience some difficulty in trying to understand Pharmacology text books and journal articles as in this category the comprehension level is understanding of passages with uncomplicated ideas and organisation. Even more difficulty would be encountered by students falling into the category expanding (a score of 43 to 65) as in this category reading comprehension is at the level of material with uncomplicated ideas, straight forward presentation and that dealt with everyday experiences.

Of the 229 ZCL2, ZCL303, and ZCL401 students tested the reading comprehension of 25% was categorised as developing or expanding (Table 4.2). These students would probably encounter severe difficulties in trying to decipher the prescribed pharmacology

texts. The scores of 30.5% of the ZCL2 students were in the developing or expanding categories (Table 4.2).

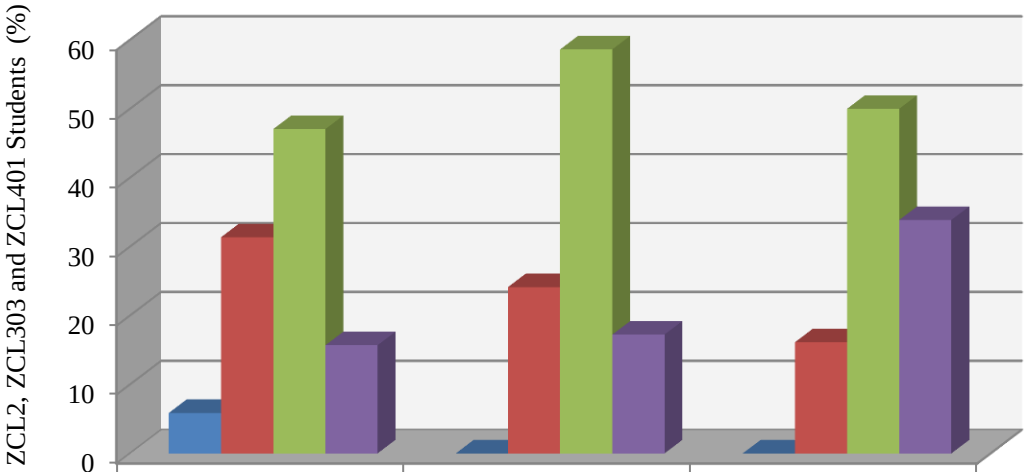
An interesting picture emerged when, for the current ZCL2 students, the English reading comprehension score as a category was related to achievement in ZCL2. The ZCL2 students (n = 118) were divided into three groups. Those with a ZCL2 mark of less than 50%, those with a mark ≥ 50 % but < 65% and lastly those students with a ZCL2 mark of ≥ 65%. As the ZCL2 mark category increased there was an increase in the number of students in the mark category with a reading comprehension of functional or proficient and a decrease in a number of students in the mark category with a reading comprehension of developing or expanding (Figure 6.4) (Chi^2, *df* = 6, *p* = .004). A similar pattern was observed when the English reading comprehension categories of all students (ZCL2, ZCL303, and ZCL401 students: n = 229) within the mark categories were examined (Figure 6.5) (Chi^2, *df* = 6, *p* = .0003).



	ZCL2 Mark <50% (n = 48)	ZCL2 Mark ≥50% and < 65% (n = 39)	ZCL2 Mark ≥ 65% (n = 31)
Developing	6.25	0.00	0.00
Expanding	31.25	33.33	16.13
Functional	50.00	58.97	54.84
Proficient	12.50	7.69	29.03

Figure 6.4 English reading comprehension categories of ZCL2 students who achieved a mark of < 50%, of ≥ 50% but < 65% or of ≥ 65%

A significant non-zero correlation ($p < .05$, r = .21) was found when the ZCL2 marks were compared to the ZCL2 students' scores for the English reading comprehension test (Figure 6.6). A similar pattern was observed when the correlation between the combined ZCL2, ZCL303, and ZCL401 scores for the English reading comprehension test were compared to the marks achieved for the ZCL2 November written examination. A significant ($p < .05$) non-zero correlation of $r = .25$ was achieved. Therefore, it can be concluded that there is a positive relationship between the students' English reading comprehension scores and achievement in Pharmacology.



	ZCL2 Mark <50% (n = 51)	ZCL2 Mark ≥50% and < 65% (n = 116)	ZCL2 Mark ≥ 65% (n = 62)
Developing	5.88	0.00	0.00
Expanding	31.37	24.14	16.13
Functional	47.06	58.62	50.00
Proficient	15.69	17.24	33.87

Figure 6.5 English reading comprehension categories of ZCL2, ZCL303 and ZCL401 students who achieved a mark of < 50%, of ≥ 50% but < 65% or of ≥ 65%

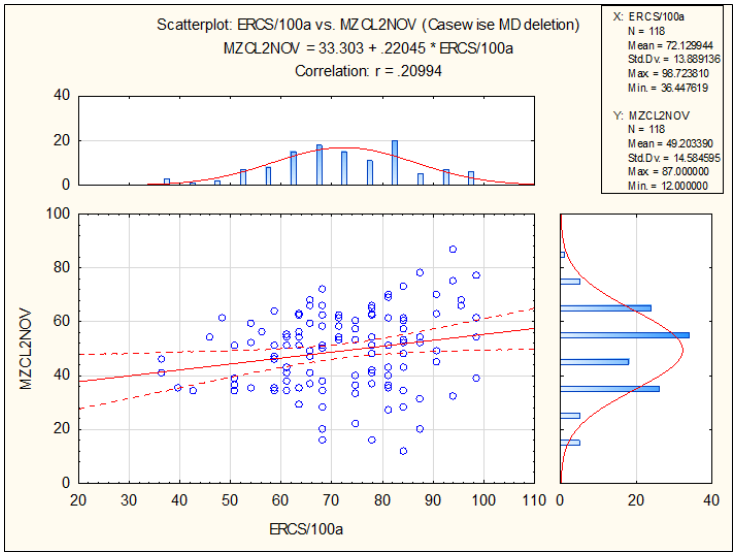


Figure 6.6 Correlation between ZCL2 Marks and scores achieved by ZCL2 students on the English reading comprehension test

During the focus group sessions students were very aware of the difficulty level of the Pharmacology texts *"So if you try to understand what is going on there and you don't understand the language of Pharmacology, now you just lost between the two buildings" (ZCL4:4)* and were in favour of a course on medical terminology *"I think it would help if we were provided with a small course with the suffixes and prefixes" (ZCL3:4).*

When the difficulty level of the prescribed texts and other material which is required reading for the course is taken into account it becomes clear that, in light of these results, support should be provided to the students with English language deficiencies as identified by tests such as the APAP English Skills test. Supplementary English courses have been shown to be more effective when they are incorporated into the discipline specific modules of the degree programme (Graham & Beardsley, 1986). A possible approach in the discipline of Pharmacology would be to include tutorials during which medical terminology is presented in an interactive manner and students are guided in the reading of discipline specific material of the appropriate difficulty level.

2.2.1. Summary - Objective Two

There was a significant difference (p = .025) between the mean scores (/100) achieved by the ZCL2 (72.13±13.89), ZCL303 (77.13±12.29), and ZCL401 (76.30±11.72) students (ANOVA, F = 3.74) indicating that there was an increase in English reading comprehension with academic progression. When the ZCL2 marks were categorised as < 50%, ≥ 50% but < 65%, and ≥ 65% there was an increase in the number of students in the mark category with a reading comprehension of functional or proficient (category ≥ 65%: 86.4% students in category) as the mark categories increased and a decrease in a number of students in the mark category with a reading comprehension of developing or expanding (category ≥ 65%: 13.6% students in category). Lastly there was a significant non-zero (p < .05) correlation between the score for the English reading comprehension test and marks for ZCL2 (r = .21).

2.3. Sub-question three: Do English skills and Pharmacology vocabulary knowledge differ between English first language (EFL) and English as an additional language (EAL) Pharmacology students?

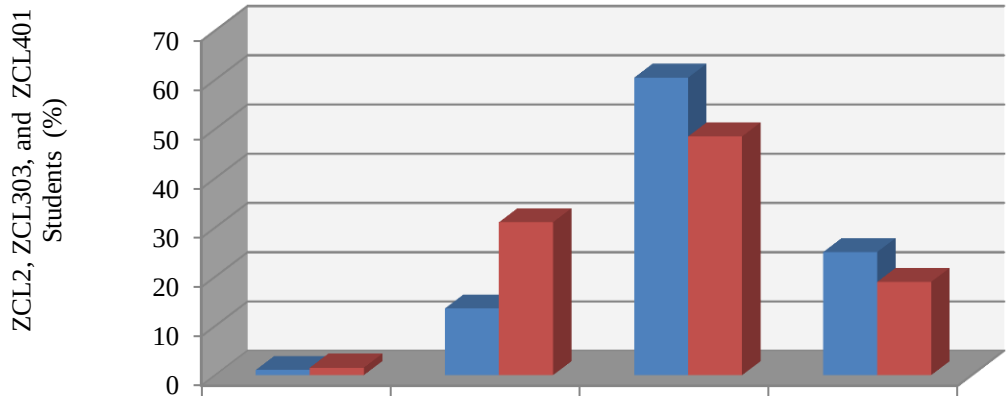
In this study both English reading comprehension and Pharmacology vocabulary knowledge were investigated. English reading comprehension was assessed using the APAP English Skills test (Section 5.1.4, Chapter 3). The students' knowledge of basic terminology used in the discipline of Pharmacology was tested using the Pharmacology Vocabulary Questionnaire (Section 5.1.3 in Chapter 3).

2.3.1. Interpretation of English reading comprehension test results

The mean scores (/100) for English reading comprehension for the EFL (combined ZCL2, ZCL303, and ZCL401 students) and EAL students were 77.34±12.41 and 72.26±13.41 respectively. The mean score of the EFL students was significantly higher (p = .0039) than the mean score achieved by the EAL students (Student's unpaired t-test, t-value = -2.9, n = 228, Cohen's d = 0.39).

When the mean scores for the three years (ZCL2, ZCL303, and ZCL401) were examined a similar trend to that reported by Long et al. (2008) was noted. The Pharmacy students tested for English skills by Long et al. (2008) demonstrated, amongst the EFL students a significant improvement in score with year of study. There was no significant increase in score with year of study amongst the EAL students. In the current study the mean score of the EFL students increased from 73.45±13.99 for the ZCL2 group to 78.77±9.33 in the ZCL401 EFL students (p = .018, ANOVA, F = 4.2, Scheffé's post-hoc test indicated significant difference between ZCL2 and ZCL303 p = .021, Cohen's d = 0.13). Amongst the EAL students the ZCL2 mean score was 71.40±13.87 and the ZCL401 mean score was 73.58±13.63 (p = .695, ANOVA, F = 0.36). Thus there was a significant increase in scores with academic progression (ZCL2 to ZCL3) amongst the EFL students but amongst the EAL students there was no significant difference between the groups.

When the combined scores achieved by the ZCL2, ZCL303, and ZCL401 students in the APAP English Skills test were analysed according to the four categories of developing, expanding, functional, and proficient the distribution of EFL and EAL students in the categories showed opposing trends. A significantly higher percentage of the EFL students (85.42%) than of the total number of EAL students (67.42%) were represented in the categories proficient and functional while in the category expanding there was a higher percentage of EAL students (31.06%) than of EFL students (13.54%) (Figure 6.7) (Chi2, df = 3, p = .021).



	Developing	Expanding	Functional	Proficient
ERCS EFL (%) (n = 96)	1.04	13.54	60.42	25.00
ERCS EAL (%) (n = 132)	1.52	31.06	48.48	18.94

Figure 6.7 English reading comprehension scores of EFL and EAL students (ZCL2, ZCL303, and ZCL401 students) categorised as developing (score = 0 to 42), expanding (score = 43 to 65), functional (score = 66 to 85), and proficient (score = 86 to 100). ERCS = English Reading Comprehension score. EFL = English first language. EAL = English alternate language.

Scores achieved on the APAP English Skills test by the ZCL2 students were also compared to the extent that English was used: in the home environment; as the medium of instruction during schooling; on campus for academic purposes; on campus for social purposes; and off campus.

The relationship between English reading comprehension scores amongst the ZCL2 EFL and EAL students and the extent to which English was used as the medium of instruction during schooling was not significant (p = .389, Student's unpaired t-test, t-value = -0.86, n = 118). The degree to which English was used in the home environment was also not significant (p = .728) relative to the English reading comprehension scores (ANOVA, F = 0.43).

There was, however, a significant non-zero correlation between the amount of English used on campus ($p < .05$, r = .19) and off campus ($p < .05$, r = .25) for social purposes and the English reading comprehension scores. The correlation between English used on campus for academic purposes and English reading comprehension scores was not significant (r = .15).

As all lectures, practical sessions, and tutorials were conducted in English and all textbooks and lecture notes are published in English there was very little variation in the extent to which English was used for academic purposes on campus within the ZCL2 EFL and EAL groups.

2.3.2. Interpretation of Pharmacology Vocabulary Questionnaire

The scores achieved by students for Part A (/50 marks) and Part B (/32 marks) of the Pharmacology Vocabulary Questionnaire were combined and converted to a percentage. The mean score achieved by the combined ZCL2, ZCL303 and ZCL401 EFL students was 58.27±11.61% and the score for the EAL students was 53.99±11.74%. The scores achieved by the EFL students were significantly higher (p = .0094) than the scores achieved by the EAL students (Student's t-test, t-value = -2.6, n = 212). Thirty per cent of the EFL students achieved a score of ≥ 65% for the Pharmacology Vocabulary test while only 16.67% of the EAL students scored ≥ 65% (Figure 6.8). More EAL students (34.92%) achieved a score of < 50% than EFL students (23.26%) (Figure 6.8) (Chi^2, df = 2. p = .077).

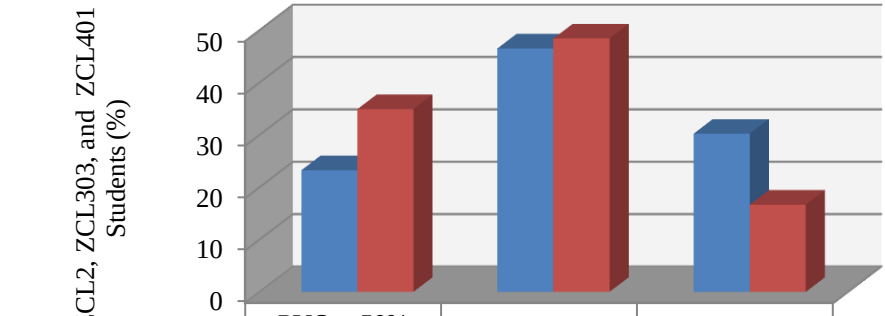


Figure 6.8 Scores achieved on the Pharmacology Vocabulary test by the combined ZCL2, ZCL303, and ZCL401 students presented as the score categories < 50%, ≥ 50% but < 65%, and ≥ 65%. EFL = English first language. EAL = English alternative language. PVQ = Pharmacology Vocabulary Questionnaire.

There was a significant trend amongst the EFL students for the scores to increase with academic year (from ZCL2 to ZCL401) (p < .0001, ANOVA, F = 26.76, Scheffé's post-hoc test indicated significant difference between ZCL2 and ZCL303 p < .0001, Cohen's d = 1.55

and ZCL2 and ZCL401 $p < .0001$, Cohen's d = 1.68). A similar trend occurred amongst the EAL students ($p = .002$, ANOVA, F = 6.55, Scheffé's post-hoc test indicated significant difference between ZCL2 and ZCL303 $p = .015$, Cohen's d = 0.66 and between ZCL2 and ZCL401 $p = .025$, Cohen's d = 0.65) (Figure 6.9).

The increase in scores for the Pharmacology Vocabulary Questionnaire with academic progression amongst the EFL students was of high practical significance (Cohen's d = 1.55 and 1.68) while that occurring amongst the EAL students was only of medium practical significance (Cohen's d = 0.66 and 0.65) (Figure 6.9). A similar finding was reported by Long et al. (2008) amongst MPharm students in the UK. There was an increase in scores for scientific terminology comprehension with academic progression in the EFL students, however, in the EAL students there was no significant increase in scores with academic progression. This finding is problematic as difficulties with discipline specific vocabulary possibly hamper deep learning and understanding forcing the student to resort to parrot learning (Long et al., 2008). An investigation of Pharmacy related vocabulary knowledge in EAL PharmD students described scores for correct meanings varying from 37% (pre-professional year) to 53.8% (second professional year) to 76% (third professional year) and 56.3% (fourth professional year) (Diaz-Gilbert, 2004).

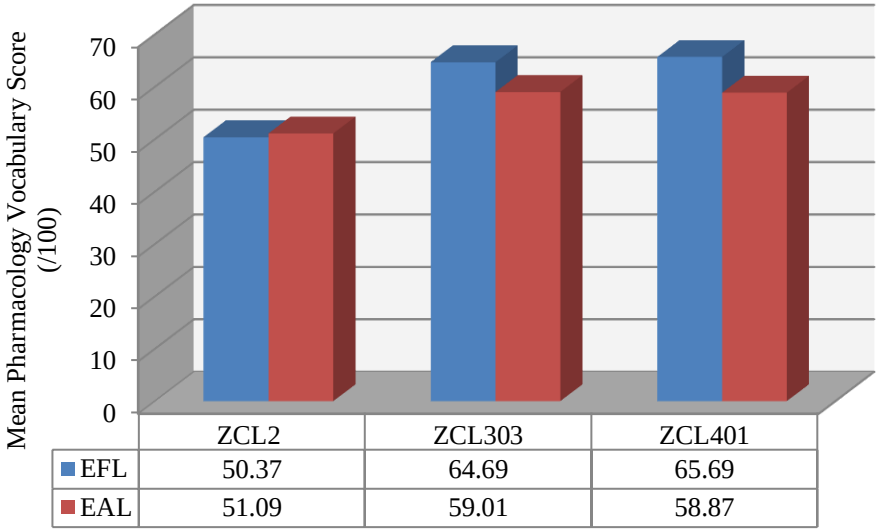


Figure 6.9 Mean Pharmacology vocabulary scores in EFL and EAL students in ZCL2, ZCL303 and ZCL401. EFL = English first language. EAL = English not first language. ZCL2: EFL *n* = 40, EAL *n* = 77. ZCL303: EFL *n* = 25, EAL *n* = 29. ZCL401: EFL *n* = 21, EAL *n* = 20.

The students were aware of the deficiencies in their pharmacology vocabulary. Some students created vocabulary lists "*in second year I made like a list of like if it started with hypo then it's too little or hyper then it's too much and stuff like that…) (ZCL3:7)* and were aware of the precise nature of the technical language of pharmacology "*Because it's like to me it's very precise wording that does.." (ZCL3:5).* There was general consensus, amongst the focus group members, that a module explaining medical terminology would be of great value:

> *I think that would help a lot if we were provided with a small course with the suffixes and prefixes... (ZCL3:4)*
>
> *Facilitator: Do you think it would help to have medical terminology.*
>
> *Lots of students concurring. Definitely. Definitely. Just a semester or term course (ZCL3:1&3)*

Unlike the English reading comprehension scores there was no significant relationships between mother tongue, amount of English used: in the home environment, as

medium of instruction at school, for academic purposes on campus and for social purposes on campus, and off campus. Pharmacology vocabulary is very discipline specific and would not be used in day to day communication whereas spoken English would assist with English reading comprehension. Thus it is not surprising to find a significant relationship only between English reading comprehension scores (and not Pharmacology vocabulary scores) and the degree to which spoken English is used for communication purposes on and off campus.

2.3.3. Summary – Objective Three

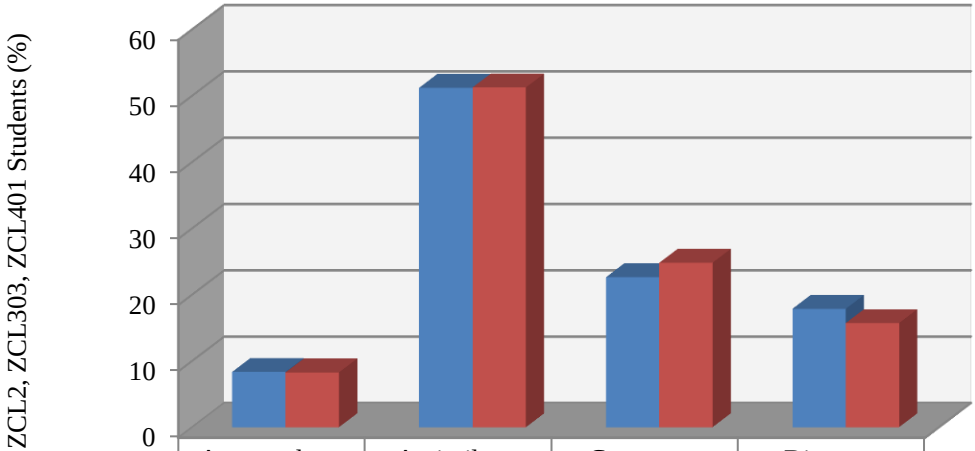
The scores achieved by EFL students for both the APAP English Skills test and the Pharmacology Vocabulary Questionnaire were significantly higher than the scores achieved by the EAL students. This indicates a significant positive relationship between English as first language and ability to understand written English as well as knowledge of discipline specific vocabulary. There was a trend towards increased scores with academic progression (from ZCL2 to ZCL401) amongst the EFL students to a greater extent than the EAL students. The English reading comprehension scores for 85.42% of the EFL students fell into the categories of functional or proficient while only 67.42% of EAL students achieved scores in these categories.

2.4. Sub-question four: Does a students' first language, if it is not the language of instruction, impact on learning styles?

"It is easy to learn when you are using your home language but with English you need to start learning language before you get to the concept" (Paxton, 2007, p. 64). This comment made by a student at the University of Cape Town depicts the experiences of many EAL students as they cope with English language challenges in addition to discipline specific challenges at the university level. The question that arises is do English language difficulties

affect the way(s) in which EAL learners approach the process of learning. The relationship between the student's English language status, namely EFL or EAL, and learning style was investigated in this study.

Similar trends, with no significant difference (p = .920), were observed in the distribution of EFL and EAL students (combined ZCL2, ZCL303, and ZCL401 students) between the four learning styles associated with Kolb's Learning Style Inventory (Section 5.1.2, Chapter Three) (Chi^2, df = 4, n = 206). The predominant learning style amongst both EFL (51.19% of EFL students) and EAL (51.24% of EAL students) was that of assimilator (Figure 6.10). The learning style converger was the next largest category with 22.62% of EFL students and 24.79% of EAL students falling into the category.



	Accomodator	Assimilator	Converger	Diverger
Kolb LS Category EFL (%) (n = 84)	8.33	51.19	22.62	17.86
Kolb LS Category EAL (%) (n = 121)	8.26	51.24	24.79	15.70

Figure 6.10 Distribution of EFL and EAL students amongst Kolb's learning styles accommodator, assimilator, converger, and diverger (combined ZCL2, ZCL303, and ZCL401 students). EAL = English first language. EAL = English not first language. Kolb LS = Kolb Learning Style

The assimilator learning style is commonly found amongst people in the sciences (Kolb et al., 2001). Pharmacy, although a qualification in the field of health sciences, is heavily based in the sciences especially during the early years of the programme. Reading for

a professional degree such as Pharmacy and carrying out professional activities on a day to day basis, as experienced by Pharmacy students during the experiential training component of the BPharm degree, can also influence acquisition of learning styles (Kolb et al., 2001). The dominant trend in this study towards one learning style (assimilator = 51.19% in EFL students and 51.24% in EAL students) is, therefore, expected.

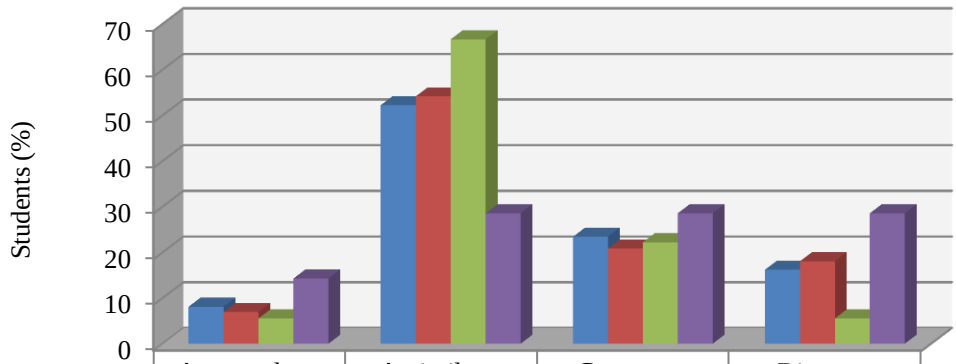
Adamcik et al. (1996) investigating learning styles amongst Pharmacy final year students reported that 54% of the students were convergers and 25% were assimilators and 12.5% and 8% were respectively accommodators and divergers. A similar preponderance of accommodators was noted by Pungente et al. (2003) who reported the presence of 36.2% of students with the converger learning style, 22.4% were accommodators, 21.6% were divergers and only 19.8% were assimilators. During studies by Adamcik et al. (1996) and Pungente et al. (2003) the learning style data was collected from first year students at the beginning of the academic year. In contrast when learning styles were examined amongst qualified pharmacists the predominant learning style was that of assimilator (33.8%) with 32.7 % being convergers, 21.2 % divergers and 12.1% accommodators (2004a). There appears to be a switch from converger to assimilator that occurs with assimilation into and growth within the profession.

The results from this study are in line with findings from previous studies amongst pharmacists/Pharmacy students in that the students investigated in this study had all completed the first year of the programme and more than 50% had been registered for the BPharm degree for more than two years during which time they would have undertaken experiential placements in community and hospital Pharmacy. The change in study style induced by the specialisation within the study area and the experiential training would have influenced the students learning styles bringing them closer to the distribution described by

Austin (2004a) (predominant category = assimilator) than to the picture emerging from first year students (predominant category = converger) (Adamcik et al., 1996).

Cultural differences have been shown to influence learning styles (Auyeung & Sands, 1996; Joy & Kolb, 2009). Countries with populations that avoided uncertainty and preferred a stable environment showed a preference for abstract conceptualisation (thinking) over concrete experience (doing). The person would prefer to think and plan things out (abstract conceptualisation) rather than to actively gain knowledge (concrete experience).

When the participating students were divided into geographical regions according to their citizenship the dominant study style in all geographical regions was that of assimilator although a higher percentage of students coming from South Africa (52%) and the SADEC (54.17%) and East African (67%) regions had an assimilator study style than students from West Africa (29%) (Figure 6.11) (Chi^2, df = 12, p =.766, n = 202).

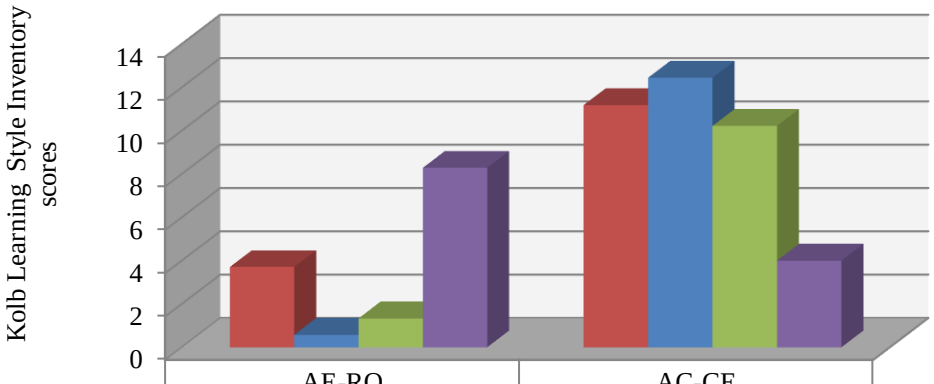


	Accomodator	Assimilator	Converger	Diverger
South African (n=101)	8.11	52.25	23.42	16.22
SADEC (n=75)	6.94	54.17	20.83	18.06
East African (n=18)	5.56	66.67	22.22	5.56
West African (n=7)	14.29	28.57	28.57	28.57

Figure 6.11 Presentation of Kolb's Learning Styles amongst students from different African regions. SADEC = Southern African Development Community

Students from West Africa attained a higher AE-RO score (ANOVA, p = .063, F = 2.46) and a lower AC-CE score (ANOVA, p = .247, F = 1.39) than students from other

regions (Figure 6.12). This indicates a strong preference for practical involvement in grasping and transforming information. The probability for the scores for AE-RO in students from West Africa (p = .063) being higher than the scores achieved for AE-RO in the other geographical regions was just above the level of significance (p = .05). The number of students in the group from West Africa was low (n = 7), an increase in group size might have resulted in a significant finding.



	AE-RO	AC-CE
South Africa (n=101)	3.71	11.19
SADEC (n=75)	0.58	12.45
East Africa (n=18	1.33	10.22
West Africa (n=7)	8.29	4.00

Figure 6.12 Variations in approaches for transforming (AE-RO) and grasping (AC-CE) knowledge amongst students from different geographical regions

2.4.1. Summary - Objective Four

Similar trends in learning styles were observed in both EFL and EAL students. The majority of EFL and EAL students were assimilators (51.19% and 51.24% respectively). These findings were in line with previously published work on distribution of Kolb's Learning styles in Pharmacy students and pharmacists. Cultural differences in learning styles were noted with West African students having a preference for practical involvement in learning as opposed to an abstract theoretical approach.

2.5. Sub-question five: How do EAL students, as compared to EFL students, approach studying Pharmacology, what are their attitudes towards

Pharmacology and what, if any, coping skills have they developed in order to master the material presented in the Pharmacology module?

The language grouping, EFL or EAL, of students who attended the focus group sessions was linked to the code assigned to the participant. The opinions of the EFL and EAL groups attending the focus group discussions could therefore be interrogated, interpreted and compared.

2.5.1. Approach to studying Pharmacology

Many students were concerned about Pharmacology prior to commencing ZCL2 because of the anecdotal information that had been passed on from the more senior students. Similar opinions were voiced about this by the EFL and EAL students although more EAL students offered opinions on this matter than EFL students. The EFL students recalled that:

> *…when you get into something you have your preconceived you know opinion just like when you said "did you hear something when you were taking into second year" and so on. We were told how challenging second year would be for all of us and all that (ZCL2:2) EFL*

> *Of course we heard a lot of stories sometimes from lecturers and then from second years and senior students saying that Pharmacology it's a scary subject, it's challenging, this and that. (ZCL2:1) EFL*

The EAL students offered similar opinions:

> *…before we started last semester, because I have some third-year friends and they really scaring us about Pharmacology, how difficult it is (ZCL2:11) EAL*

> *Actually I don't think it's a good idea to listen to any of the people from other years, because they just totally derail you (ZCL3:1) EAL*

> *I think that most of us, our attitude towards Pharmacology was moulded by listening to people who have done the years. They will tell you "no this thing is so difficult" and once you are there you sort of, you've got this fear, you will fail this thing (ZCL3:3) EAL*

The approach to studying Pharmacology must be viewed through the students' perspective which has been coloured by the information received from the senior students. For some EAL students this acted as a stimulus and they rose to the challenge as though they were used to university education being challenging and viewed this as just one more challenge to be conquered. (This was an opinion voiced by more EAL students than EFL students).

> *I think that most of us, our attitude towards Pharmacology was moulded by listening to people who have done the years. They will tell you "no this thing is so difficult" and once you are there you sort of, you've got this fear, you will fail this thing and it makes it unenjoyable (ZCL3:3) EAL*

> *But it kind of depends as well, for some people like just telling them it's going to be difficult like it just gives them another approach. Then they say "no, then I'm going to concentrate more on this subject, in terms of the other subjects they try to neglect. And then Pharmacology they say "no Pharmacology is like a difficult subject so let me try and work harder on it" and like, like I would take it as a challenge. (ZCL4:5)EAL*

> *I think that the initial stress is important to actually know that "okay this is a difficult subject, let me rather tackle it like more in depth and then get it going". And then as soon as you know how you doing it and then to just the way you want to do it. (ZCL4:5) EAL*

> *...tell you "oh no you just going to fail anyway", you know. It's actually improved my own attitude towards the studying as well as the thing, of the course itself (ZCL3:1) EAL*

> *I killed myself studying, and I told myself you know what if other people can just do it there's no way in hell I'm going to just let other people demotivate me and tell me that no it's so hard, blah, blah, blah, you just going to fail and things like that (ZCL3) EAL*

The EFL students who had a positive attitude towards Pharmacology voiced their enjoyment of the subject without the negative connotations of the threat. The EFL students were more prominent amongst this group

> *Pharmacology to me is where my passion is. That is the section the subject that I want to know more. It excites me to know just like you saying how drug works, when it interacts with the human body. So I am eager to know more (ZCL2:2) EFL*

> *I actually view it as an exciting subject because we are now, I mean I've heard a lot about drugs even before I started Pharmacy but now here I am in this Pharmacy class and am actually studying the way those drugs work in my body, so for me it's sort of exciting, you know and it makes me….The reason why it gets me excited is because I'm actually gaining something, a knowledge that, it's like so many people that the drugs but they don't know how they function they don't know how, what happens really after taking a drug. So I just excited you know imagining taking the drug and then it goes into the liver metabolism and then absorption (laughter) yah seriously looking at it (ZCL2:1)EFL*

> *It is easily my favourite subject to learn, mostly because the sections we doing this year are specifically interesting to me. Like all of the CNS stuff we do and the opioids and things like that (ZCL3:4) EFL*

However the EFL students were also more prominent amongst the group who voiced a dislike for Pharmacology.

> *I don't enjoy learning that because I don't understand it. The language in the textbooks for those chapters, are just….And the chapters along, and it's over my head (ZCL3:7) EFL*

> *The thing with me, Pharmacology and I just don't gel. And because of that I hate it, I hate learning it. I make my notes and make cards, I make this and I make that, I can't learn it. And if I learn a section, I learn it and then I'll think okay I know that, and then I learn the next section and if I think back to the*

first section I can't remember anything. And like then I like I fail every test. So there is no motivation I suppose (ZCL3:8) EFL

So applying Pharmacology to me is totally difficult really I have to say. It's like I can't add one and one and make two out of it. It has to be something straight and forward that is how, that is the problem I have realised I have with Pharmacology. Though I thought it was just going to be a very fun subject on knowing the body and knowing that drugs and how they work, but it has proven so far to be a challenge to me compared to you know the calculator subjects, chemistry and others. So that's what I have realised (ZCL2:8) EFL

In terms of techniques used while studying, such as the use of mind maps, summaries, and flash cards, the opinions of the EFL and EAL students were similar. This could have been influenced by the fact that the academic staff in the discipline of Pharmacology, have a concerted strategy aimed at promoting the use of visual methods of studying Pharmacology. Constructing mind maps allows students to gain an overview of the sections within the Pharmacology syllabus. The development of these study guides has been incorporated into practical session during ZCL2.

My problem initially was in second year was mind maps. It was a foreign concept to me. I struggled in second year I think because of that. Third-year I have been using mind maps and my marks improved dramatically (ZCL3:3) EAL

Like to make it more visual. Like everyone says, like I have mind maps on my wall….It helps a lot (ZCL3:6) EAL

Mind maps are like life savers. (ZCL4:1) EFL

I have a book where I just have mind maps in it, and then all the sections are systematically put in there… (ZCL3:2) EFL

Both EFL and EAL students were equally of the opinion that in order to succeed in Pharmacology an understanding of the work was required and that therefore preparation for tests and exams needed to start well before the date of the assessment.

> *…the second semester of second year, I decided no you've got to understand, like the mechanism of action, to work out adverse effects and things like that. So I can sit in a test and I can think mechanisms of action and I can make up side-effects, well not make up, but I can work out side-effects in my head (ZCL3:7) EFL*

> *With pharmacology you have to do a lot more understanding than actually parrot fashion, because there is no way that you can study pharmacology parrot fashion, it's just not going to work..,, (ZCL4:2) EFL*

> *then now in third-year I understood it a lot better, and I enjoy it so my learning got a lot better towards it. Like I enjoy learning for Pharmacology (ZCL3:6) EAL*

2.5.2. Summary – Objective Five

From the opinions voiced during the focus group discussions it would appear that the attitude towards, approach to, and coping skills used by EAL and EFL students are similar. Some subtle differences were voiced such as the EFL students' positive attitudes towards Pharmacology not being clouded, in the same comment, by the negativity voiced by senior students, as it was for the EAL students. Also those EFL students who disliked Pharmacology were more vocal about their opinions.

2.6. Sub-question six: Will the introduction of the dialogic practice of exploratory talk increase reasoning, English skills and achievement in Pharmacology in students?

As little work has been done at the university level this study aimed to investigate the introduction of exploratory talk, to a Pharmacology classroom (BPharm programme), in order to determine whether the practice led to improvement in achievement in Pharmacology

amongst second year Pharmacy students. To further this aim the practice of exploratory talk was introduced during SI sessions – this served as the intervention. Supplementary Instruction sessions are enrichment sessions that the ZCL2 students attended on a voluntary basis. The sessions were led by a senior student who was trained in the application of the practice of exploratory talk. The students who attended the SI sessions formed the experimental group (ZCL2Exp) and the remainder of the ZCL2 students were the comparison group (ZCL2Com). Achievement in the November Pharmacology examination, APAP English Skills test scores, and scores achieved for Raven's SPM were examined pre and post intervention in the experimental and comparison groups.

2.6.1. Raven's Standard Progressive Matrices

Raven's SPM was administered to the ZCL2Com and ZCL2Exp groups prior to and at the end of the intervention period. There was no significant difference (p = .997) between the scores (/60) achieved by the ZCL2Com (48.7±6.13) and ZCL2Exp (48.70±6.13) prior to the intervention (Student's t-test, t-value = 0.00, n = 117). In terms of Raven's SPM the two groups were, therefore, evenly matched prior to the intervention. The ZCL2Com average score during the post-intervention period (49.07±5.86) was higher than the pre-intervention score (48.70±6.13) but the increase was not significant (p = .154, Students t-test, t-value = 1.44, n = 184). The score in the ZCL2Exp group did not change significantly (p = .261, Students t-test. t-value = 1.15, n = 23).

There was also no significant difference (p = .0997) between the ZCL2Com and ZCL2Exp groups for the change in score achieved in the post intervention period (Student's t-test, t-value = 1.66, n = 112). The inclusion criterion for the ZCL2Exp group was attendance of at least 50% of the SI sessions during the intervention period. An increased exposure to the intervention (application of exploratory talk) would possibly have led to a

more marked change in Raven's SPM scores. The small sample of the ZCL2Exp group could also have contributed to the lack of a significant change in scores for Raven's SPM. A support and mentoring system for the SI leader to assist with a more effective application of exploratory talk during SI sessions as well as encouraging ZCL2 attendance of SI sessions might have improved the outcomes.

The pre-intervention mean score for the combined ZCL2 sample was 48.70±6.36. This score falls below the 25th percentile for Raven's SPM (25th percentile = score of 49: score derived from the 1992 Smoothed British Norm for the Self-Administered Test Completed at Leisure, Adults) indicting that the score was below average relative to the norms established in the UK for Raven's SPM (Table 2.4, Chapter 4) (Raven et al., 2000). There are variations in the norms established for Raven's SPM in different countries (Table 6.1). Thus the mean score for Ravens SPM for the combined ZCL2 group would either fall above the 25th percentile (US, Argentina, and Poland) indicating average intelligence or below the 25th percentile (UK) indicating below average intelligence depending on the norms selected for comparison (Table 6.1).

Table 6.1
Smoothed norms for Raven's SPM for UK, US, Argentina, and Poland (Raven et al., 2000)

Age in Years							
Percentile	22				25		
	18 to 22		21 to 22	19 to 24	23 to 27	23 to 27	23 to 27
	UK 1982	US 1993	Argentina 2000	Poland 1991	UK 1982	US 1993	Poland 1991
90	58	58	57	54	58	58	58
75	57	56	54	51	57	56	57
50	54	52	51	48	54	52	54
25	49	47	48	43	49	47	44

Several researchers have noted lower scores for Raven's SPM for sub-Saharan Africans – the Jensen effect (Rushton & Skuy, 2000; Rushton et al., 2002; Wicherts et al., 2010). Raven's SPM was administered to first year psychology students at the University of

the Witwatersrand. Mean raw scores of 43.32±8.79 and 53.90±4.11 were achieved by the African and White students respectively. These scores fell on the 14th and 61st percentiles (1993 US Norms) (Rushton & Skuy, 2000). A select group of University of Witwatersrand University students (Engineering students) were also administered the Ravens SPM. Mean raw scores achieved were 56±2.6, 53±.9, 50±6.4 for the White, Indian, and African students respectively (Rushton et al., 2002). Clearly these students had all been accepted into a degree programme at an established University and had passed standardised school leaving examinations (matriculation examination) and been accepted, on academic grounds, into the degree programme. The authors suggested that reasons for the differences in scores achieved on the Raven's SPM should be investigated (Rushton & Skuy, 2000; Rushton et al., 2002). Brouwers et al. (2009) suggested that "the Raven might contain elements that benefit people from one country more than people from another country" (p331) while Wicherts et al. (2010) suggested that the Flynn effect had not yet occurred in sub-Saharan Africa to the same extent that it had in the UK and US and that this could have contributed to the differences in Raven's SPM scores. Israel (2006) proposed that there was a bias in Raven's SPM in terms of home language. African first language speakers may be negatively biased on the basis of home language and receive lower scores for Raven's SPM.

2.6.2. English reading comprehension

The APAP English Skills test was employed to investigate English reading comprehension. The test was applied prior to and at the end of the intervention period. There was an improvement in the scores achieved by both the ZCL2Exp as well as the ZCL2Com group post-intervention (Section 4.2, Chapter 4). The increase in score (/100) from the pre-intervention testing to the post-intervention testing was significant for the ZCL2Com group (pre-intervention = 70.53±13.67, post-intervention = 74.75±12.65, p = .0002, Student's t-test, t-value = -3.89, n = 62) and just beyond the 95% probability level of significance (p = .0611)

for the ZCL2Exp group (pre-intervention = 76.62±14.15, post-intervention = 78.63±13.78, Student's *t*-test, *t*-value = -1.99, *n* = 20). As the ZCL2Exp group was formed by self-sampling (voluntary attendance of SI sessions) the group size was small which might have contributed to the significance level being just above .05.

There was no significant difference (p = .27) when the change in score from pre- to post-testing was compared between the ZCL2Com and ZCL2Exp groups (Student's *t*-test, t-value = 1.11, *n* = 82). Once again the small sample size of the ZCL2Exp sample could have contributed to the change in score not being significant.

2.6.3. Achievement in Pharmacology

Marks achieved for the November ZCL2 written examination paper were used as a measure of achievement in Pharmacology. The mean mark achieved by the combined ZCL2 sample was 48.82±15.15%. The mean mark achieved by the ZCL2Com sample (46.47± 14.48%) was significantly (p = .0004) lower than the mark achieved by the ZCL2Exp sample (58.70±14.14%). The difference was of high practical significance (Cohen's d = 0.85).

Therefore, the students who attended the SI sessions and were exposed to the intervention (introduction of the dialogic practice of exploratory talk) attained significantly higher achievement in ZCL2.

2.6.4. Student perceptions of exploratory talk and influences on learning styles

During the focus group discussions the ZCL2 students brought up the topics of SI sessions and group discussions. The students appeared to be strongly in favour of discussions held during SI sessions:

> *"But the thing I found you know that to be most useful is usually group discussions…SI sessions give ideas on how to answer questions" (ZCL2:1)*

> *"Because to me Pharmacology is not a subject that you just sit down and read and read. It's something that is interactive. The times that I spent in the SI I can actually tell myself that I learn better than when I was not able to attend it." (ZCL2:2)*

During the previous year the didactical approach during SI sessions had been for the SI leader to stand in front of the group and explain concepts in a lecture format. During the intervention period this was changed and the dialogic practice of exploratory talk was introduced during SI sessions. The students appreciated the advantage of the new approach and stated:

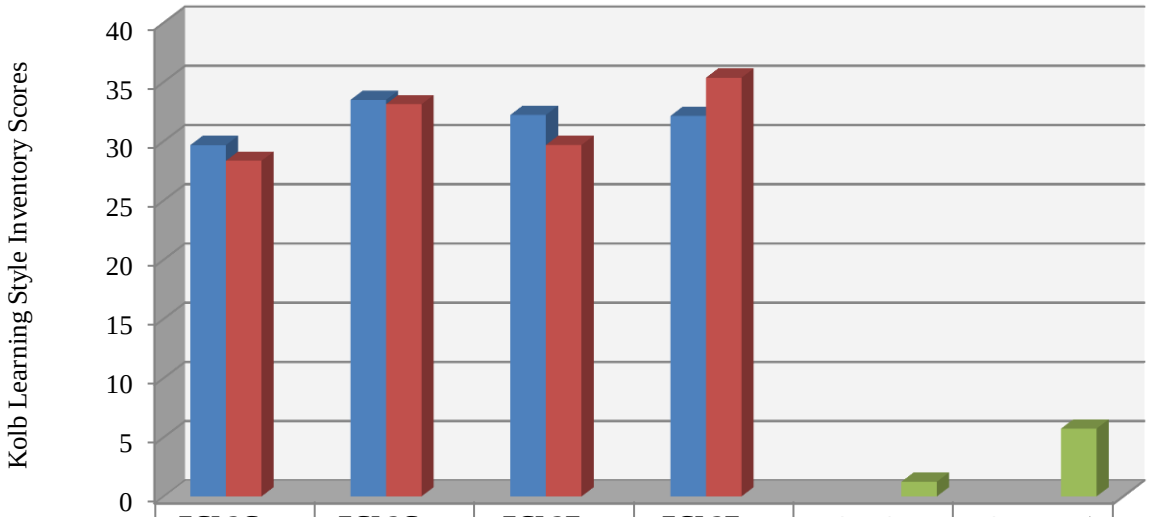
> *"I prefer the new way of doing SI. The discussions work much better you learn a lot during discussions" (ZCL2:8)*

Actively using exploratory talk during group discussions appears to have had an effect on learning styles or the approach to gaining knowledge. The Kolb Study Style Inventory (used in this study) measures on a vertical axis the gaining of knowledge on a continuum between two poles of abstract conceptualisation (AC) which is conceptual and analytical thinking, and the opposite extreme in the gaining of knowledge which is concrete experience (CE) which is learning from experiences. On the horizontal axis the processing of information is measured on the continuum from reflective observation (RO) which represents thinking about a task and the possible solution before application, and active experimentation (AE) which consists of active involvement.

In the application and practice of exploratory talk students would actively and rigorously discuss a concept until group consensus had been obtained. If the technique was effectively applied it could be expected that training in and use of the technique would tend to shift the participants personal learning styles for the processing of information from reflective observation (RO) to active experimentation (AE). During the group discussions held in the SI

session the ZCL2Exp students would have been actively applying their knowledge to solve the problems/questions with which they had been presented.

In the ZCL2Exp students the score for reflective observation (RO) decreased from 32.22±5.66 during the pre-intervention period to 32.13±4.3 at the end of the intervention (Figure 6.13). At the same time the score for active experimentation (AE) increased from 29.68±6.56 prior to the start of the intervention to 35.56±6.21 post-intervention. The difference (between post-intervention and pre-intervention values) for the mean value on the horizontal processing continuum (AE-RO) for ZCL2Exp (5.73±9.34) was higher than the value for ZCL2Com (1.24±10.90).



	ZCL2Com Pre (n=91)	ZCL2Com Post (n=92)	ZCL2Exp Pre (n=23)	ZCL2Exp Post (n=22)	ZCL2Com Δ (n=87)	ZCL2Exp Δ (n=22)
RO	29.67	33.48	32.22	32.13		
AE	28.34	33.12	29.68	35.36		
AE-RO					1.24	5.73

Figure 6.13 Scores achieved by ZCL2Com and ZCL2Exp students for AE and RO, the two components of processing of information. RO= reflective observation. AE = active experimentation. Δ = change in the difference between AE and RO between the pre- and post-intervention periods.

Although not quite significant (p= .07) there was a definite trend towards an increase in active processing of knowledge (Student *t*-test, *t*-value = -1.77, *n*=109). Specialisation during the education process can result in changes in learning styles due to "habits acquired during professional training…" (Kolb et al., 2001, p. 197). This is indicative of the

effectiveness of the intervention in that the exposure to and involvement in the use of exploratory talk had shifted the approach used for processing information amongst the ZCL2Exp group. It is possible that a more significant result could have been achieved if the sample size of ZCL2Exp had been larger. Unfortunately, as SI attendance is voluntary, the experimental group was self-sampled, via attendance of ≥ 50% of SI sessions, and could not be increased in size.

2.6.5. Summary - Objective Six

Students in the experimental group (ZCL2Exp) who attended SI sessions during which the dialogic practice of exploratory talk was implemented achieved significantly higher scores for the ZCL2 November examination than the students in the comparison group (ZCL2Com) who were not exposed to exploratory talk. There was also a shift in learning styles in the ZCL2Exp group that was greater than in the ZCL2Com group. Although not statistically significant (p = .07) at the $p < .05$ level after the intervention the AE-RO score for the ZCL2Exp students had increased to a greater extent than in the ZCL2Com students and the difference was significant at a $p < .1$ level. An increase in AE-RO is indicative of a preference for active involvement in the processing of knowledge. Adaptation of learning styles with specialised training has been noted (Kolb et al., 2001). The increase in AE-RO is aligned with the practice of exploratory talk during which students are actively involved in formulating responses and building common knowledge. Finally during the focus group sessions the ZCL2 students voiced strong support for the group discussion approach in SI sessions. It can, therefore, be concluded that the exposure to the dialogic practice of exploratory talk improved achievement in Pharmacology 2, possibly modified learning styles and was positively accepted and valued by the students.

2.7. Academic progression

The effect of academic progression, from ZCL2 to ZCL303 and then to ZCL401, on reasoning skills (Raven's SPM), English reading comprehension (APAP English Skills test), Pharmacology vocabulary knowledge (Pharmacology Vocabulary Questionnaire), and learning styles (Kolb Learning Style Inventory) was investigated. The discussion will be enriched and reinforced by excerpts from the focus group discussions held with the ZCL2, ZCL303 and ZCL401 students.

Statistically significant differences between ZCL2, ZCL303, and ZCL401 were present for English reading comprehension (p = .025, ANOVA, df = 2, F = 3.74), preference in terms of processing of knowledge (AE-RO) (p = .007, ANOVA, df = 2, F = 5.11), and Pharmacology vocabulary knowledge (p < .00001, ANOVA, df = 2, F = 27.92). The difference was of large practical significance ($\eta 2$ = .211) for the score achieved for the Pharmacology Vocabulary Questionnaire, of medium practical significance ($\eta 2$ = .048) for preferences in processing of knowledge (Kolb's LSI) and of small practical significance ($\eta 2$ = .032) for English reading comprehension.

Student knowledge of pharmacological terminology increased significantly with academic progression from ZCL2 (50.9%) to ZCL3 (61.26%) (Post-hoc testing indicated a significant difference between ZCL2 and groups ZCL303 and ZCL401 with p = .00002). The increase in scores then started plateauing between ZCL303 (61.26%) and ZCL401 (62.36%). At the NMMU the students complete systems pharmacology by the end of ZCL303. The ZCL401 module focuses on application of the pharmacology presented during ZCL2 and ZCL303 in the clinical environment. The outcomes of testing pharmacological vocabulary knowledge are therefore in line with the academic approach to presentation of the modules and increases in knowledge relate to the periods when new material is presented.

Although there was an increase in English reading comprehension with academic progression from 72.13% in ZCL2 to 77.13% in ZCL303 and 76.30% in ZCL401 and analysis of variance detected a significant difference (p = .0025) of small practical significance (η^2 = .032) the post-hoc test was not powerful enough to detect any pairwise differences. The trend, however, appeared to be similar to the gain of pharmacological knowledge in that a greater increase in English reading comprehension was noted between ZCL2 and ZCL303 which then tapered slightly to ZCL401.

The movement towards preference for active experimentation as preferred means of processing of information was interesting. The significant difference in (AE-RO) was between the ZCL303 and ZCL401 students (Post-hoc testing with p = .0125). The module ZCL401 is structured to encourage the students to apply their pharmacological knowledge. After the first term the lecture orientated didactical approach is dropped in favour of a problem based, experiential model. The students attend hospital rounds three mornings a week and are required to screen patient charts, perform at least one in depth analysis of pharmacological therapy, implement pharmacist interventions, and undertake drug information requests from medical staff. On the 4th morning the students attend a review session on campus when they give case presentations which are staff and peer reviewed. Written assessments for the course are problem based. The students are presented with detailed case studies (three) and are required to optimise pharmacological management. This approach would encourage and nurture and active approach to processing knowledge which is in line with the finding that the measure of active knowledge processing (AE-RO) was significantly higher in the ZCL401 students.

There was no significant differences (p = .31) in scores achieved for Raven's SPM between the ZCL2 (48.70/60), ZCL303 (50.12/60), and ZCL401 (49.03/60) students. The

absence of a significant difference between the scores indicated that academic progression did not affect the reasoning ability of the students. By the time the students have attained the 2nd year of the BPharm programme they were relatively mature academically and would possess fairly well developed reasoning ability by the time they reached ZCL2. Another factor which could have impacted on these findings is the reported poor ability of the Raven's SPM to discriminate between more able young adults that is between the higher scoring candidates (Raven et al., 2000). A tool with better discriminatory ability, such as Raven's SPM Plus, might have yielded more significant results by allowing differences between the more able candidates to be distinguished.

The students felt that academic progression from ZCL2 to ZCL401had allowed them to gain an overview of the discipline. With academic maturity they were able to integrate their knowledge and gain a fuller understanding of the material. In the words of the fourth year students:

> *But now in fourth year like everything is coming together and I'm thinking " but I didn't understand this in second year". Now it's like "ag it's so easy". Yeah because now things just . . . the puzzle is complete and all the pieces fit. In second year it was like random pieces and it was like "okay" ... everything is so connected but in second year it was very abstract, everything was standing on its own,. (ZCL4:1)*

> *so this year with hospital hours it was more like easier for me to understand the pharmacology because everything just falls in place. It makes sense to me now. . . (ZCL4:4)*

> *... you like bring everything together, like it's an overall picture, instead of like just chapters in small boxes, you like put everything together, so this links how to this other chapter, oh this it's used in that other chapter as well, so why is that. So it brings everything together, like now I can see the overall picture of why we studied everything. But in second year and fourth-year it was just like we did not say how this is second year work, we are not going to*

be asked about that that's third-year work, that's antibiotics, that's got nothing to do with other medication but it's not actually that. A patient is treated with everything possible to treat conditions. It's not about treating only a disease it's about treating a patient with all the medication that we know. (ZCL4:5)

2.7.1. Summary – academic progression

An increase in English reading comprehension, Pharmacology vocabulary knowledge and the tendency towards active experimentation in processing of knowledge was noted with academic progression from ZCL2 to ZCL303 and to ZCL401.These findings are in line with the content and design of and relationship between the modules which leads to a progressive accumulation of knowledge with incremental application culminating in the module ZCL401.

2.8. Predictors of success in Pharmacology 2 (ZCL2)

Knowledge of which parameters are predictors of student success would be of great benefit to a Department presenting a BPharm degree. The knowledge could be used to identify students at risk with subsequent implementation of remedial action (Sharif et al., 2003). Knowledge of significant predictors of success in ZCL2 would enable the Department to implement remedial programmes in an attempt to improve the pass rate in ZCL2. The parameters that were investigated as possible predictors of success were gender, EFL/EAL status, study style as derived using Kolb's LSI, SI attendance, English reading comprehension, reasoning ability as indicated by scores on Raven's SPM, and BPharm1 weighted average.

Following regression analysis only two of the seven parameters investigated were positively correlated with the ZCL2 mark for the November examination. The two parameters were attendance at SI sessions (p = .02) and BPharm1 weighted average (p < .001). The positive correlation between attendance at SI sessions and achievement in ZCL2 is a further indication of the success of the intervention – introduction of the practice of

exploratory talk during the SI sessions. This finding emphasises that attention should be paid to encouraging the students to attend SI sessions and to the provision of support for the SI leaders to ensure that the dialogic approach of exploratory talk is promoted during the sessions.

In this study and cohort of ZCL2 students mother tongue was not a significant predictor of achievement in ZCL2. However, there was a significant non-zero correlation between English reading comprehension scores and achievement in ZCL2. This would seem to indicate the possibility that it is not mother tongue but rather English skills that correlate with achievement in Pharmacology. This is supported by the finding of Sharif et al. (2003) that English language skills were a strong predictor of achievement in the MPharm programme at Manchester University.

3. CHAPTER SIX SUMMARY

In this chapter the quantitative results presented in Chapter Four and the qualitative results presented in Chapter Five were interpreted and triangulated. The qualitative data provided rich descriptions, insight and perspectives which added weight to the quantitative data. The results were discussed in relation to the research questions that were asked at the start of this document in Chapter One. The research questions have all been discussed and answered and the findings have been linked to the published literature.

The intervention, the application of the practice of exploratory talk during SI sessions was successful as the experimental group achieved higher scores in the final written examination for ZCL2. This quantitative finding was supported by the qualitative data derived from the focus group session when the students voiced strong support for the application of exploratory talk and group discussions during SI sessions. At the end of the

intervention there was also a slight shift in learning styles, in the experimental group, towards active involvement in processing of knowledge (increased AE-RO).

There was no difference in learning styles or approach and attitude to studying pharmacology between the EFL and EAL students. More students with English reading comprehension scores in the categories functional or proficient were amongst the students achieving more than 65% for ZCL2 and a significant non-zero correlation was found between ZCL2 marks and English reading comprehension indicating that English language skills play a role in achievement in Pharmacology 2.

The final conclusions to be drawn from the study and the recommendations deriving from this work are presented in the next chapter, Chapter Seven.

CHAPTER SEVEN
CONCLUSIONS AND RECOMMENDATIONS

1. INTRODUCTION

Pharmacology, a major subject in the BPharm degree presented at the NMMU, is a discipline that demands a deeper understanding of the material and requires, initially, familiarisation with the technical language of the discipline. The medium of instruction for the BPharm degree at the NMMU is English. All text books are published in English and all hand-outs are printed in English. But for the majority of students (59.2%) their mother tongue is not English. The use of English as medium of instruction has been reported to be related to poor outcomes for EAL students at the university level (Deyi et al., 2007).

This study set out to investigate issues of language and learning in a multilingual Pharmacology classroom. In order to do so an intervention in the form of the introduction of the teaching strategy of exploratory talk was applied to a sample (ZCL2Exp) of the second year pharmacology students and to allow for investigation of the changes that occur with academic progression to be studied a parallel data collection from the ZCL303 and ZCL401 students occurred.

2. SUMMARY OF FINDINGS

The main findings of the study are summarised in this section. The findings are presented in three sections:

- Issues of teaching – the intervention;
- Issues of language; and
- Academic progression and indicators of success in ZCL2.

2.1. Issues of teaching – the intervention

The results strongly indicated the success of the intervention in terms of both the quantitative and qualitative data. The quantitative data demonstrated significantly improved achievement in ZCL2 amongst the experimental group who had attended the SI sessions during which the practice of exploratory talk was introduced. There was also a trend to modification of learning styles in the ZCL2Exp students who participated in group discussion during which exploratory talk was employed. There was an increased preference for active experimentation and decreased preference for reflective observation (AE-RO was increased) in the processing of knowledge. When exploratory talk is practised the participants actively applied their knowledge, provided supporting information for their statements and, as a group, built common understanding and deeper knowledge of the concept under discussion. These quantitative findings were triangulated with qualitative data derived from focus group discussions. The focus group discussions with the second year students provided rich information pertaining to the students' perceptions of the intervention. The students were in favour of the new format of SI sessions (introduction of the dialogic practice of exploratory talk) and were conscious of the academic benefit that accrued from participation in the sessions. According to the students:

> *"I prefer the new way of doing SI. The discussions work much better you learn a lot during discussions" (ZCL2:8)*

> *"Because to me Pharmacology is not a subject that you just sit down and read and read. It's something that is interactive. The times that I spent in the SI I can actually tell myself that I learn better than when I was not able to attend it." (ZCL2:2)*

A further indication of the success of the intervention was that attendance at SI sessions was a significant indicator of achievement in ZCL2.

2.2. Issues of language

When the issues of language were examined the picture that emerged was complex. There was a significant correlation between students' scores for the APAP English Skills test and marks achieved for the ZCL2 November examination. This finding indicated that English reading comprehension played a role in achievement in Pharmacology 2. A further link between achievement in ZCL2 and English language skills was demonstrated by the fact that 83.87% of students who achieved a mark of greater than or equal to 65% for ZCL2 had an English reading comprehension in the category of proficient or functional. According to a student "*So if you try to understand what is going on there and you don't understand the language of pharmacology, now you just lost between the two buildings*" (ZCL4:4). In addition English first language students achieved significantly higher scores than EAL students for English reading comprehension and knowledge of pharmacological vocabulary.

Learning styles were not affected by English language status. A similar distribution amongst the four categories was achieved by both EFL and EAL students. The dominant category was that of assimilator. Culture has been demonstrated to affect learning styles (Joy & Kolb, 2009) and in this study a difference was discerned in learning styles between students from West Africa and students from South Africa and the SADEC and East African regions. There was a trend towards a stronger inclination for active involvement in grasping and processing of knowledge amongst the West African students than in the other three groups.

When the question of differential achievement in Pharmacology by EFL and EAL students was examined a changing trend was discerned. In 2005 EFL students achieved significantly higher scores for ZCL2 than EAL students (Boschmans & McCartney, 2005). Amongst the cohort of ZCL2 students enrolled in this study (2011) the EAL students

achieved significantly higher scores than the EFL students. Thus the picture had switched with English mother tongue no longer associated with greater achievement in ZCL2. When achievement in ZCL2 relative to English language status was examined in the ZCL303 and ZCL401 groups a transitional scenario, between that of 2005 and 2011, emerged. Although the average mark for EFL students was higher than the mark for EAL students the difference was not statistically significant. Additionally when only the marks of current ZCL2 who were South African citizens were analysed there was no difference in the marks achieved by EFL and EAL students. Despite the improved overall performance of EAL ZCL2 students there is still cause for concern in that there was a lower percentage of total number of EAL students represented in the higher achievement category for ZCL2 ($\geq$ 65%) than of EFL students.

Thus in terms of issues of language, amongst the cohort of ZCL2 students who participated in this study, English as first language did not relate to a greater achievement in ZCL2. However, English language skills did relate to achievement in ZCL2 and higher scores were achieved for English reading comprehension and Pharmacology vocabulary knowledge by EFL students. Thus it would seem that amongst all students, no matter the mother tongue, improvement in English language skills would probably be linked to improved performance in ZCL2.

Finally, language did not impact on study skills and both EFL and EAL students had similar attitudes to and used similar approaches to studying Pharmacology.

2.3. Academic progression and indicators of success in Pharmacology 2 (ZCL2)

> *But now in fourth year like everything is coming together… the puzzle is complete and all the pieces fit. In second year it was like random pieces and it was like "okay" … everything is so connected but in second year it was very abstract, everything was standing on its own. (ZCL4:1)*

As indicated by the quotation from a fourth year student academic progression is associated with added academic maturity that allows for a fuller and deeper understanding of the material.

The results from this study revealed an increase in English reading comprehension and Pharmacology vocabulary knowledge from ZCL2 to ZCL401. In addition there was a tendency towards active experimentation in the processing of knowledge. This is in line with the problem based teaching methodologies used during the module ZCL401. The increased experiential learning could also modify learning styles towards active experimentation as reflected in the results.

Parameters linked to success in ZCL2 were also investigated. Regression analysis revealed that attendance at SI sessions and prior achievement in BPharm1 were significantly linked to achievement in ZCL2.

3. CONCLUSIONS

The following conclusions can be drawn:

- Sub-question One: The relationship between EFL and EAL and achievement in ZCL2 is complex. In 2005 the EFL students achieved significantly higher marks for ZCL2 than the EAL students (Boschmans & McCartney, 2005). When the marks achieved for ZCL2 by the current ZCL401 and ZCL303 students were interrogated the EFL students achieved higher marks than the EAL students but the difference was no longer significant. The current ZCL2 EAL students achieved significantly higher scores for ZCL2 than the EFL students, a reversal of the picture observed in 2005. However, when the non-South African students were removed from the sample of current ZCL2 students there was no longer a

significant difference between the marks obtained by the EFL and EAL students, possibly due to non-South African students have higher entry score and/or being mature students with high motivation to succeed. This finding will be further elucidated on in the discussion pertaining to Sub-question Two.

- Sub-question Two: There was a significant non-zero correlation between English reading comprehension and achievement in Pharmacology and the requisite reading material for the BPharm programme has been reported to require a high level of English reading comprehension (Fuller et al., 2007; Roberts et al., 1994). Thus this study seems to indicate that it is English language skills such as reading comprehension rather than EFL or EAL status that is linked to achievement in Pharmacology.

- Sub-question Three: Students whose first language was English achieved significantly higher scores for the APAP English Skills test and the Pharmacology Vocabulary Questionnaire than the EAL students. There was a significant increase in English Reading comprehension score with academic year (academic progression) amongst the EFL students but not amongst the EAL students. Scores for Pharmacology vocabulary knowledge did increase with academic progression for both the EFL and the EAL students, however, the increase in score achieved amongst the EFL students was of greater practical significance. The difference between the mean scores achieved by the EFL and EAL students for both English reading comprehension and Pharmacology vocabulary knowledge were smaller for the ZCL2 group than for the ZCL303 and ZCL401 groups (English Reading comprehension difference in mean scores EFL - EAL: ZCL2 = -0.72, ZCL303 = 5.68, and ZCL401 = 7.82. Pharmacology vocabulary knowledge difference in

mean scores EFL – EAL: ZCL2 = 2.05, ZCL303 = 8.04, ZCL401 = 5.21). The greater difference in scores between the ZCL401 and ZCL303 EFL and EAL students than between the ZCL2 EFL and EAL students is in line with the findings of the previous two objectives. Namely that the current ZCL2 EAL students achieved higher scores for ZCL2 than the EFL students. But amongst the ZCL303 and ZCL401 students the ZCL2 marks achieved for the EFL students were slightly higher than those of the EAL students while the difference in scores for English reading comprehension and Pharmacology vocabulary questionnaire were greater for these cadres.

- Sub-question Four: There was no relationship between the students' first language and learning styles. Assimilator was the dominant study style identified in both the EFL and the EAL students. A difference in learning styles distribution was noted when the data were analysed according to geographical region of citizenship. Cultural differences have been documented as modifiers of learning styles (Joy & Kolb, 2009).

- Sub-question Five: The EFL and EAL students adopted similar approaches to studying Pharmacology and had similar attitudes to the module.

- Sub-question Six: The dialogic approach of exploratory talk implemented during SI sessions significantly increased the mean ZCL2 mark achieved by ZCL2Exp as compared to the ZCL2Com mark. The students had positive attitudes towards and valued the benefits of involvement in the practice of exploratory talk.

- Academic Progression: The Students' English reading comprehension and Pharmacology knowledge levels improved with academic progression.

- Predictors of ZL2 achievement: Two of the seven parameters tested were significantly related to achievement in ZCL2. These were SI attendance and BPharm1 marks.

The findings of this study provided insights into the teaching of pharmacology in a multilingual classroom. More effective approaches to teaching pharmacology and areas for remedial activity that will contribute towards improved achievement levels have emerged from this study. These include the introduction of the practice of exploratory talk during practical sessions and the implementation of context-embedded remedial English and discipline specific vocabulary activities. The qualitative results, in addition to strengthening the quantitative findings through triangulation, have also provided a deep, rich and detailed description of the lived experiences of pharmacology students. These data will provide insights into the student's experiences for Pharmacy lecturers and are a resource for understanding student perspectives.

4. LIMITATIONS OF THE STUDY

Limitations pertaining to sample size and selection and to the setting of the study must be borne in mind when the findings of the study are considered. This section will elucidate on the limitations relating to sample size, setting of the study and sampling approach used that are pertinent to this study

4.1. Sample size

The study comprised an intervention component and a parallel data collection from comparator groups. For the intervention component the experimental subgroup consisted of 23 subjects. The researcher had no control over the size of the experimental subgroup as it was a self-selecting sample. Attendance of SI sessions during which the intervention was applied was on a voluntary basis. Although this sample size falls within the recommendation

of Onwuegbuzie et al. (2004) for an experimental design the implication of the small experimental group size is that some findings might not be of practical significance due to the effect of sample size on statistical testing. Nevertheless despite the small size of the experimental group findings pertinent to the main research question were significant namely that the students who participated in the intervention achieved higher scores for ZCL2 than the comparison group. The value of the intervention was further substantiated by the qualitative data.

4.2. Setting

Careful consideration must be given to extrapolation of the findings as the study was sited in one university situated in a specific province (Eastern Cape) in South Africa, presenting the BPharm programme with a specific student demographic mix. However, the insights provided by the findings of this study may be translated into other HET institutions where similar conditions pertaining to language of presentation and student demographics exist.

4.3. Sampling

Purposive sampling was used. The samples only consisted of Pharmacology students enrolled at the NMMU. As such caution must be exercised in terms of extrapolation of the findings of this study to students at other institutions. However, the student body in the Pharmacy Department at the NMMU is fairly representative of students at other institutions offering the BPharm degree. Thus the findings of this study should be of interest and value to all institutions presenting modules in Pharmacology to BPharm students.

5. RECOMMENDATIONS FOR FURTHER STUDY

The findings of this study have illustrated the value and effectiveness of the implementation of the practice of exploratory talk at the tertiary level. To date little research

into the practice of exploratory talk has been undertaken at the university level. The study has also highlighted the poor technical vocabulary skills amongst the student body and the relationship between English skills and academic achievement in a discipline such as Pharmacology.

Further areas for research emerge from these findings. These include:

- Investigation of the effect(s) of implementation and integration of the dialogic practice of exploratory talk into mainstream Pharmacology teaching;

- As the APAP English Skills test is a better indicator of achievement in Pharmacology than the student's first language (mother tongue) future research directions could include exploration of possible mechanisms to improve English language skills and discipline specific vocabulary knowledge in both EAL and EFL students.

- Discipline specific vocabulary knowledge was poor across the majority of students thus a possible area for research would be to investigate the development of a lexicon or bilingual glossary (English/ isiXhosa) in the discipline of Pharmacology and assess the impact of such a tool on the concept literacy of Pharmacology students; and

- As throughput rates in Pharmacology are below desired levels a valuable area for interrogation would be possible markers of academic achievement in the BPharm programme and mechanisms to improve throughput.

6. CONCLUDING REMARKS

This study interrogated issues of teaching and learning in a multilingual university classroom. These issues are encountered on a daily basis by academics in South Africa and elsewhere in the world where multilingual student bodies exist. The process of investigating these issues has, on a personal level, greatly increased my understanding of the students' perspective – a valuable experience for an academic as it allows one to relook at situations with fresh insight. From a research perspective the outcomes of the study have clearly indicated that, at the university level, students do benefit from the application of the practice of exploratory talk. Another finding of note was the predominance of English reading comprehension rather than the student's mother tongue as a variable contributing to achievement in Pharmacology. Finally while reflecting on the journey travelled while undertaking this research project I realised that what started as a study to enable the researcher to complete an academic qualification has, through the process, opened up large exciting vistas of future research areas pertaining to education at the university level.

"Somewhere, something incredible is waiting to be known."

Dr Carl Sagan (1934 to 1996)

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APPENDIX A

Raven's SPM Answer Sheet

Nelson Mandela Metropolitan University
for tomorrow

TEACHING PHARMACOLOGY RESEARCH

RAVEN'S PROGRESSIVE MATRICES

STUDENT NUMBER: _____BIRTHDATE: _____(dd/mm/yr)

BPHARM YEAR: _____ZCL MODULE REGISTERED FOR: _____

TODAY'S DATE: _____

Choose one answer only. Answer by MAKING A CROSS (X) over the appropriate number.

SET A						
A1	1	2	3	4	5	6
A2	1	2	3	4	5	6
A3	1	2	3	4	5	6
A4	1	2	3	4	5	6
A5	1	2	3	4	5	6
A6	1	2	3	4	5	6
A7	1	2	3	4	5	6
A8	1	2	3	4	5	6
A9	1	2	3	4	5	6
A10	1	2	3	4	5	6
A11	1	2	3	4	5	6
A12	1	2	3	4	5	6

SET B						
B1	1	2	3	4	5	6
B2	1	2	3	4	5	6
B3	1	2	3	4	5	6
B4	1	2	3	4	5	6
B5	1	2	3	4	5	6
B6	1	2	3	4	5	6
B7	1	2	3	4	5	6
B8	1	2	3	4	5	6
B9	1	2	3	4	5	6
B10	1	2	3	4	5	6
B11	1	2	3	4	5	6
B12	1	2	3	4	5	6

PLEASE TURN OVER

SET C								
C1	1	2	3	4	5	6	7	8
C2	1	2	3	4	5	6	7	8
C3	1	2	3	4	5	6	7	8
C4	1	2	3	4	5	6	7	8
C5	1	2	3	4	5	6	7	8
C6	1	2	3	4	5	6	7	8
C7	1	2	3	4	5	6	7	8
C8	1	2	3	4	5	6	7	8
C9	1	2	3	4	5	6	7	8
C10	1	2	3	4	5	6	7	8
C11	1	2	3	4	5	6	7	8
C12	1	2	3	4	5	6	7	8

SET D								
D1	1	2	3	4	5	6	7	8
D2	1	2	3	4	5	6	7	8
D3	1	2	3	4	5	6	7	8
D4	1	2	3	4	5	6	7	8
D5	1	2	3	4	5	6	7	8
D6	1	2	3	4	5	6	7	8
D7	1	2	3	4	5	6	7	8
D8	1	2	3	4	5	6	7	8
D9	1	2	3	4	5	6	7	8
D10	1	2	3	4	5	6	7	8
D11	1	2	3	4	5	6	7	8
D12	1	2	3	4	5	6	7	8

SET E								
E1	1	2	3	4	5	6	7	8
E2	1	2	3	4	5	6	7	8
E3	1	2	3	4	5	6	7	8
E4	1	2	3	4	5	6	7	8
E5	1	2	3	4	5	6	7	8
E6	1	2	3	4	5	6	7	8
E7	1	2	3	4	5	6	7	8
E8	1	2	3	4	5	6	7	8
E9	1	2	3	4	5	6	7	8
E10	1	2	3	4	5	6	7	8
E11	1	2	3	4	5	6	7	8
E12	1	2	3	4	5	6	7	8

THANK YOU FOR YOUR PARTICIPATION

APPENDIX B

Pharmacology Vocabulary Questionnaire

PHARMACOLOGY VOCABULARY QUESTIONNAIRE: PART A

STUDENT NUMBER			
TODAYS DATE			
BPHARM YEAR	2	3	4

For each word in column A select *one* of Column B, C, D, or E by placing a cross (X) in the appropriate box and then provide a meaning for the word in column F

A	B	C	D	E	F
WORD	DO NOT KNOW	HAVE NEVER SEEN	WORD FAMILIAR	I KNOW WORD	MEANING OF WORD
activating					
acute					
anaemia					
attack					
chronic					
clinical					
compartments					
concurrent					
controlled					
counsel					
counteract					
depression					
diurnal					
epigastric					
failure					
fatal					

PHARMACOLOGY VOCABULARY QUESTIONNAIRE: PART A

A	B	C	D	E	F
WORD	DO NOT KNOW	HAVE NEVER SEEN	WORD FAMILIAR	I KNOW WORD	MEANING OF WORD
flushed					
gnawing					
impaired					
interaction					
intermittent					
maintenance					
motility					
nausea					
onset					
optimal					
output					
pernicious					
persistent					
potent					
precipitate					
predisposed					
procedure					
productive					
puffiness					
rebound					
recurrent					
reflex					

PHARMACOLOGY VOCABULARY QUESTIONNAIRE: PART A

A	B	C	D	E	F
WORD	DO NOT KNOW	HAVE NEVER SEEN	WORD FAMILIAR	I KNOW WORD	MEANING OF WORD
resolve					
secondary					
slow-release					
steady					
stenting					
subsequent					
suffered					
synergistic					
therapeutic					
thrombotic					
ulcer					
vomiting					
Thank you for completing the questionnaire.					

PHARMACOLOGY VOCABULARY QUESTIONNAIRE: PART B

STUDENT NUMBER				
TODAYS DATE				
BPHARM YEAR	2	3	4	

SCENARIO

The underlined words in each paragraph are written in Column A. For each word in column A select ***one*** of Column B, C, D, or E by placing a cross (X) in the appropriate box and then provide a meaning for the word in column F

A	B	C	D	E	F
WORD	DO NOT KNOW	HAVE NEVER SEEN	WORD FAMILIAR	I KNOW WORD	MEANING OF WORD
1 Mr Brown ***suffered*** an ***acute*** asthma ***attack*** and was admitted to hospital. The attack had commenced 30 minutes prior to admission. When questioned Mr Brown mentioned that he had twisted his ankle 2 days before the incident and was taking Ibuprofen to relieve the pain. He enquired whether this drug might have ***predisposed*** him to an acute asthma attack. Prior to the attack Mr Brown was well ***controlled*** and was receiving ***maintenance*** therapy of ***concurrent*** ***slow-release*** Theophylline and inhaled beclomethasone and used ***intermittent*** inhaled salbutamol.					
suffered					
acute					
attack					
predisposed					
controlled					
maintenance					
concurrent					
slow-release					
intermittent					
2 Lipophilic drugs tend to distribute into the deeper ***compartments*** of the body such as adipose tissue with ***subsequent*** reduction in plasma concentration of the drug. For such agents it will take longer for ***steady*** state to be achieved.					
compartments					

PHARMACOLOGY VOCABULARY QUESTIONNAIRE: PART B

	A	B	C	D	E	F
	WORD	DO NOT KNOW	HAVE NEVER SEEN	WORD FAMILIAR	I KNOW WORD	MEANING OF WORD
	subsequent					
	steady					
3	Patients who have been diagnosed with a *chronic* condition such as hypertension or *depression* should be *counselled* by the pharmacist to ensure compliance and improve outcomes. On reviewing the patient's medication the pharmacist should assess the appropriateness of therapy and confirm that there are no *clinically* significant drug *interactions*.					
	chronic					
	depression					
	counselled					
	clinically					
	interactions					
4	On admission Mr Ncula was looking quite flushed, was feeling *nauseous* and had had one episode of *vomiting*. He also complained of a *gnawing* *epigastric* pain. On examination the doctor found a *productive* cough, increased gastric *motility*, facial *puffiness* and a reduced urinary *output*.					
	flushed					
	nauseous					
	vomiting					
	gnawing					
	epigastric					
	productive					
	motility					
	puffiness					
	output					

PHARMACOLOGY VOCABULARY QUESTIONNAIRE: PART B

	A	B	C	D	E	F
	WORD	DO NOT KNOW	HAVE NEVER SEEN	WORD FAMILIAR	I KNOW WORD	MEANING OF WORD
5	*Diurnal* variations in blood pressure are a common clinical picture with higher levels occuring during the day than at night. Often *failure* to respond to treatment occurs because medication is taken at the incorrect time of day. Some drugs used to treat hypertension can *precipitate* *rebound* tachycardia *secondary* to vasodilation and must be prescribed with a second agent that will *counteract* this effect.					
	diurnal					
	failure					
	precipitate					
	rebound					
	secondary					
	counteract					

APPENDIX C

Language History Questionnaire

LANGUAGE HISTORY QUESTIONNAIRE

To complete the questionnaire please place a cross in the appropriate box or fill the required information in the box provided. Thank you.

1) **Date:** _____ *(use the format for the date of DD/MM/CCCC)*

2) **Student number:** _____

3) **Gender** MALE | FEMALE

4) **Enrolled for:** BPHARM - 4 years | BPHARM EXTENDED PROGRAMME - 5 years

5) **Registered for:** ZCL203 | ZCL303 | ZCL401

6) **Date of Birth:** _____ *(use the format for the date of DD/MM/CCCC)*

7) **Place of birth:**

Town	
Country	

8) **Citizenship:**

South Africa	
Other (fill in country)	

9) **Country of permanent residence:** _____

10) **What language(s) did you learn/speak first?** _____

11) **What is your Mother's first language/mother tongue?** _____

12) **What is your Father's first language/mother tongue?** _____

13) **Language(s) spoken at home:** **(If more than one language is used list all languages)**

with Mother	1)
	2)
	3)
with Father	1)
	2)
	3)
with brothers/sisters	1)
	2)
	3)

14) **Among the languages you know which language is the one that you would PREFER to use:**

At home with your family	
On campus (social)	
On campus (lectures)	
On campus (SI sessions)	
In general	

LANGUAGE HISTORY QUESTIONNAIRE

15) Language(s) during schooling: (If more than one language was used list all languages)

	Language(s) used for Teaching	Language(s) used for Assessment (exams)	Country
Pre-School (before year 1)			
Primary School (year 1 to year 7)			
Secondary School (Year 8 to year 12)			
Tertiary Education **before** current BPharm			
Name of above Tertiary Qualification			

16) Current language(s) use: **If more than one language is used include all languages. Include in brackets after the name of the langage the percentage of the time you use this language *e.g. isiXhosa (75%)***

ENVIRONMENT	LANGUAGE 1 (%)	LANGUAGE 2 (%)	LANGUAGE 3 (%)
Academic (on campus)			
lecture presentation			
group study - informal			
SI sessions			
personal notes			
reading for course			
discussing ZCL with peers			
studying			
Social (on campus)			
chatting to class mates			
social non BPharm friends			
in library			
administrative matters			
Life off campus			
place of residence			
socialising			
listening to music			
leisure reading			
TV viewing			
Movies			
email / internet			
Facebook or similar			
Sms/texting			

Thank you for completing the questionnaire.

APPENDIX D

Ethical Approval: Faculty Research, Technology and Innovation

Committee of Education at NMMU

Nelson Mandela Metropolitan University

for tomorrow

FACULTY OF EDUCATION
Tel . +27 (0)41 504 2125
Fax. +27 (0)41 504 9383

14 March 2011
Ms SA Boschmans / Prof P Webb
Education Faculty
NMMU

Dear Ms SA Boschmans

TEACHING PHARMACOLOGY AT THE HET LEVEL: ISSUES OF LANGUAGE OF INSTRUCTION IN A MULTILINGUAL CLASSROOM

Your above-entitled application for ethics approval served at the March meeting of the Faculty Research, Technology and Innovation Committee of Education (ERTIC).

We take pleasure in informing you that the application was approved by the Committee.

The ethics clearance reference number is **H11-Edu-CRT-006**.

We wish you well with the project. Please inform your co-investigators of the outcome, and convey our best wishes.

Yours sincerely

Ms J Elliott-Gentry
Secretary: ERTIC

APPENDIX E

Written Informed Consent

• PO Box 77000 • Nelson Mandela Metropolitan University
• Port Elizabeth • 6031 • South Africa • www.nmmu.ac.za

Nelson Mandela Metropolitan University
for tomorrow

SOUTH CAMPUS
PHARMACY DEPARTMENT
Tel . +27 (0)41 5042717 Fax. +27 (0)5042744
Shirley-Anne.Boschmans@nmmu.ac.za
DATE XXX

Ref:

Contact person: Mrs S-A Boschmans

Dear Participant

You are being asked to participate in a research study. Participation is voluntary. The study will investigate the issues of language of instruction in a multilingual classroom during the teaching of Pharmacology. The outcomes of this study will be used to optimise the teaching of Pharmacology at NMMU.

During the study data will be collected pertaining to English language skills (APAP English Skills Test pre-admission data and current testing) and health related vocabulary, you might be asked to participate in a focus group discussion, you will complete a study style assessment, you will be asked about your day to day language use, and your problem solving ability will be assessed. Your name will not be linked to this data (student numbers will be used in isolation as data identifiers) and confidentiality will be maintained at all times.

To participate, it will be required of you to provide a written consent that will include your signature, date and initials to verify that you understand and agree to the conditions.

You have the right to query concerns regarding the study at any time. Immediately report any new problems during the study, to the researcher. A telephone number of the researcher is provided. Please feel free to raise any concerns.

Furthermore, it is important that you are aware of the fact that the ethical integrity of the study has been approved by the Research Ethics Committee (Human) of the university. The REC-H consists of a group of independent experts that has the responsibility to ensure that the rights and welfare of participants in research are protected and that studies are conducted in an ethical manner. Studies cannot be conducted without REC-H's approval. Queries with regard to your rights as a research subject can be directed to the Research Ethics Committee (Human), Department of Research Capacity Development, PO Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031. If no one could assist you, you may write to: The Chairperson of the Research, Technology and Innovation Committee, PO Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031.

If you do partake, you have the right to withdraw at any given time, during the study without penalty or loss of benefits. Although your identity will at all times remain confidential, the results of the research study may be presented at scientific conferences or in specialist publications. This informed consent statement has been prepared in compliance with current statutory guidelines.

Yours sincerely

Shirley-Anne Boschmans (Researcher)

NELSON MANDELA METROPOLITAN UNIVERSITY

INFORMATION AND INFORMED CONSENT FORM

RESEARCHER'S DETAILS	
Title of the research project	**Teaching Pharmacology at the HET level: Issues of language of instruction in a multilingual classroom.**
Reference number	
Principal investigator	**Shirley-Anne Boschmans**
Address	**Pharmacy Department, Faculty of Health Sciences, PO Box 77000** **Nelson Mandela Metropolitan University** **Port Elizabeth**
Postal Code	**6031**
Contact telephone number (private numbers not advisable)	**041-5042717**

A. DECLARATION BY PARTICIPANT		Initial
I, the participant and the undersigned	(full names)	
ID number		
Address (of participant)		

A.1 HEREBY CONFIRM AS FOLLOWS:		Initial
I, the participant, was invited to participate in the above-mentioned research project		
that is being undertaken by	Shirley-Anne Boschmans	
from	Pharmacy Department, Faculty of Health Sciences	
of the Nelson Mandela Metropolitan University.		

THE FOLLOWING ASPECTS HAVE BEEN EXPLAINED TO ME, THE PARTICIPANT:					Initial
2.1	Aim:	The investigators are studying issues of language of instruction in the teaching of Pharmacology. The information will be used to optimise teaching of Pharmacology in the Pharmacy department, NMMU.			
2.2	Procedures:	I understand the procedures that have been stipulated in the information letter.			
2.5	Confidentiality:	My identity will not be revealed in any discussion, description or scientific publications by the investigators.			
2.6	Access to findings:	Any new information or benefit that develops during the course of the study will be shared as academic publications.			
2.6	Voluntary participation / refusal / discontinuation:	My participation is voluntary	YES	NO	
		My decision whether or not to participate will in no way affect my present or future studies/career.	TRUE	FALSE	

3. THE INFORMATION ABOVE WAS EXPLAINED TO ME/THE PARTICIPANT BY:									Initial
Shirley-Anne Boschmans									
in	Afrikaans		English	X	Xhosa		Other		
and I am in command of this language.									
I was given the opportunity to ask questions and all these questions were answered satisfactorily.									

4.	No pressure was exerted on me to consent to participation and I understand that I may withdraw at any stage without penalisation.	
5.	Participation in this study will not result in any additional cost to myself.	

A.2 I HEREBY VOLUNTARILY CONSENT TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT:		
Signed/confirmed at	on	2011
Signature of participant	Signature of witness:	
	Full name of witness:	

B. STATEMENT BY OR ON BEHALF OF INVESTIGATOR								
I,	Shirley-Anne Boschmans			declare that:				
1.	I have explained the information given in this document to			(name of participant)				
2.	He / she was encouraged and given ample time to ask me any questions;							
3.	This conversation was conducted in	Afrikaans		English	X	Xhosa		Other
4.	I have detached Section C and handed it to the participant			YES		NO		
Signed/confirmed at				on		2011		
Signature of interviewer				Signature of witness:				
				Full name of witness:				

C. IMPORTANT MESSAGE TO PARTICIPANT	
Dear participant Thank you for your participation in this study. Should, at any time during the study: - you require any further information with regard to the study,	
Kindly contact	Shirley-Anne Boschmans
at telephone number	041-5042717

APPENDIX F:

Chapter Four Tables

Table F.1: *Gender, age, BPharm programme type, birth region, and citizenship in ZCL2, ZCL303 and ZCL401 samples*.

Table F.2: *Gender, age, BPharm programme type, birth region, and citizenship in the ZCL2Com and ZCL2Exp samples*.

Table F.3: *English as mother tongue, language used for teaching at school and language used at home in the ZCL2, ZCL303 and ZCL401 samples*.

Table F.4: *Language used for academic purposes, language use on campus, and language use off campus in the ZCL2, ZCL303 and ZCL401 samples*.

Table F.5: *English as mother tongue, language used for teaching at school and language used at home in the ZCL2Com and ZCL2Exp samples*.

Table F.6: *Language used for academic purposes, language use on campus, and language use off campus in the ZCL2Com and ZCL2Exp samples*.

Table F.1.

Frequency distribution of gender, age, BPharm programme type, birth region, and citizenship in the three sample groups ZCL2, ZCL303 and ZCL401 where the ZCL2 sample is the combined ZCL2Com sample and ZCL2Exp sample prior to self-selection into experimental and comparison samples.

	Group							
	ZCL2		ZCL3		ZCL4		Total	
	n	%	n	%	n	%	n	%
Gender	*(n = 120)*		*(n = 67)*		*(n = 41)*		*(n = 228)*	
Male	49	40.83	23	34.33	19	46.34	91	39.91
Female	71	59.17	44	65.67	22	53.66	137	60.09
Age (years)	*(n = 114)*		*(n = 66)*		*(n = 37)*		*(n = 217)*	
19 to 20	24	21.05	3	4.55	0	0.00	27	12.44
21	30	26.32	13	19.70	1	2.70	44	20.28
22	19	16.67	10	15.15	9	24.32	38	17.51
23	14	12.28	15	22.73	13	35.14	42	19.36
24	8	7.02	8	12.12	2	5.41	18	8.29
25	2	1.75	6	9.09	3	8.11	11	5.07
26 to 29	7	6.14	6	9.09	7	18.92	20	9.22
30 to 53	10	8.77	5	7.58	2	5.41	17	7.83
BPharm Programme	*(n = 120)*		*(n = 67)*		*(n = 41)*		*(n = 228)*	
4 Yrs	94	78.33	58	86.57	32	78.05	184	80.70
Extended/Foundation	26	21.67	9	13.43	9	21.95	44	19.30
Birth Region	*(n = 120)*		*(n = 67)*		*(n = 41)*		*(n = 228)*	
South Africa	59	49.17	33	49.25	26	63.41	118	51.75
SADEC	51	42.50	22	32.84	7	17.07	80	35.09
E. Africa	4	3.33	12	19.91	4	9.75	20	8.77
W. Africa	5	4.17	0	0	3	7.31	8	3.51
Asia	1	0.83	0	0	1	2.44	2	0.88
Citizenship	*(n = 120)*		*(n = 67)*		*(n = 41)*		*(n = 228)*	
South Africa	60	50	35	52.24	26	63.42	121	53.07
SADEC	52	43.34	21	31.34	7	17.07	80	35.09
E.Africa	4	3.33	11	16.42	4	9.76	19	8.33
W.Africa	4	3.33	0	0	3	7.32	7	3.07
Europe	0	0	0	0	1	2.43	1	0.44

Gender: Chi^2 (df = 2, n = 228) = 1.62; p = .445 ; Age: Chi^2 (df = 14, n = 217) = 44.11; p = .0001 ; Programme: Chi^2 (df = 2, n = 228) = 2.10; p = .350 ; Birth Region: Chi^2(df = 8, n = 228) = 23.48; p = .0028 ; Citizenship: Chi^2 (df = 8, n = 228) = 25.44; p = .0013.

ZCL2 = ZCL2 combined group; ZCL303 = ZCL303 comparator group; ZCL401 = ZCL401 comparator group. Extended = students registered for the Extended BPharm (5 years) programme. Foundation = students registered for the Science Foundation programme 1 year) prior to registration for BPharm.

SADEC = Southern African Development Community = Botswana, Mauritius, Namibia, Seychelles, Swaziland, Tanzania, Zambia, Zimbabwe. E. Africa = East Africa = Cameroon, Democratic Republic of Congo, Ghana. W. Africa = West Africa = Burundi, Kenya, Somalia, Uganda. Asia = China, Pakistan. Europe = Netherlands.

Table F.2.
Frequency distribution of gender, age, BPharm programme type, birth region, and citizenship in the ZCL2Com and ZCL2Exp samples

	Group					
	ZCL2Com		ZCL2Exp		Total	
	n	%	n	%	n	%
Gender	*(n = 97)*		*(n = 23)*		*(n = 120)*	
Male	39	40.21	10	43.48	49	40.83
Female	58	59.79	13	56.52	71	59.17
Age (years)	*(n = 93)*		*(n = 21)*		*(n = 114)*	
19	7	7.53	1	4.76	8	7.02
20	13	13.98	3	14.29	16	14.04
21	19	20.43	11	52.38	30	26.32
22	18	19.35	1	4.76	19	16.67
23	13	13.98	1	4.76	14	12.28
24	8	8.60	0	0.00	8	7.02
25	2	2.15	0	0.00	2	1.75
26 to 29	6	6.45	1	4.76	7	6.14
30 to 53	7	7.53	3	14.29	10	8.77
BPharm Programme	*(n = 97)*		*(n = 23)*		*(n = 120)*	
4 Yrs	72	74.23	22	95.65	94	78.33
Extended/Foundation	25	25.77	1	4.35	26	21.67
Birth Region	*(n = 97)*		*(n = 23)*		*(n = 120)*	
South Africa	55	56.70	4	17.39	59	49.17
SADEC	34	35.05	17	73.91	51	42.50
E. Africa	4	4.12	0	0.00	4	3.33
W. Africa	4	4.12	1	4.35	5	4.17
Asia	0	0.00	1	4.35	1	0.83
Citizenship	*(n = 97)*		*(n = 23)*		*(n = 120)*	
South Africa	55	56.70	5	21.74	60	50.00
SADEC	34	35.05	18	78.26	52	43.33
E.Africa	4	4.12	0	0.00	4	3.33
W.Africa	4	4.12	0	0.00	4	3.33
Europe	0	0.00	0	0.00	0	0.00

Gender: $Chi^2(df = 1, n = 120) = 0.08$; $p = .774$; Age: $Chi^2 (df = 8, n = 114) = 13.44$; $p = .098$; Programme: $Chi^2 (df = 1, n = 120) 5.03$; $p = .025$; Birth Region: $Chi^2(df = 4, n = 120) = 17.62$; $p = .0015$; Citizenship: $Chi^2 (df = 3, n = 120) = 14.45$; $p = .0024$.
ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group.
Extended = students registered for the Extended BPharm (5 years) programme. Foundation = students registered for the Science Foundation programme 1 year) prior to registration for BPharm.
SADEC= Southern African Development Community = Botswana, Mauritius, Namibia, Seychelles, Swaziland, Tanzania, Zambia, Zimbabwe. E. Africa = East Africa = Cameroon, Democratic Republic of Congo, Ghana. W. Africa = West Africa = Burundi, Kenya, Somalia, Uganda. Asia = China, Pakistan. Europe = Netherlands.

Table F.3.

Frequency distribution in the ZCL2, ZCL301, and ZCL401 samples of the use of English as mother tongue, language for teaching at school, and language used at home.

	Group							
	ZCL2		ZCL303		ZCL401		Total	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Mother Tongue	n=120		n=67		n=41		n=228	
English	43	35.83	30	44.78	20	48.78	93	40.79
not English	77	64.17	37	55.22	21	51.22	135	59.21
Schooling - Lang for Teaching	*n*=120		*n*=67		*n*=41		*n*=228	
No English	53	44.17	28	41.79	19	46.34	100	43.86
Primary only	4	3.33	4	5.97	1	2.44	9	3.95
Secondary only	19	15.83	8	11.94	8	19.51	35	15.35
Prim. & Sec.	44	36.67	27	40.30	13	31.71	84	36.84
Language use at home	*n*=120		*n*=65		*n*=41		*n*=226	
No English	32	26.67	24	36.92	13	31.71	69	30.53
English with 1 of M/F/S	13	10.83	2	3.08	4	9.76	19	8.41
English with 2 of M/F/S	7	5.83	7	10.77	7	17.07	21	9.29
English with 3 of M/F/S	68	56.67	32	49.23	17	41.46	117	51.77

Mother tongue: Chi^2(*df.* = 2, *n* = 228) = 2.75; *p* = .253; Schooling- language of teaching: Chi^2(*df.* = 6, *n* = 228) = 2.67; *p* = .849; Language use at home: Chi^2(*df.* = 6, n = 226) = 10.45 *p* = .280; ZCL2 = ZCL2 combined group. ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. Mother Tongue = first language(s) respondent learnt to speak. Primary School = first seven years of schooling. Secondary School = years eight to 12 at school – following year 12 entry to tertiary education is granted if the marks gained during the final year 12 examination meet the entry criteria. No English = Language other than English used as medium of instruction during both primary and secondary schooling. Primary only = English used as the medium of instruction in primary school but not in secondary school. Secondary only = English used as medium of instruction in secondary school but not in primary school. Prim. & Sec. = English used as the medium of instruction in both primary and secondary school. Language use at home = Family members with whom the respondent communicated with in English in the home environment. No English = Did not communicate in English with mother, father, or siblings. English with 1 of M/F/S = spoke in English with one of mother, father, or siblings. English with 2 of M/F/S = spoke in English with two of mother, father, or siblings. English with 3 of M/F/S = spoke in English with all of mother, father, and siblings.

Table F.4.

Frequency distribution in ZCL2, ZCL303, and ZCL401 of language used for academic purposes, language use on campus, and language use off campus.

	Group							
	ZCL2		ZCL303		ZCL401		Total	
	n	(%)	n	(%)	*n*	(%)	*n*	(%)
Language use academic (%)	n=118		n=65		n=41		n=224	
0 to 24	0	0.00	0	0.00	0	0.00	0	0.00
25 to 49	0	0.00	0	0.00	0	0.00	0	0.00
50 to 74	2	1.69	0	0.00	0	0.00	2	0.89
75 to 89	4	3.39	4	6.15	2	4.88	10	4.46
90 to 99	55	46.61	28	43.08	14	34.15	97	43.30
100	57	48.31	33	50.77	25	60.98	115	51.34
Language use on campus (%)	*n*=120		*n*=65		*n*=41		*n*=226	
0 to 24	2	1.67	3	4.62	1	2.44	6	2.65
25 to 49	15	12.50	6	9.23	5	12.20	26	11.50
50 to 74	37	30.83	13	20.00	10	24.39	60	26.55
75 to 89	21	17.50	20	30.77	4	9.76	45	19.91
90 to 99	19	15.83	10	15.38	8	19.51	37	16.37
100	26	21.67	13	20.00	13	31.71	52	23.01
Language use off campus (%)	*n*=120		*n*=66		*n*=41		*n*=227	
0 to 24	0	0	1	1.52	0	0.00	1	0.44
25 to 49	7	5.83	7	10.61	2	4.88	16	7.05
50 to 74	46	38.33	18	27.27	11	26.83	75	33.04
75 to 89	31	25.83	15	22.73	16	39.02	62	27.31
90 to 99	22	18.33	18	27.27	7	17.07	47	20.70
100	14	11.67	7	10.61	5	12.20	26	11.45

Language use academic: $Chi^2(df = 6, n = 224) = 4.58$; $p = .598$; Language use on campus: $Chi^2(df = 10, n = 226) = 12.08$; $p = .280$; Language use off campus: $Chi^2(df = 10, n = 227) = 11.00$; $p = .357$;

ZCL2 = ZCL2 combined group. ZCL303 = ZCL303 comparator group. ZCL401 = ZCL401 comparator group. Language use academic = Percentage of language use in an academic environment that was English (lecture presentation, group study informal, Supplementary Instruction (SI) sessions, personal notes, reading for course, discussing pharmacology with peers and studying). Language use on campus = Percentage of language use on campus that was English (social conversation with class mates, social conversation with non-BPharm friends, in library, administrative matters). Language use off campus = Percentage of language use off campus that was English (at place of residence, socializing off campus, listening to music, leisure reading, television viewing, watching movies, email/internet, Facebook or similar, sms/texting).

Table F.5.

Frequency distribution in the ZCL2Com and ZCL2Exp samples of the use of English as mother tongue, language for teaching at school, and language used at home.

	Group					
	ZCL2Com		ZCL2Exp		Total	
	n	(%)	n	(%)	n	(%)
Mother Tongue	*n*=97		*n*=23		*n*=120	
English	40	41.24	3	13.04	43	35.83
not English	57	58.76	20	86.96	77	64.17
Schooling – Lang for teaching	*n*=97		n=23		*n*=120	
No English	41	42.27	12	52.17	53	44.17
Primary only	4	4.12	0	0.00	4	3.33
Secondary only	11	11.34	8	34.78	19	15.83
Prim. & Sec.	41	42.27	3	13.04	44	36.67
Language use at home	*n*=97		*n*=23		*n*=120	
No English	30	30.93	2	8.70	32	26.67
English with 1 of M/F/S	11	11.34	2	8.70	13	10.83
English with 2 of M/F/S	7	7.22	0	0.00	7	5.83
English with 3 of M/F/S	49	50.52	19	82.61	68	56.67

Mother tongue: $Chi^2(df = 1, n = 120) = 6.43$; $p = .0112$; Schooling- language of teaching: $Chi^2(df = 3, n = 120) = 12.14$; $p = .0069$; Language use at home: $Chi^2(df = 3, n = 120) = 8.61$; $p = .035$; ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group. Mother Tongue = first language(s) respondent learnt to speak. Primary School = first seven years of schooling. Secondary School = years eight to 12 at school – following year 12 entry to tertiary education is granted if the marks gained during the final year 12 examination meet the entry criteria. No English = Language other than English used as medium of instruction during both primary and secondary schooling. Primary only = English used as the medium of instruction in primary school but not in secondary school. Secondary only = English used as medium of instruction in secondary school but not in primary school. Prim. & Sec. = English used as the medium of instruction in both primary and secondary school. Language use at home = Family members with whom the respondent communicated with in English in the home environment. No English = Did not communicate in English with mother, father, or siblings. English with 1 of M/F/S = spoke in English with one of mother, father, or siblings. English with 2 of M/F/S = spoke in English with two of mother, father, or siblings. English with 3 of M/F/S = spoke in English with all of mother, father, and siblings.

Table F.6

Frequency distribution in ZCL2Com and ZCL2Exp samples of language used for academic purposes, language use on campus, and language use off campus.

	Group					
	ZCL2Com		ZCL2Exp		Total	
	n	(%)	*n*	(%)	*n*	(%)
English use academic (%)	n=95		*n*=23		*n*=118	
0 to 24	0	0.00	0	0.00	0	0.00
25 to 49	0	0.00	0	0.00	0	0.00
50 to 74	2	2.11	0	0.00	2	1.69
75 to 89	3	3.16	1	4.35	4	3.39
90 to 99	42	44.21	13	56.52	55	46.61
100	48	50.53	9	39.13	57	48.31
Language use on campus (%)	n=97		*n*=23		*n*=120	
0 to 24	1	1.03	1	4.35	2	1.67
25 to 49	14	14.43	1	4.35	15	12.50
50 to 74	30	30.93	7	30.43	37	30.83
75 to 89	16	16.49	5	21.74	21	17.50
90 to 99	14	14.43	5	21.74	19	15.83
100	22	22.68	4	17.39	26	21.67
Language use off campus (%)	*n*=97		*n*=23		*n*=120	
0 to 24	0	0.00	0	0.00	0	0.00
25 to 49	7	7.22	0	0.00	7	5.83
50 to 74	37	38.14	9	39.13	46	38.33
75 to 89	25	25.77	6	26.09	31	25.83
90 to 99	17	17.53	5	21.74	22	18.33
100	11	11.34	3	13.04	14	11.67

Language use academic: $Chi^2(df = 3, n = 118) = 1.66$; $p = .646$; Language use on campus: $Chi^2(df = 5, n = 120) = 3.90$; $p = .564$; Language use off campus: $Chi^2(df = 4, n = 120) = 1.89$; $p = .756$;

ZCL2Com = ZCL2 comparison group; ZCL2Exp = ZCL2 experimental group

Language use academic = Percentage of language use in an academic environment that was English (lecture presentation, group study informal, Supplementary Instruction (SI) sessions, personal notes, reading for course, discussing pharmacology with peers and studying). Language use on campus = Percentage of language use on campus that was English (social conversation with class mates, social conversation with non-BPharm friends, in library, administrative matters). Language use off campus = Percentage of language use off campus that was English (at place of residence, socializing off campus, listening to music, leisure reading, television viewing, watching movies, email/internet, Facebook or similar, sms/texting).

APPENDIX G

Focus Group Transcripts

G1: ZCL2 Focus Group Transcript

G2: ZCL303 Focus Group Transcript

G3: ZCL401 Focus Group Transcript

G1: ZCL2 Focus Group Transcript

Introduction by facilitator

Three discussion points:

1. Your approach to studying Pharmacology
2. Your attitude to Pharmacology
3. How do you manage Pharmacology

Student 5: Well how I study Pharmacology is I have set times otherwise it becomes very difficult to try and fit something in you know we all say there is not enough time for everything it's quite true so I've made times when I study Pharmacology. I'll study on a Monday night, a Wednesday night and Friday night and those are obviously the days we have Pharmacology (ZCL2:5) and what I do is then I take the notes, the slides that we given and then I'll take my Rang and Dale and my Katzung and I will try and make the concept a bit bigger than what the lecture slides give, you know add more to it you know and then I summarise I have my own books that I summarise in because I find it very difficult to study from you know looking at notes and then looking at other you know class notes that are handwritten and then to textbooks and SAMF as well. So I'll try and get it all into one and then I rather study from that and I find it much easier because I don't know I remember things better when I have my own way of structuring things (ZCL2:5) that's pretty much how I go about it. And then sheer number of times that I read over it is just how I learn. I know some people say things or speak it out not for me I just read it, learn it. That's how I go about it. (ZCL2:5)

Student 2: first of all I would say Pharmacology to me is a subject that I like very much and uhh and I wouldn't say so far that I really enjoyed it the way I would love to or maybe my performance in it. The reason is because you know when you get into something you have your preconceived you know opinion just like when you said "did you hear something when

you were taking into second year" and so on. We were told how challenging second year would be for all of us and all that (ZCL2:2); and last year was difficult I can say for myself and I believe most of the younger ones here it was difficult. So we focus much of our attention on doing things that are very urgent. You have reports pracs and all that and not having enough time to give to Pharmacology. I would say my performance so far on the subject is because I never have enough time you know to study Pharmacology, maybe two times in a week at most. Then when the test is coming that is when I create time to begin to read. Probably by that time I cannot put everything in my memory or in my long-term memory you know to perform the way I would love to so it would require probably adopting a better approach which she has just mentioned she has specific times during the week she has to study and I think that to me sounds more objective you know logical, than just study at impulse, yeah but so far so good, I read things, I understand the way our lecturers have always explained things. I do believe that most of the students also follow up. The only thing I struggle with as a person is memory. When i put too make here sometimes I struggle to recall them when the time comes. That's just the only problem I would say for now. Start studying earlier or study on a regular basis. I would be able to remember a lot of things than currently I am doing. So that's what I would say for now (ZCL2:2).

Facilitator: But it's always time?

Student 2: I believe so

Student 7: Touching on my study habits, I normally do it in stretches. Like we have five days in the week, in a working week, so I normally do it like after the Monday lecture I do the stuff we did on Monday and using maybe the Rang and Dale and on Tuesday I use Katzung. So, but that limits my study period to maybe..... it cuts it down because it means that I can do Pharmacology and something else on Monday, I can do Pharmacology and something else on Tuesday, Pharmacology and something else on Wednesday, so I am just like exchanging the

two things, the two textbooks (ZCL2:7). Plus the study done there is more time so I can understand the things because there's more time I'm kind of going over it a second time, but that normally works when you don't have pressure, because it's a normal timetable (ZCL2:7). But assuming you've got a chemistry test on Friday, it's not like Thursday night you going to read Pharmacology you will definitely have to do the chemistry first. And that's how I am often surviving (ZCL2:7)

Facilitator: So you do the same section in Katzung and then you look at it in Rang and Dale the same thing....

Student 7: Yes with the notes (ZCL2:7)

Facilitator: So the repetition yeah...

Student 7: so that I can at least write notes on what Katzung is saying and what Rang and Dale is saying on the same topic (ZCL2:7).

Facilitator: and they put it slightly differently... The two, sometimes doesn't it help you understand when you read the two books..... The same section in the two different books they put it slightly differently

Student 8: the thing that helps me really is like a group discussion or explaining something to somebody because that I never forget it even if I am in the tests I will just write it like maybe there I explained it to somebody else (ZCL2:8) and being in class helped me so much because even if I haven't read and the question comes and I remember the lecturer saying how it happens, I intend to recall much better than when I read it and try to explain to myself (ZCL2:8). Or if somebody explains to me if I don't understand something, I find it much better like when I am alone (ZCL2:8). Okay fine I do understand when I read that somehow I tend to like I cannot link maybe if the question comes and then it's a you link it to something else appropriate our get more of like straight and forward questions "what are the effects of this", but the link in ?..... becomes more difficult where I can't apply it compared to where

somebody explained it to me or the lecturer explains or apply it. So applying Pharmacology to me is totally difficult really I have to say (ZCL2:8). It's like I can't add one and one and make two out of it. It has to be something straight and forward that is how, that is the problem I have realised I have with Pharmacology. Though I thought it was just going to be a very funny subject on knowing the body and knowing that drugs and how they work, but it has proven so far to be a challenge to me compared to you know the calculator subjects, chemistry and others. So that's what I have realised (ZCL2:8).

Student 3: For me I tried like at the beginning of the year to use this method to use a timetable to get Monday, Wednesday, Friday but I'm not that organised. So I find myself like I usually when we go through a lecture, my strongest point is when I listen in the lecture and when I go home like I didn't understand that and then I go over it (ZCL2:3). And sometimes when I feel I can understand it I do not have the strength to go to my book and study something that I think I have understood. And then when I go for SI again and we do the questions then when I don't understand the questions that and I go back to the books (ZCL2:3), but then I think mostly I really get down to the books when we like have tests coming up (ZCL2:3), beause I think that's when I really get to the books but during the, when we don't have pressure for getting to the books I mostly rely on listening in the lectures and asking questions like maybe when my friends are discussing and all that, then I listen (ZCL2:3) back to studying it's not my strongest point(ZCL2:3).

Student 4: I'm Chad, I'm a repeat student and the way I approach Pharmacology this year was somewhat different (ZCL2:4). I took… When I realised that the tests with Rang and Dale and Katzung. I didn't focus too much on Rang and Dale and Katzung. I only use it when I do not understand something or diagrams to give me a visual aspect of what's going on in the Pharmacology and the work and stuff and you will realise in for example the hyperlipidaemia you will see the Katzung go into great detail into very much detail, all that lipids and those

things and if you concentrate on those type of things it confuses you and you will see in the tests it's not about that. Okay you have to understand the pathophysiology, I mean the physiology and anatomy and all that things, goes hand-in-hand with Pharmacology. So the main idea is get, familiarise with the pathways is important understanding the anatomy how the body works and all that try to link it with the drugs. So it's all a linking thing. The main thing that I wanted to do is just use the Katzung and the Rang and Dale as a guideline the pathways the summaries behind the drugs (ZCL2:4), That list write it down on a page as it is there, the more you write the more you will remember it so I like to write things down. The more I see it the more it goes into my brain, the more I remember it (ZCL2:4). So that helps me a lot, and mind maps as well. The mind maps…… Even if I did a mind map last year I'll do your mind map again just to help me remember (ZCL2:4). That's how I approach it. For me and helped quite a lot better much better than last year. So yah from my point of view (ZCL2:4)

Student 9: Okay for me what I really liked especially last term and this one is the fact that the way our lecturers would do, they would ask a question, they would lecture okay fine, then they would ask us to sort of scenario things then it really helped me because it showed me that I could link things up like the way (someone's name) she would tell us, explain things, and she would say "having said that with a particular drug what you think the questions would be for somebody who is having this problem and giving that drug" and it stimulated a lot of thinking and in that way I could predict and the precautions and the side-effect, it was really interesting (ZCL2:9).

Student 11: For me I'm really not a person who can set up a timetable so what I normally do is depending on how I understood the lecture that day I will go back and try to, I just make sure that what I think I don't know I have to read through it. Which yah sometimes I do and

sometimes I don't. It just depends on how confident I am about something (ZCL2:11). And then another thing is mostly I begin to study seriously when there are like two days before the test because I find it hard for me to study four days or a week before because I won't be serious enough and I will forget. I don't know…. I work better under pressure (ZCL2:11).

Facilitator: So we must give you a lot of pressure!

Student 11: Not really but I don't want a lot of pressure but when I'm three days before something I'll be like… I will just read through…… I only read one page but if I have two hours before something I will read five chapters. But I don't want more pressure, it's not like it works, it just works average from me. Sometimes when I really try to like now we started group discussions with two of my friends, we have group discussions….And It's helping me a lot because it encourages me to read, now I'm realising that it's not that I can't remember things if I read them a week before it's just that I didn't know I can actually remember. So the group discussion is actually helping me (ZCL2:11). Yah and last before we started last semester, because I have some third-year friends and they really scaring us about Pharmacology, how difficult it is (ZCL2:11), but then I didn't understand how they passed it if it was difficult that difficult at the same time, so I just didn't take their word for it I just want to see for myself (ZCL2:11).

Facilitator: Do you want to continue talking about studying, but we can also start talking about your attitude, how you feel about Pharmacology and maybe before you even got here you heard about it. So how you actually feel about let's start talking about that too. You can talk about both.

Student 1: The way I studied…… The textbooks Rang and Dale and Katzung, and they are too big, They contain a lot of stuff. So for me most of the time I'm lazy to read those. So I actually settled on Lippincott that's the one that I use most during my study times (ZCL2:1). And then personally I don't have a personal study timetable that today I'm going to study

Pharmacology for one hour or two hours. I don't have that. It's spontaneous sometimes I'm just in the mood of reading. If I'm in the mood of reading I may actually cover let's say right now we've done hyperlipidaemia, hypertension and then we doing ischaemia. So if I am in the mood probably within those three, four hours I can actually go over everything that we have done, but mostly it's just spontaneous, and then three or four days before the test, yah I can really sit down and study, but most I'll be focusing on the lecture notes and then to create my own questions. So… Hyperlipidaemia I will just go over the lecture slides and then I will create my own questions and then I will try answering them. If I can't answer them using those lecture notes and then I'll refer back to the Lippincott, and then the Katzung and Rang and Dale most of the times, if at all I use them, I use them to refer to diagrams or tables. That's the way I do it. But the thing I found you know that to be most useful, is usually group discussions (ZCL2:1) and also SI. During SI sessions we are given a lot of questions to answer, so at least I familiarise myself you know on how I'm supposed to answer questions you know in exam or test situations, but when it comes to my approach now, my attitude. How I feel about Pharmacology. Initially yah, I can't say initially. I'll say that……. it's exciting, overall I view it as an exciting subject, because it's like the transition from first to second year. Of course we heard a lot of stories sometimes from lecturers and then from second years and senior students saying that Pharmacology it's a scary subject, it's challenging, this and that. But for me I actually view it as an exciting subject (ZCL2:1) because we are now, I mean I've heard a lot about drugs even before I started Pharmacy but now here I am in this Pharmacy class and am actually studying the way those drugs work in my body, so for me it's sort of exciting, you know and it makes me….The reason why it gets me excited is because I'm actually gaining something, a knowledge that, it's like so many people that the drugs but they don't know how they function they don't know how, what happens really after taking a drug. So I'm just excited you know imagining taking the drug

and then it goes into the liver metabolism and then absorption (laughter) yah seriously looking at it (ZCL2:1), because I was never scared. They were just saying Pharmacology is difficult and challenging and I said "okay most people passed it". So it's possible for me to pass it, and secondly for me it's exciting because the attitude that you take is very, very important especially when you study it so for me it's actually an exciting subject (ZCL2:1).

Facilitator: Did they really build up things about Pharmacology before you got to second year? They petrify you before you even get there

Student 2 Before the school reopened actually I bought my Pharmacology textbooks. That was after our first year. I went to the bookshop there and I opened it up… It was Katzung. The diagrams there and you know the illustrations you know it looks a bit complicated. So you know I had to take time to think over it but when we started lectures in pharmacokinetics and from there to pharmacodynamics I realised that it's not as complicated as I had earlier on perceived it and based on what I had before. So to me today it is probably the most fascinating aspect of everything to do with Pharmacy (ZCL2:2). I enjoy 'ceutics and Pharmacology to me is where my passion is. That is the section the subject that I want to know more. It excites me to know just like you saying how drug works, when it interacts with the human body. So I am eager to know more (ZCL2:2). I must say that our lecturers have gone out of their way to make the work easier for us. If only we would understand how to factor in our own abilities into their own efforts I think everything will come out fine. (ZCL2:2)

Facilitator: Do you think Pharmacology demands too much of you.

Student 6: I wanted to say my experience actually in Pharmacology. I had done Pharmacology in my diploma and I thought it would be just an easy road. I must admit that was nothing what we have done in diploma. I have realised that I'm really into Pharmacy here

and like I said I took it lightly and I used to hear Mrs Boschmans say you must sleep Pharmacology drink it and I used to think this one thinks we're here to specialise in Pharmacology. Then the marks told me "you are doing nothing, you are here to joke". I realised and I must admit I have done one or two things to improve my Pharmacology like I watch videos on some subjects, and I like use more textbooks, I mean whatever I can grab. (ZCL2:6)

Student 10: Yah Pharmacology. (Laughter).Umm….I think I can say Pharmacology is a beautiful subject but it doesn't get its deserved time from students. I think it deserves much more. If it were from me I think I would be doing Pharmacology only because I mean it's amazing, beautiful (ZCL2:10). I think Pharmacology, for me a good way of approaching it is like a lot and a lot of questions. It helps and a lot of good discussion, it helps (ZCL2:10), read it just read and make summaries. I find it difficult to read and understand that I think reading for me doesn't work and making summaries and questions everything. Senior students I think they were quite creepy about Pharmacology and everything and I think, I don't know if it's I let's say I need like to ask someone a question I wouldn't think about now the second year student as you know, you'd prefer someone who has experience you know but I'd rather ask someone that also doesn't understand. Then you can just work things out (ZCL2:10). I don't really have confidence in the senior students. They are not quite encouraging so I just keep my distance yah (ZCL2:10).

Student 12: Well I can say my experience in Pharmacology. In the beginning of the year I think it was it was a bit of…… because I think things were not so complicated but then when we got down to earnest and we started learning about the drugs and you had to learn all the sympathetic and all that it became complicated. For me when I do Pharmacology, the only time I get to read is when I feel I'm lagging behind in class, because if I go to the next class and I go through what we are doing before the class I feel I can't really understand.

Even if I try to understand I feel like I don't really know what they're talking about. It's like I have to constantly just keep reading. But when you have a chemistry test like on Friday you wouldn't have time to start reading Pharmacology and then thing is now you start lagging behind and then you have to catch up again. And then because for me I think I take a lot of time reading because I have to write my notes and like add onto the notes were given so I have to go through my Katzung and Rang and Dale and add onto my notes and then read them and read them again for the test. So by the end like I always finish before the test definitely and write my notes and everything and read, but you feel like that you would have learnt more, it's just that you didn't have time for it. You would have learnt more but you have to consider; okay you definitely have to put time for everything else but you feel like yes you understood the stuff…… that….That you would have understood it better if you would have probably structured your time better or something (ZCL2:12).

Facilitator: So you don't have enough, quite enough time, you want all-time at the end to be able to go over your work

Student 12: you want more time. (ZCL2:12)

Facilitator: So it gets frustrating

Sudent 12: the thing is like discussions. Discussions really, really help because you can be reading day in day out but once you just have like one discussion with your friends, you figure that you actually knew the stuff when you actually say it out and it actually sticks in your head better than just constantly reading all the time (ZCL2:12); and also the practical I think they really help because it gives you a time to go through your work, and do the mind maps and answer the questions and the application questions and they are very helpful (ZCL2:12). Yeah, I think that's my experience. (ZCL2:12)

Student 10: Another thing with now, I think, I don't know how most people look at it like that way but I think now we study to pass rather than to know like for a long time like we know it

for the next five years. We study I need to go to third year. That's it. That's the basic thing that encourages us to study so that a problem. We need to carry it until we die and stuff (ZCL2:10)

Student 11: I also want to say maybe that's the reason like why today in Pharmacology we were asked beta-blockers. Most people, I didn't know whether we were just shy to say the answers out or we just forgot. The reason is when you do the work it's if you were like studying to know for knowledge sake it will stay in the long term memory but I'm studying for a test that's tomorrow so I'll memorise get 70% or 60. When the exam comes I got through again pass and when next year comes I will go over it when like I'm required to know it. But if I'm not required to know it for next year then I won't carry it with me so basically it's mostly studying to mostly pass. We do want to know; it's not that we don't know anything, we do know something, but it would have been better if we had more time because it will stick. (ZCL2:11)

Facilitator: That is something else that we can also talk about. How do you; have you; is the way you; have you had to change your approach and your study methods for Pharmacology. What's worked before, does not work now. Have you had to change or do you use the same methods you've always used. Have you had to adapt at all for Pharmacology would you just use the same techniques, the same way you study other the subjects. Is it the same for everything or do you do anything different, do you feel; and you can still talk about all the other things as well.

Student 2: Okay quickly I want to respond on the question you just asked now. For me I plan my study but sometimes it becomes difficult to keep to that plan. You know, I think it was in our fourth semester last year, I can't remember how many tests we wrote, either 15 or 18 of them. You find that every time you are studying for a test or you are studying for a tutorial or a practical and you find students we have many focusing attending to things that are very

urgent. I have to read I have got a test to write. Now those other areas you know that are very crucial they get neglected. There is no I can't study Pharmacology the same way we study probably any subject that carries less weight, and expect the same result, so I have to give it more time. So for me this semester I decided that I'm going to change the way I study. I'm going to give Pharmacology more time because it's the only way I can know it more and improve my performance (ZCL2:2). Well I understand a lot of students focus on reading just the past exam. That's not why I study; I study to know it. It's better for me when I understand something, the knowledge stays with me. I don't easily forget (ZCL2:2). And another thing I also didn't mention was some other people have already said that it has been very beneficial to study in groups. When you study and ask questions and discuss it, that's when you realise "oh I didn't even know this". Or I didn't even know I can understand this. So study groups have been very very beneficial and if more students in the class would really understand that that is useful, I believe they are going to exploit that opportunity. Because Pharmacology to me is not a subject that you just sit down and read and read. It's something that is interactive. The times I spent in the SI I can actually tell myself that I learn better than when I was not able to attend it (ZCL2:2).

Student 3: For me I think Pharmacology like I mostly inclined to, I'm comparing it to chemistry and all the other modules that we do. It's something that I can relate to, it's something that I can picture in my mind, as compared to chemistry like when they teach us and I think "what is that". So sometimes I kind of neglect it because I think I can relate to it so I can easily understand it so I have to focus on the stuff I think "this is so complicated", so I have to put more effort in it. At the end of the day I neglect Pharmacology (ZCL2:3). And then I also a think that on my approach to Pharmacology I had to, especially this semester, I had to leave that attitude where "I don't have to study like constantly", I'm trying, I really am. This semester, and concerning hours I'm trying to, every week, I get at least times, 3 days in a

week to sit down, and like (I cannot settle down, I just can't) to settle down and open my Rang and Dale and just read over the topics that we had already done before. I think that's how I'm trying to change my study method this semester (ZCL2:3).

Student 4: So now like the attitude towards studying Pharmacology. Firstly it built up with a fall. I failed and then I went back asked Mrs Boschmans and I spoke to her and she gave me a study plan, I mean she advised me to set out a study and I went that. For me, I improved in the tests and all that (ZCL2:4). Although I didn't finish her section because of time but in the section that I did I did pretty well like 70 or 80%. In the last test I got a good mark. So my approach did work. My change in strategy worked compared to last year because last year was very busy for me. This year it's not busy at all. I have a lot of free time so I can study like a lot of methods, all the methods I can get (ZCL2:4). Yah and so the attitude changed and also I miss the working at the Pharmacy. So you grasp the value of Pharmacology because when the patients come to you, they come to you with hope; they have no hope. They come to you and they sick and they want information and you can take your knowledge of Pharmacology and you can say you know Corenza and that's phenylephedrine. All the stuff and you know it runs through your mind you don't say it out loud. You say yeah it will help you, but you confident. You know there's a lot of pharmacists like in my workplace there is a lot of people who didn't have the opportunity to study Pharmacy so they don't have that knowledge, so then you appreciate it more and that plays a major role in your attitude towards Pharmacology as well because to look at it we very few, especially like me for living in South Africa (ZCL2:4). We very few. It's like there's a lot of foreigners so as South Africans we should be proud and go with all of it. There's a lot of job opportunities in Pharmacy so that plays a major role in my like Pharmacology, my attitude comes from there, the money and everything (ZCL2:4).

Student 2: I just want to add something, pertaining to my attitude, towards Pharmacology. Another factor you know, that also affects, how, you know, how we . . . . That is, our attitude towards the subject, is also the lecturers themselves. That is first and foremost the way they teach, because we find that the way one lecturer teaches the subject, is different from the way another lecturer teaches the subject. So when it comes to certain lecturers, yah, I know that even if I don't write notes, you know the stuff will sink in. I will always remember it. It's like (laughter). Yah I always remember it. But now when it comes to other lecturers . . . . . It's difficult, it's difficult. Okay, yah, so that way, the way, that is their teaching methods, and also the other thing is that, probably there . . . Sometimes during, you know, during lectures, it's like lecturers they say certain things. Let's say probably especially towards the test, you see. They actually, you know it's like, some of them they focus more on you know on reminding us the test is coming . . . . And then others they focus more on letting us, you know, trying to let us understand, you know, what we supposed to know. So, such that if a lecturer comes, one lecturer comes, and then reminds you more and more about the test, obviously my attitude will be test orientated, because I don't want to fail. I don't want to repeat. So obviously I will just study so as to pass the test, and then make sure that I proceed to the next level. Rather than you know, trying to understand the stuff. So lecturers, although not to a greater extent, but to some extent, they also influence us on our attitude towards the study of the subject (ZCL2:2).

Facilitator: I'm sure they do. (Laughter) anyone else got anything to say? I think we are running dry of things to say now? So would you basically say the way you study Pharmacology is the same, the same approach you use for your other subjects? Hmmmm? Because no one's really said anything about that. Do you have to use a different strategy for Pharmacology compared to other subjects.

Student 2: That's what I said before. I used to use the same . . . (ZCL2:2)

Facilitator: . .And it didn't . . .

Student 2: . But now I have to change it because it's not working. Yah I need more time for the subject because this is vast, because in a lecture you cover so much, and so much information given. You need time to go through that again and again, to digest that information. It's not like that in other subjects. There are some subjects I can lie on my bed, cover my handouts and read, yes!, And then go and write it and pass, and I will still remember. I can take just a topic in Pharmacology and spend two hours trying to reason out how does this really happen, you know. So that's where the difference comes (ZCL2:2).

Facilitator: So there is a difference for you.

Student 2: There is a difference for me. The more time I give it, I think the better I get (ZCL2:2).

Student 3: . . . . And you also have to constantly refer to first year stuff. Like I use my tutorial book, because I don't remember the terminology, like from first year, so I come across it and I'm, like, "okay I have to get my tutorial book" and look okay "like what does that mean" and then I go back to my notes again, so I think you have to constantly refer to first year stuff. (ZCL2:3)

Facilitator: Okay anyone else got anything. Yes you would like to say something.

Student 10: I think, ummm, I have also changed my study approach. Last semester I wasn't consistent like maybe this week I will look at it three times, next week once, but then now it's like before I forget I will look at it again. Before I forget I'll get it again, yah that's how I have changed (ZCL2:10).

Facilitator: And does that differ to your, the way you manage your other subjects?

Student 10: Yah, a lot. The others yeah, in like Mr (name) said, it's just . . . . (Laughter) yah some subjects you just read once and then do questions maybe, four question papers or something, and then yah (ZCL2:10).

Facilitator: Yah?

Student 1: Personally, the way I study Pharmacology and to some extent also chemistry, it's more or less the same. But when it comes to other modules like ZP, ummmm,what else? Biochemistry . . . What? . . . Yah and pharmaceutics . . . Yah it's a little bit different. It's like some modules, you know, they demand more my time, than others. ZP mostly we are just discussing during lectures and the things that we do there, they are, they are things that you can easily relate to. Things that you can actually, when you sit down, you can actually think, think, like you can come up with the answers. You can actually think you are given the scenario. You can actually think how you would go about the situation. But when it comes to chemistry, Pharmacology, mostly those subjects they deal with factual information so you've got to know your stuff, but some modules although you are supposed to know your stuff, but you can actually expand on the little knowledge that you may have. But when it comes to Pharmacology, to chemistry, for me I just have to know everything. So the way I study them, it's different (ZCL2:1).

Facilitator: Yes it slightly different, yeah. Okay anyone else got anything, burning issues they want to raise, or anything else they want to say? Well . . . Yes?

Student 12: . . ummmm I think in Pharmacology . . . This program that we had to work the externship, I think it's really helped, because when you actually go to the Pharmacy setting and you actually see the drugs and you actually see that this one is used for this, and then you think about class and what you doing, it actually helps. So, yah, I think it was a very good idea because now you actually know the drugs, you learnt the new drugs and you can, you even know the new trade names and all that and it actually helps you to know that this drug is for this (ZCL2:12). And then the problem with . . . . Okay my other approach with Pharmacology it's that I . . . . I don't read it the same way that I read say chemistry, because in chemistry I feel like we have many past papers, so I can just read like go through my notes

like use my notes as reference sometimes. Just go through them once or twice and then if I am like able to do so many papers, and then I go to, get to see what questions they ask and how to approach them. Yah I feel more confident. But in Pharmacology since we don't really have question papers. So You actually have to read your work and understand it because yah because I feel like subjects like chemistry most the time, like (name) said you read just to get pass. Yeah that's usually most people's approach. So you just do as many past papers as you can, because you know when you do that, you go to the exam and it'll probably just going to be the same thing. But in Pharmacology it's a bit tricky because you have to know the stuff, yah (ZCL2:12).

Facilitator: Okay, thank you. All right . . .nothing else? We are all talked out . . . You've got something . . .

Student 2: I've got something to say . . (ZCL2:2)

Facilitator: Good

Student 2: Just a little bit on the part of the comment that she made. I have always been anxious knowing how to respond to questions. Either during SI sessions or maybe in the classroom, where the lecturer will put a question across, even in the exam. Ummmm it's important to me to know, when the lecture says "can you explain this" or "how do you relate this to things". I just want to know ummmm . . . What is the lecturer's expectation, because if I don't understand the question or how the lecturer wants me to respond. I may have some ideas which might not be far from the truth or the answer, but I drift in my own way into something that is irrelevant. For example the exam, the test we wrote, I think the first test, there was ummmm, ummmm one particular question that had to do with derivation which most of us got wrong in that we left what was required by the lecturer, in that we were even deriving an equation, an equation that was already there (laughter). I made the same mistake and I wasted the time and I could have used in thinking properly and answering another

questions and getting some of them correct, okay, but I just wasted that time on that session, and maybe I failed the session, so that's just one area that I'm very much concerned. We want to know more when questions are put across. How do we respond. I'm clearly interested in that. Because if you ask me a question and I just didn't understand your question and I answer it in my own way, I may not have answered what you asked me. That's just a concern. (ZCL2:2)

Facilitator: Anyone got anything else to add, then I think what we'll do is I will say . . . .

Student 1: SI sessions give ideas on how to answer questions (ZCL2:1)

Student 8: I prefer the new way of doing SI. The discussions work much better you learn a lot during the discussions. (ZCL2:8) Another thing test feedbacks are not beneficial. (ZCL2:8)

G2: ZCL303 Focus Group Transcript

Facilitator: Thank you for coming, really appreciate it. The topic is your approach to studying Pharmacology. How you do it. How you go about it. Do you do it? Pearl is here because even though we recording it, Pearl is also acting as a scribe to make notes during sessions, so she is not going to participate, she is just going to quietly sit in the corner. All right, so studying Pharmacology, which is very much on your minds, now you know Pharmacology is a bit earlier, I'm not sure if you know, do you know?, Did you hear? It's now going to be on the 11th. (long discussion about changing the date). Anyone like to say anything to get the ball rolling. How these focus groups work is just for you to talk and say what you think about something. You know, so in this case it's studying Pharmacology. I'm here totally just to hear, not to act , react, anything like that. Anything you want to say that… To make us aware of what it's like to be on the other side.

Student 1: I think you need a reason, you can't like, you need to, whatever you study you need to know why you study (ZCL3:9), like give a reason to whatever . . . . . (ZCL3:9)

Facilitator: You need to understand, you can't just learn it.

Student 9: Understand it, learn it yeah, you need to know which you actually looking at (ZCL3:9), so it's very important; probably read extra but the time also then comes into factor, because you can't read everything, you know, and you can't keep going and reading the textbook all the time, because you have other things to do. So I don't know, making summaries doesn't work with me, because I can't write and study at the same time. If I study something I concentrate just on the handout and if I have to make notes from the textbook, then I write down on the side. So yeah that is how I probably doing my way of studying (ZCL3:9).

Student 4: I am pretty much the opposite to that, where all I do for studying is basically do is write it down and the more I rewrite it the more I know it. I mean this whole year basically after the lecture I go and just rewrite it. I have a full. . I'm trying to think . . Those big black books, I've got a full one of those with just Pharmacology, just summaries (ZCL3:4).

Student: I bought four exercise books in first year and I still have those

Student 2: I can say something that helped me with studying, I remember the first ZCL3 test I didn't do so great and I realised my mistake was that, ummh, I tried to read everything and I realise now certain lecturers have certain ways of asking questions so I'll know maybe for Mrs Kubashe's section I know when I am studying, I've got to focus mostly on those aspects that she likes to ask, like interactions and things like that. For Leah's section she likes those little nitty-gritty points of how you dose it and things, or you know, all those things that you normally wouldn't focus on, so I think once you get a better understanding of how your lecturer teaches you, and what they like to focus on, then that's helped me quite a lot (ZCL3:2).

Student 3: Okay, I am again, I use a mixture of what he's doing and what he's doing, but I like my visual things, so I will normally draw diagrams, especially when it comes to mechanism of action, and try to incorporate the physiology of it as well, to make me understand how the drugs work a little bit better (ZCL3:3). My problem initially was in second year was mind maps. It was a foreign concept to me. I struggled in second year I think because of that. Third-year I have been using mind maps and my marks improved dramatically (ZCL3:3).

Facilitator: So did it help you then once you got into it

Student 4: Yeah, I was making notes from the textbook, I was, I think I was actually in second year, wasting a lot of time making notes because I wanted to understand and go

deeper and deeper which was not actually necessary. Because when they asked the questions it was like one point or online answers were I would study the thing, go through Rang and Dale, plus Katzung plus the Lippincott which wasted a lot of time. But this year I tried to focus on the notes more, and if I don't understand something I will go to the textbooks then, and try and figure out how it's done, or what the notes is saying(ZCL3:4).

Student 2: Because another thing I think helped me, like especially for those topics that we did in the beginning, all the CNS topics, antipsychotics, and Alzheimer's and whatever, I went and I read up about, DiPiro has good descriptions of the actual disease itself, so if you try and understand it from that aspect, first of all then you can see how the drugs work and what makes them effective in dealing with that disease and stuff like that (ZCL3:2). Because I know in the first test I really hadn't focused on, and I messed up my oral, I really just hadn't studied it in a way that, ummh, in a way that, yeah in a way that things were asked. (ZCL3:2)

Facilitator: So your pathophysiology from first year is gone.

Student 2 & 3: It's out the window. So if you don't really actually go back and revisit it, then you have a problem. (ZCL3:2 & 3)

Student 6: I think it's like everything, the way I used to like remember, like when I study, I link it to something so that I can remember it, like the CNS section, there's a lot of like facts that you have to know, otherwise like understand it, so I always link it to, like a situation and then I can recall it ... (ZCL3:6)

Facilitator: To make it more real that….

Student 6: ….Like to make it more visual. Like everyone says, like I have mind maps on my wall….It helps a lot (ZCL3:6)

Student 1: For me what works, I read the notes, the handouts and then I make long notes on the handouts and then I make short notes and then make shorter short notes, and then make mind mapS (ZCL3:1)

Student 2: And then we make crib notes (laughter) and flashcards (ZCL3:2)

Student 1 & 2: ….And I also make flashcards (ZCL3: 1&2) .

Student 4: How do you manage to finish though? (ZCL3:4)

Student: By the time you've done all this year done it five times and you know the stuff.

Student 3: Do repeat the writing, it comes to you and flashcards helps in a way because if you don't understand something. The way you study flashcards because you are jumbling all the different sections. When you study you study and sort of in the test you try to remember what comes after each other. With a flashcard system you can learn something about SSRI's and the next flashcard is something about SNRI's for instance. In that way the stuff sticks much better (ZCL3:3).

Student 9: Yah but the thing is when you write notes doesn't it take so much time that by the time you end up……(ZCL3:9)

Student 2: It does, in the beginning it does. (ZCL3:2)

Student 2:….If you don't time yourself. If you write notes immediately after each lecture, that's what we do. We write immediately after the lecture in the big book and then when you get home like, maybe on another day, when you decide at the end of the week you just study by my notes, but then you do your short notes and then after that like, I have a book where I just have mind maps in it, and then all the sections are systematically put in there and then I

just put it in, use whatever colours I use and then yeah, have that. And then from the mind maps then we do the crib notes…. (ZCL3:2)

Student 1: ….Flashcards (ZCL3:1)

Student 2: And by that time it stuck in your head, and like I have a couple of friends including (name), and we just sit and discuss. We discuss any possible questions that like the examiner could ask us (ZCL3:2). We try and get into the lecturers head and see… Okay what could she really ask us on this. You wouldn't believe how much it actually helps. It helps quite a lot (ZCL3:2).

Facilitator: We do actually tell you during the lectures what is important….If you listen. I think you might find that very useful next year, when you having to revise to have all those summary notes.

Student 9: That something I actually learnt about Pharmacy, make notes of everything. Keep the notes. (ZCL3:9)

Student 6: and all those notes that you write afterwards, if you've done it for the first test you still have it for the end of the year so you don't actually have a lot of writing to do (ZCL3:6).

Student 4: We've got to study for these exams now, I will do it today in Pharmacology. I will be finished making notes for the year, and then I can just revise from the book (ZCL3:4).

Student 9:….But do you study from your written notes by just reading it. (ZCL3:9)

Students: Yeah yeah

Student 9: But then there is just one question I would like to ask. The notes you give us in class, do you actually, because you ask for us to go and read further. When you ask us to read

further do you, sometimes it's difficult to make out how much you want us to read about it. (ZCL3:9)

Facilitator: Enough to make you understand the skeleton

Student 9: Enough to make us understand. So basically if we understand work in the notes then we fine. (ZCL3:9)

Facilitator: You should be fine….You might not be the 90%, but you will do well

Student 1: But you see another thing that I find that helps me, if you look at your notes, some textbooks explain, because obviously the lecturers have their own books that they consult, when they prepare our slides for us. Some books explain some other things in a different way, they give you a different perspective on this (ZCL3:1).

Student 9: I think Katzung, the language in Katzung is more scientific then the language in Rang and Dale, but I prefer, if I don't understand something I will go to Rang and Dale first and then go to Katzung and see how it does (ZCL3:9).

Student 4: Katzung is very upper-class, Rang and Dale very middle class and Lippincott is a lower class…."We've made little pictures for you" (ZCL3:4)

Student 1: That's what I like about Lippincott! (ZCL3:1)

Student 9: I've never looked at it (ZCL3:9)

Student: It's worth it yeah.

Student: Maybe next year….

Student 5: Aren't you scared though that when you write out your notes, that you rephrase it differently to what the notes are actually saying, because that's why I don't to summaries. I'll

always scared that what I'm writing down isn't what the notes are actually saying, and I learn something…. (ZCL3:5)

Student 5: Because like to me it's very precise wording that does…, (ZCL3:5)

Student: that's the thing. My summaries are word for word to be completely honest, straight out of the text, it's just the writing that helps me (ZCL3:4).

Student 9: so the thing is that it is just a way that you understand better by writing, (ZCL3:9) It's not that you getting like like…(ZCL3:9)

Student 4: … It's because I can't read something and then write it down without having to pay attention to it (ZCL3:4).

Student 5: I think me and you study similarly. I read through it, then make notes on it…..ag not notes – a mind map, just of the drugs. Just write the classes, the drugs and then I go again and start learning each thing individually, and then comparing them with each other (ZCL3:5).

Student 9: I don't use mind maps. I just take the notes, I put it down and then I read, I read the stuff from the slides and then you've I don't understand something or I think that the lecturer emphasised something in class then I go back to the textbook and look at it. If there's anything extra that needs to be put in I put it there (ZCL3:9) and get on you know, there's just so much work and you don't want to spend so much time on one slide and at the end of it you don't get a question from it in the test and whatever you have not looked at, you get a question (ZCL3:9).

Student 5: I only got to the textbook for mechanisms or if I don't understand what the notes say (ZCL3:5).

Student 6: how do you remember everything if you just read over it, don't you forget a lot. (ZCL3:6)

Student 9: no. I actually remember better, because I am like ….ummh to study like "okay that slide is at the top, and this one is there, and this one down there, there, there. (ZCL3:9)

Student 5: it's a lot of repetition though (ZCL3:5)

Student 9: it's, yeah, I can't write notes, nor mind maps, all the mind maps I have are from the pracs. (ZCL3:9)

Student 2: Pierre what happens if you say you can't write notes and you read through and then you learn it like that, what happens when it comes to application questions, because for me it's like that….(ZCL3:2)

Student 5: I don't learn it like a parrot (ZCL3:5)

Student 2: No! No! So how do you learn it, if you just like go over the stuff and then you don't write the notes (ZCL3:2)

Student 5: When I, I learn it, but I try to understand what I'm learning so that it makes sense in my mind, I make a mental picture, I don't literally go draw a picture, I make a mental picture of how it works, and then I try and apply that (ZCL3:5).

Facilitator: But everyone learns differently, people have different styles. Some people learn by writing, some people learn just by reading, some people have to be marching up and down to learn.

Student 6: Well like the day before I've learnt all the important points, and then I just go over. I put all the important things like the mind maps on my cupboard and probably like two days before I'll just read that repeat it over and then it gets in my head (ZCL3:6).

Student 4: It also depends for me what section it is, because I mean I find some other sections, I don't have a problem sitting there studying and remembering, but then there are other sections where I just cannot get into my head, like antimicrobials. (ZCL3:4)

Student 9: I think the notes, the notes that the lecturer gives makes a big difference... How you actually understand stuff. (ZCL3:9)

Student 5: And the completeness of the notes (ZCL3:5)

A chorus of yeses

Student 4: If it says "refer to class notes", I won't. (ZCL3:4)

Student 9: Because I mean, there is sometimes the lecturer would….No I wouldn't blame the lecturer, I would blame myself, saying I'm too slow to catch up to the lecturer you know, when it keeps saying it on every slide "refer to class notes". (ZCL3:9)

Student 4: This is the thing. This is why in ZP I don't take notes any more, because I can't keep up with how quickly the slides change. (ZCL3:4)

Student 9: Listening and writing at the same time, you can't keep up. And I mean if, if sometimes you just get like the same notes on the slides being dictated back to you. I mean, I could do that myself at home and not come to lectures you know. So I would prefer if, okay you get lecturers who do explain it perfectly, you know, and you get some lecturers which just dictate the same slides to you, which I think even a seven-year old could read that back to me, something like that. But yeah I'm not pointing at anybody. (ZCL3:9)

Facilitator: No not at all, all anonymous.

Student 5: If something is explained in a way that I understand it, or just explained that I understand it, then I will understand. I'm not like parrot at all, like when I'm studying, if I understand what I'm studying, then I will remember it (ZCL3:5). But like, I can't just learn the spectrum of activity of antimicrobials because I'll just never remember it. It's like random little concepts. (ZCL3;5)

Student 9: Then that's stuff you have to parrot learn then. (ZCL3:9)

Student 5: I can't do that. I can't parrot. (ZCL3:5)

Student 2: But another thing I realise, there is some lectures I actually enjoy. If I enjoy that lecture I will listen in class, and if explain about, I'll remember it much better. In the exam I'll even be thinking, no but you know she actually said this, and this, and this. You know what I mean, like it helps with my recall better (ZCL3:2). Whereas with all the stuff as you are saying with some of the notes are missing and stuff, you don't even listen. Because you not really motivated. It's just like okay. It's just a drag you know…..It's just extra work. Very few people actually go back and …(ZCL3:2)

Student 9: I'll be like, I go home and write my notes, like, if it says "Refer to class notes" okay, I'm not going to get anything from here, I not going to listen. I go home and sit quietly and see what I can do about it. (ZCL3:9)

Facilitator: what does "refer to class notes" mean. (Laughter).

Student: We should be asking you that.

Student: Refers to roneo'd notes.

Student: but we never discuss it.

Facilitator: I just wanted to understand what it meant. A discussion that happened in the class?

Student 4: It's supposed to be, we talk about in class and then we supposed to write down the field. So often we just skip over it. (ZCL3:4)

Student 2: Because nobody responds, and then there is no discussion, so you go find out for yourself.

Student 2: Sometimes there is a discussion but there is no answers to your questions. (ZCL3:2)

Student (All): Lots of vagueness yah (All)

Facilitator: Okay, right. Let's move on, okay thank you; I just want to know. All right let's just talk about attitude now. Attitude to Pharmacology. Uummh, how you feel about having to study Pharmacology, from, different things, like has it changed from how you feel about Pharmacology from second year to third year. Before you even started second year, did you have, had you heard about Pharmacology, and had you build up a certain mind set about Pharmacology, before you even started. That type of thing.

Student 9: The main attitude is just to not to take anything for chance with Pharmacology. You can't say this is not important, I'll leave this and do that, you just; everything is important and you have to start from day one, you know (ZCL3:9).

Student 4: It's not like other subjects where you can make something up and maybe be right. (ZCL3:4)

Student 9: Like something like ZP like where you can sometimes try and use your Pharmacology knowledge, and you know use it like in practice to know and make up if you can. But with Pharmacology it's quite difficult and you have to start from day one, if you want to actually make it… (ZCL3:9)

Facilitator: So how do you feel about that.

Student 9: It keeps you disciplined, yah, and I think it does bring in a kind of ethic, like work ethic, that orientates you towards a way that….I don't know how to say it, it's, but its a way, it just orientates you towards a more, you know you have to get the work done, and there's no other option you know, so you had to take the work done you know, that's the bottom line (ZCL3:9).

Student 6: I think from second year I didn't…., it was like a new subject we hadn't done any of it yet so I found it quite hard to learn and then I didn't really learn it that well, and then now in third-year I understood it a lot better, and I enjoy it so my learning got a lot better towards it. Like I enjoy learning for Pharmacology (ZCL3:6).

Student 4: It is easily my favourite subject to learn, mostly because the sections we doing this year are specifically interesting to me. Like all of the CNS stuff we do and the opioids and things like that (ZCL3:4). The only section I don't really enjoy are the hormones, diabetes is fine and thyroid is fine, it's just the corticosteroids and all the contraceptives and antimicrobials. Those sections I can't stand. (ZCL3:4)

Student 7: I don't enjoy learning that because I don't understand it. The language in the textbooks for those chapters, are just….And the chapters are long, and it's over my head (ZCL3:7), and it's "refer to class notes" and I'm just not motivated to study those chapters. I rather just leave them out.(ZCL3:7)

Student 4: if you look at the last test we had, it's just I think with antimicrobials being something I specifically dislike. The only reason I really struggle with it is the sheer volume of it, because for this last section, this last test, we only had a small section of it to learn, and even that took me at least half an hour to just skim through. That's basically a ridiculous amount of time to spend on something that is going to have so few marks in the test. I don't remember anybody telling me about Pharmacology before I went into second-year, mostly just people saying that second year itself was tough. They didn't single out Pharmacology (ZCL3:4).

Student 1: When I first started, when I finished my first year and started my second year there was a lot, a lot of information I got from people who had moved on, about Pharmacology. It was horror story upon horror story about how difficult… (ZCL3:1). How you really, really, if you make it through second year, yoh, yoh, its…… You done, you might as well go and graduate because it..... So it became a self-fulfilling prophecy because you got into second year thinking yoh, it's difficult. When I'm studying for Pharmacology, then, in second year I'm thinking okay there is a very high possibility, the percentage, the chances of me not passing this is in the 90s, the 90th percentile, so it becomes a self-fulfilling…… It cripples you (ZCL3:1). So well, that changes eventually after yah, after a while, moving on to third year; but then what I'm trying to say is it would have been better for me if someone had told me Pharmacology is a fascinating module, you want to learn more. It's not necessarily about passing or failing. If you narrow down a whole module into whether you going to pass or whether you going to fail, it just takes out the fun out of it. There is a lot more to this than getting a 50 or getting 45 (ZCL3:1).

Student 8: The thing with me, Pharmacology and I just don't gel. And because of that I hate it, I hate learning it. I make my notes and make cards, I make this and I make that, I can't

learn it. And if I learn a section, I learn it and then I'll think okay I know that, and then I learn the next section and if I think back to the first section I can't remember anything. And like then I like I fail every test. So there is no motivation I suppose (ZCL3:8).

Facilitator: You have a mental block about it.

Student 5: I think it's also very demotivating if you like take all the time, study for two or three weeks, non-stop, have no life, and then you go and fail it (ZCL3:5).

Student 5: But I think the remembering thing is with me as well, because like I have to read the same thing maybe twice and then maybe the third time I do it before the test. So three times at least before I actually remember something. (ZCL3:5)

Student 3: I would agree I think that most of us, our attitude towards Pharmacology was moulded by listening to people who have done the years. They will tell you "no this thing is so difficult" and once you are there you sort of, you've got this fear, you will fail this thing (ZCL3:3), and it makes it unenjoyable, but third-year is much better because you have been there in second year and you get to third-year and you've got the concept. (ZCL3:3)

Student 7: People actually said that third year is much easier than second year and I don't agree with that. (ZCL3:7)

Student: No I don't think it's much easier.

Student: No it's definitely not easier. You've got more time that all.

Student 4: The thing is in second year the Pharmacology was less but harder, this year I think it's easier work, there's just a ton more of it. (ZCL3:4)

Student 9: There's also the chemistry. (ZCL3:9)

Student 3: You just have more time in third-year, you not doing all these Chem pracs and all that other things. (ZCL3:3)

Student 7: I found that in second year because I had like "the fear", that I went into the year, I've got three Pharmacology textbooks and I refer to every single one of them and make notes, and I absolutely killed myself by working that hard to not fail (ZCL3:7), but then second semester of second year, I decided no you've got to understand, like the mechanism of action, to work out adverse effects and things like that. So I can sit in a test and I can think mechanisms of action and I can make up side-effects, well not make up, but I can work out side-effects in my head (ZCL3:7).

Facilitator: Logic

Student 7: Yah so I have got the logic now from second year and third year has been okay, because I don't study as hard I just work it out. (ZCL3;7)

Facilitator: So you study in a more clever way.

Student 7: Study smart not hard. (ZCL3:7)

Student 1: Actually I don't think it's a good idea to listen to any of the people from other years, because they just totally derail you. I remember after my first test I was so depressed after my oral, I was really depressed, but I was so determined not to fail my second test I was killing myself studying. My whole world stopped I just studied Pharmacology. Like for the second test that we did I thought I can't afford to get a mark lower than.....???. I killed myself studying, and I told myself you know what if other people can just do it there's no way in hell I'm going to just let other people demotivate me and tell me that no it's so hard, blah blah blah, you just going to fail and things like that (ZCL3:1). I don't think it's a good idea to get advice from other students about, especially about Pharmacology. If you have a problem

rather consult the lecturers, because at least they not going to demotivate you and tell you "oh no you just going to fail anyway", you know. It's actually improved my own attitude towards the studying as well of the thing, of the course itself (ZCL3:1).

Student 9: I think that's the thing when everyone said that second year was so difficult (ZCL3:9) and then coming to third year when I made it through second year and then coming to third year. It was like oh you know I've now made it now everything is fine you know everything is okay, and I was very relaxed for the first tests and then it showed in my first test, Pharmacology test mark, oh no its actually all right. That affected me in a way. (ZCL3:9)

Facilitator: Okay, and tell me, do you think you've, have you had to change your study style, your approach to studying, in Pharmacology compared to other subjects to what you used before you got to Pharmacology?

Student: Absolutely

Student 3: Yes I think it's something that physically forced onto you, you have to do it for Pharmacology. You study differently for chemistry than what you do for Pharmacology (ZCL3:3). As I said earlier mind maps for me was a total foreign concept. When it was introduced to us I tried to use it for other subject but it doesn't sort of gel with them, but with Pharmacology it's mainly there to help you, because everything is nicely summarised and you sort of understand. With my mind maps I'll even go further I put the mechanism of action in there, small but at least I can understand so when I look at the mind map I have all my classes plus my mechanism of action and if there is space I'll put in side-effects and drug interactions as well (ZCL3:3).

Student 1: It's like Pharmacology is a degree on its own. (ZCL3:1)

Student 1: Definitely (a number of students concur) because whatever my studying skills are for Pharmacology I can't translate them into any other module and vice versa (ZCL3:1). For the previous pharmaceutics..... The previous test pharmaceutics, to be quite frank I think I studied for two days. I think the day before and the day of the test which is not healthy, it worked out well, but you cannot do that for Pharmacology, you cannot do that, but even a week before, for me I need a minimum of a month, at least to start (ZCL3:1).

Student 6: It works differently, with Pharmacology you have to understand, with pharmaceutics you just have to remember, because yah so don't really have to understand anything (ZCL3:6).

Student 3: It also the words you come across, for me it's like I been working in Pharmacy for a while so those words sort of will stick with me much better but in second year especially, when you start using all these drug names you think "oh my word" I'll never remember all these names and that's also the scare factor when it comes to Pharmacology is the language that you talking (ZCL3:3).

Student 9: It's not something that you ever done at school as well. (ZCL3:9)

Student 3: Yah unless you've worked in Pharmacy you never going to come across some of those words, because even in retail they use retail names and not the generic names or active ingredient names (ZCL3:3).

Student 6: Working definitely helps though (ZCL3:6).

Student: It does!

Student 5: There is a lot of stuff I remember from working, like I just remember . . . . .(ZCL3:5)

Student 9: That's probably something I'm missing out on then, because I only work when I go back and it's not kind of, it is not that different. It's similar but still you know it's different. I'm on holiday when I'm there and it's very different to when I'm here you know, I want to get my hours done. (ZCL3:9)

Student 6: I suppose also if you working during the year while you studying . . . . . (ZCL3:6)

Student 9: Yah and then everything is fresh and you like going with. (ZCL3:9)

Student 7: You go look at the product's. I can remember the things, seeing things like practical things, you know, I remember that way better than when sitting down studying. (ZCL3:7)

Student 4: I actually remember things better from trade names as opposed to the actual drug names. So what I did in second year was I went through all the sections that we had studied, I wrote down every drug from every section and then I put the trade name in when I could, when I knew what it was and I could find it and that helped me a lot. Because I mean that's stuff you work with every week, and what it did this person come in for this for, it was itchy (ZCL3:4).

Facilitator: So basically you saying it was like a new language.

Student(s) All & 3: Yes definitely (students concurring) and sometimes it still is, you learn new things every day (ZCL3:3).

Student 2: It's like going to study in Cuba, then you first have to learn how to speak for a year and then study in Spanish (ZCL3:2).

Student 6: I think differently in the beginning, with all the names, with all the different side-effects. Like the lecturer will just .....all these side-effects you don't know what they are, I know now but..... (ZCL3:6)

Student: I just learned psoriasis

Student 7: But even that questionnaire you gave us the other day, with all the different words, I knew what they were, okay there were about two that I had never seen in my life but I knew what they..... I just didn't know how to explain, it was so difficult to explain (ZCL3:7).

Facilitator: Can I tell you where those words came from, they came off second year prac handouts, tests and exam papers. I took them straight off that.

Student 9: Some I'd never seen. It's like yah where did this come from. (ZCL3:9)

Student 4: There were only two that I hadn't seen, diurnal and..... (ZCL3:4)

Student 1: Also another thing that puts us at a disadvantage is the subject matter, most of those words are derived from those languages, and it's easier to understand or to work out what something means if you have that Latin background (ZCL3:1).

Student 9: I do think physiology helped a lot. (ZCL3:9)

Facilitator: Do you think it would help to have medical terminology.

Students 1 & 3: Lots of students concurring. Definitely. Definitely. Just a semester or term course (ZCL3:1&3).

Student 4: Because if I can use an example are word that we were all surprised by when we learned what it was telangiectasia, now how on earth like without the use of a medical dictionary, which obviously is simple enough to get and use, how like with no background

how must we know that that means spider veins. Though the same time like spider veins does not really describe it. (ZCL3:4)

Student 8: Yes it does (ZCL3:8)

Student: Not in a medical conversation

Student 6: I don't think we really should be spoon fed, like if we should have a short course on it that would help a lot, because they know a student doesn't really write the words down and write the meanings of words down. I suppose you can just look in the dictionary then, just to remember. (ZCL3:6)

Student: Or Google

Facilitator: How many of you have dictionaries, medical I meant . . . . Or Google.

Student All: I think we all. (All)

Student 7: If I come across a word or side effect I don't know then I immediately look at up and write it down, but like I don't always remember them. I know in second year I made like a list of like if it started with hypo then it's too little or hyper then it's too much and stuff like that .....(ZCL3:7)

Student 4: I think that would help a lot if we were provided with a small course with the suffixes and prefixes... (ZCL3:4)

Facilitator: That how a course in medical terminology would be exactly what you did; is how you would do something on medical terminology.

Student 4: Like if it says nephro..... It's kidney related, if it's hepatic it's liver related. (ZCL3:4)

Student 9: And if it's .....itis it's inflammation (ZCL3:9)

Student 3: We did something like this was it last year? No first year in physiology where ....itis is inflammation. Not extensive. (ZCL3:3)

Student 9: I think if it was incorporated into the physiology, in the pathophysiology that we do with the physiology, it would actually be a very good idea. You can take out business and ZP; it would be helpful. (ZCL3:9)

Facilitator:.... But you need business, everyone needs business in life.

Student 1: But what about computers you can do that in first year. (ZCL3:1)

Student 3: Yah take out WRC(ZCL3:3)

Facilitator: Some people come to varsity and they haven't had much experience with computers, unfortunately.

Student 5: Maybe take the criteria less seriously, like not, like if you have a computers and you know how to use Word and you don't use WRSC, having computers at school. (ZCL3:5)

Student 6: I think it would have been, I know you only start Pharmacology in second year, but it would have been nice if you do some medical stuff in first year, because I remember I wasn't really going to study Pharmacy and then after first year I didn't really want to do it any more because I hadn't actually started studying Pharmacy, and then I just stayed. I enjoy it now, I love it. (ZCL3:6)

Student: Why do we have physics.....

Student 2: The other thing that makes me mad is that other universities like for example Rhodes they only start Pharmacology in third-year, others like Wits, they have multiple

choice for their exam questions, that really really makes me mad because it feels like we not going to ever be on the same level. They just going to have like a skimp knowledge of you know that Pharmacology, and we are expected like really, which is a good thing I'm not saying it's a bad thing.. (ZCL3:2)

Student 7: That's why we rated the best in the country.... (ZCL3:7)

Student: No, no, no, I know that, I'm just saying you know that um... Things like that for.....

Student 3: they should give us the title like "pupil pharmacists" or something. (ZCL3:3)

Facilitator: I have survived Pharmacology....

Student 4: Instead of giving us a BPharm, um give us an APharm (ZCL3:4)

Student 9: An A class Pharm (ZCL3:9)

Student 2: So I mean maybe if there was a way that the curriculum would be you know done in such a way that everybody is doing the same thing because really it just makes me really, really upset that those people have it easy, it's a breeze, it's a walk in the park. Pharmacology for them just 1,2,3,4 oh that's just it, you know (ZCL3:2).

Facilitator: You..... I can tell you that I've spoken to people, just for you, from the Department of Health in the Free State, for example, and National Department of Health, and they say, (they didn't know I was from NMMU) and they said they like the students from NMMU because the graduates from NMMU know what they are doing; they can function effectively in the workplace. Now that's huge praise for you, that, we were sitting with a lot of academics and he just singled out NMMU, as the graduates that they like. That you are sought after graduates, because you can function you know what you're doing. And it's because, I think it's because you start Pharmacology earlier, finish virtually all the classes by the end of third

year and in fourth year have the time to apply and put it all together; because you need to do that.

Student 3: The division is important. Definitely. (ZCL3:3)

Student 9: Application because that's what you going to do in the real world (ZCL3:9).

Student 1: I have a friend from Rhodes, that I play basketball with. She was telling me that like when..... It's just ridiculous I was studying for my second test during one of the games, so she was telling me that like all the topics that we did for example this year, they squeeze it all into six months to try and get all the work done. It's just ridiculous because they just like scratching on the surface. You speak about something and they have absolutely no idea what you're talking about, so like if we were ..... How can I say ...To improve on pharmacists in general, because sometimes you go to pharmacies and it's appalling how those pharmacists..... They don't even counsel you. You go there and they just give away medicine , they just don't care. For them it's just you know if I've served 1000 customers then you know, even if I've given them the wrong medicine then it doesn't really matter. For them it's just about the job, about the money, about the quantity, yah (ZCL3:1).

Student 4: It's like some pharmacies in PE, I won't mention names, where they have said before okay we expected to serve 60 customers in an hour, and that comes down to a minute for a customer, and I promise you I have barely enough time to put everything through the medical aid in a minute let alone counsel everyone..... "This is how you must take it, take it after food, are you on any other medicine, don't take this at night", yah stuff like that. (ZCL3:4)

Student 7: But most of the people in retail they not even studying like assistant courses or anything, the people behind dispensing they just like..... they just people. (ZCL3:7)

Student 3: But they should. Pharmacists should do..... (ZCL3:3)

Student 9: But did get the cashier and staff that would come and help in.... And say if a patient comes in for OTC medication, I've seen a teller, I mean sorry the cashier, come in and say what would you like, they use this for that and this for this. (ZCL3:9)

Student: That doesn't happen in our group

Facilitator: You know what the sad thing is we need to maintain our own standards and if we just stand by and see that happening and don't say anything, then it continues, but it's hard to then lay a complaint.

Student 9: Especially if you're a student. (ZCL3:9)

Student 1: You continue your job because you need the hours.(ZCL3:1)

Facilitator: Okay I think we'll switch the recorder off now, I don't think we need to record this section of the conversation; but is there anything before, I don't want.... I want to come back to this. Is there anything else anyone wants to say about studying Pharmacology before we end off.

Student 3: I speak for me, I feel that Pharmacology consumes so much of your time during test week, that when you study for the other subjects you don't really concentrate hard enough, okay you will pass, you sort of just try and absorb those things in the short period of time, without really understanding the other subjects, because Pharmacology consumes most of your time during test week. I feel that actually personally I have a problem with that when you do pharmaceutics or ZP you spend so little time on that because Pharmacology is there and just takes everything (ZCL3:3).

Facilitator: what do you suggest

Student 3: I don't know maybe.... Go back to the old system or.... (ZCL3:3)

Student 9: You know the thing with test week is that we look to pass not to learn. I'm looking to pass the test week but not.... I learn this later but for now I just want to pass, then when it comes to exams it's very difficult for me to recap on the work because I memorised everything but then I have forgotten by the time I'm in the exam comes. So I think if it's evenly spaced out you know in terms of if Pharmacology is say one week, even if test week it goes on for like three weeks, in terms of one Friday you have Pharmacology, one Friday you have Pharmacy Practice, one Friday you have Pharmaceutics, it's just a suggestion, you know, it would give us more time to actually learn the work, to understand, and you know keep it in mind for a longer time, than just making it through. (ZCL3:9)

Student 7: Yah but then you will still like have classes in between because you can't just stop for three weeks. (ZCL3:7)

Student: Yah no that's fine.

Student 7: And then classes in between your minds on other things and then it's pracs, it's just not enough time. (ZCL3:7)

Student 2: Even maybe over two weeks instead of just the one week. Like yah maybe the Pharmacology on Monday, then you can have the PR on Friday, you can still maybe write the other subjects on the Wednesday, whatever, just to give space, because honestly speaking my world stops when I'm studying Pharmacology everything else takes a backseat, which is why I prefer to write that Pharmacology paper first; then I can study and I know I can put my stuff away. (ZCL3:2)

Facilitator: We are not allowed to have Pharmacology first in the test week all the time.

Student 4: My big problem with test week especially when you have Pharmacology either on the Monday or the Wednesday, not that it would be any better on Friday, is I work myself so hard on Pharmacology, like I basically work myself into the ground, so I am burnt out for everything else. Specifically if you look at the second term, where we wrote Pharmacology, went off for exams, wrote exams and then went off on holiday and then came back and wrote pharmaceutics and ZP on the same day. I did quite badly on those exams I studied so hard for Pharmacology I was completely burnt out, I'm just glad I had good DPs, and I knew I was kind of going to be burnt out after studying for exams. (ZCL3:4)

Student 10: I also think maybe if we can like actually have more frequent tests and may be write off some of the work in the second semester. Because now at the end of the year there is so much work we actually have to study to remember all that to go with that..... I don't know..... you not focused. Also we said like for the test you get like one, one section is like 10 times half marks, then there is so little that you actually tested on other work, and then you learn so much stuff and then you only tested on certain stuff which count such high marks. They can actually ask more stuff for, less marks. (ZCL3:10)

Student 3: To what you're saying is smaller tests, but less work. (ZCL3:3)

Student 4: Smaller more frequent tests. (ZCL3:4)

Student 10: Yah then you can focus on each section equally. (ZCL3:10)

Student 1: But as another suggestion would it be possible for us to break down the module and have an exam in June for all the work, is that what you mean? (ZCL3:1)

Student: So you can actually write an exam in June and another one in November.

Student: A semester module even

Student 5: Even with the test I wouldn't mind with it being a three-hour test on more of the work that we studied because I think everyone would do better, because like you don't always focus so much in-depth on everything and then always perchance that section that you didn't study will be like 20 or 30 marks and then you fail. (ZCL3:5)

Student 6: But I think if you had one exam and you wrote it off you just going to..... it's written off and yah but you just going to write it off then, just think about how many times you study Chem and it's written off and then you don't ever look at it again. (ZCL3:6)

Student 4: I don't think you write it off but I think you will be able to know it more in detail..... (ZCL3:4)

Student: Yah, you think you will.....

Student 6: .... And then you'll have more time to study. (ZCL3:6)

Student: ..... Yah but once you've written a bit off in June, you don't need to go look back because you not going to write any more tests on it and it's over.

Student: But in fourth year you revise everything again.

Student 6: Yah but it's like a day or something like that, and you need it for the whole of fourth-year. You need to because if you work now over the whole year, you keep on going back to because you have to study it, and once you've written a it off, if you had to in June ..... (ZCL3:6)

Student 4: Or split it up into two exams then at the end of the year. (ZCL3:4)

Student 9: How much of the chemistry do we actually remember from the semester modules .... (ZCL3:9)

Student 10: But then what if you have a bad exam then you fail, that means you got to just have to do repeat the whole thing all over again. (ZCL3:10)

Student 10: In the exam you can have just like a really bad day, and then like on the day of the actual exam and you only get one chance. That's why a lot of people are actually stuck repeating because maybe they just had a bad day and they just, you know, you understand what I mean. (ZCL3:10)

Students All & 9: *Students concurring.* I agree. I know what you mean. I had a disulfiram reaction before the exam. (ZCL3:All & 9)

Student 5: The exam is 60% of all the year, the whole year that you've worked hard which only counts 40%. (ZCL3:5)

Student: Exactly

Facilitator: Its actually worse it's 67% and 33%

Student 7: I agree with Stuart in like second year, like I don't remember pretty much anything from second year work, you can't just go, you can't just write an exam, then okay cool I passed, get my degree and then go work and you don't remember anything. So that is my huge problem and I stress about it because like you can't go out there and not know anything, and it's a little bit scary that I don't remember much from second year. (ZCL3;7)

Facilitator: That's what fourth-year is for.

Student 2: Or else another suggestion would be if we could write two papers for Pharmacology, we could have paper on focusing on like mechanisms of action or things like that and then another one focusing mainly on application type questions because more, other people strengths lie in, well, rote learning, and other people strengths lie in application, it

would be more balanced that way if we could maybe perhaps have two papers instead of the one paper and then get the average of that as your final mark. That would actually make, yah .... Even if we wrote them at the end of the year but as two papers. That would I think even things out. (ZCL3:2)

Student: Like chemistry, it works, it really helps.

Student 9: It divides the work for you, you learn it much better because there's less to learn you know. (ZCL3:9)

Student 2: There's lessons to learn for the one say it's mechanisms and drug names, whatever, in the first test, if you know you're mechanisms in the next test you going to be able to figure out your side-effects and contraindications from your mechanisms of action. (ZCL3:2)

Student 9: Maybe if you test you can start with an open book test from third year in which .... (Lots of laughter) .... No like you would have learnt the mechanism of actions and then when you come to the application you can bring your books, you know. (ZCL3:9)

Student 3: No, but I think that's cheating because in the real world it's not going to be like that. You can't have ..... You can have two tests, one with just mechanisms of action and one with side-effects. I think two tests is a good idea but then why dont you do it then first semester and second semester.(ZCL3:3)

Student 2: Like first semester work and second semester work. (ZCL3:2)

Student 3: ... But keep it the same. I don't think mechanisms of action for one test and drug interactions for another..... (ZCL3:3)

Student 2: No it wouldn't be obviously in that format. It would be a certain aspect in the one paper and then a certain aspect in the other paper, so they can also have .... Because what

frustrates me the most about studying Pharmacology is that you study so much work and then some sections don't even get asked, because they don't have enough marks to ask, you know what I mean .... You can only stretch them to 200 marks by giving half marks ... (ZCL3:2)

Student 3: So, so two tests will give the coverage.. . (ZCL3:3)

Student 9: If both of them are 100 and 100 marks then the lecturers can ask more questions . . . (ZCL3:9)

Student 2 & 9: ..... And plus there is a higher chance of passing . . . (ZCL3:2&9)

Student: Exactly, you get a better chance of passing . . . .

Student: Probably about 5% . . . . (Laughter)

Student 2: If you look at some of the questions, you realise you study . . . . Like for example look at the last test that we wrote, all that stuff you learnt on antimicrobials and then you just get asked one question, you know what I mean it makes you feel like, okay why was I studying everything else, you know what I mean . . . (ZCL3:2)

Student: It's demotivating . . .

Student: But you must know it . . . .

Student: No, no, of course you must know it .. .

Student 10: That's why I said like you must ask more questions but just make it with half marks or less marks for each question and ask more stuff on all the sections. (ZCL3:10)

Student 9: But that's what I learnt about Pharmacology you can't take anything for chance, you have to study everything. (ZCL3:9)

Student 5: Not that you give it to us, but you know that they will be a question from the section, that you know you aren't studying like 10 sections for no reason. (ZCL3:5)

G3: ZCL401 Focus Group Transcript

Facilitator: Okay what this is about. This is.. it's part of the research to look at the teaching of Pharmacology and to find out how to improve the teaching of Pharmacology. We've also been looking at the whole issue in terms of language of instruction in teaching Pharmacology because for many people the medium of instruction, which is English, is not your home language. So that, that also creates problems. So what we would like to do is: a focus group is really where we just have a topic and you talk about it and say how you feel about and how you've experienced it. That really is what it is and then Pearl is here and she's just going to jot down points and then we also record the session. Okay just so that afterwards we know what was said and we can pull out things that are the same and I've done similar groups with the second and the third years, to see how things change as you progress academically and become more mature in the academic environment and in your knowledge. Okay so . . . . That's what we'll do and unfortunately they only can give me this little recorder which doesn't have a phenomenal microphone to pick up sound so we'll need to pass it along to whoever is talking. It's just a bit inhibiting in one way but that's the only way we can do it. Okay so the first thing that I thought we could talk about is your approach to studying Pharmacology. You know how do you go about it, has it maybe, you know, is it any different to anyone else, how you handle Pharmacology . . . . . Anyone got anything to say (laughter) . . . . . I mean basically, you know, what do you do, nitty-gritty. How do you . . . Do you study it the night before, do you need more time for it, do you write, learn, notes summary, overheads, whatever.

Student 2: Okay I prefer to kind of grab the concept of it, rather than cramming. I have to be able to logically understand why this drug is used, to be able to remember its name and how

it works. I can't just remember facts. So that's how I prefer to study, so in other words I can't cram, so I have to start way beforehand, yeah . . . That's all I can think of for now. (ZCL4:2)

Facilitator: Okay

Student 1: I think that for Pharmacology mind maps are really really really helpful, from second year, third year, and now. Mind maps are like lifesavers. When you start off in second year things seem a bit foreign and you think Pharmacology, well personally to me, I used to think that it was like any other subject, studying chemistry or pharmaceutics, but I realised a little bit late that actually it's not. It needs a whole lot of attention to detail, because it's easy to mix up stuff and then to just lose your way. So then for me mind maps with a lot of detail, especially per system and then understanding how the thing works, and then how what goes wrong with it, to now know how the drugs will help it. So then yeah for me then mind maps especially that are very helpful. But now in fourth year like everything is coming together and I'm thinking " but I didn't understand this in second year". Now it's like "ag it's so easy". Yeah because now things just . . . the puzzle is complete and all the pieces fit. In second year it was like random pieces and it was like "okay". (ZCL4:1)

Student3: I think for me it's also the same as what Monique does like to learn a lot of facts and then try and remember it for the test doesn't work from me as much as like I can then write a test, afterwards I don't sort of remember, like looking at indications is maybe the one thing that's the stresses this point is like, if I learn indications just memorising them you can remember for the test, because if I, because so when I study, I study quite in advance so then I try and take a look at sort of the topic that it's used for, like opioids for instance and I look at what are opioids used for and then try and understand the patho behind the disease condition so then when the indications come, I know why, and then I can remember. So like if I look one year especially with this year using DiPiro, it helped so much. And it sort of made us

looking in the hospital program made us understand exactly why is it used for that. Because in class sometimes we give an indication but we don't have the patho with the Pharmacology so when you say "it's used for this and this" like if we don't sort of go and look it up and try and understand it for ourselves sometimes, that's how I feel, we not really going to understand it, because we've just got given the knowledge in class, so then to immediately get the whole concept and understand it. We might lose that if we don't go home and then look at the condition, yeah. But that sort of how I, sort of Pharmacology came together for me this year was looking at the patho with and DiPiro like just made it so easy this year. (ZCL4:3)

Facilitator: So do you think it'll be much better because that's what we're going to be doing with the new curriculum. Pathophysiology is moving into where we, when we present Pharmacology. Cellular will happen in the beginning in first year and then for each of the systems we'll do patho and then start the Pharmacology. That would make more sense to you.

Student 3: I think see yah and then looking at it even from the clinical side, then when you go to the hospital we'll have skills already there and then we can take so much further than us having to go to the hospital and sort of learn for ourselves and re sort of catch up on maybe the indications. When the doctor says some of the indications then "oh yeah I remember that" but you don't sort of think about it because it's not ever really linked to condition that you actually gone into detail with. So when he says it then you "oh okay now it makes sense" because he explains to you what the patient in front of you has got it with. But then learning Pharmacology, I yah, also just do it like Monique says, start sort of in advance to try and understand the concept and then like the pictures make, the diagrams of the mechanisms make like the world of difference yah, to actually see it. So just learning facts like yah . . . . (ZCL4:3)

Facilitator: I think that's very true in Pharmacology, to make a mental picture, that's what I'm always trying to tell you, if you haven't got that. Those diagrams are so important.

Student 4: Maybe just to continue what they said, for me the way I understood Pharmacology in second year, third year, is basically on indications and the pathophysiology. That's mostly because my background is from other medical, my mum is a nurse and stuff, so I knew how asthma appears and symptoms of diseases. So when I saw the drugs now, I could then relate to the diseases unlike the other guys who like read first and then . . . I first know what to treat it for and then I work with the drug and literature. I understand how the drug acts and the side-effect associated. All because I had a bit of knowledge from the disease being managed, so even my side effects of the drug, some of them I'd seen in the hospitals, so this year with hospital hours it was more like easier for me to understand the Pharmacology because everything just falls in place. It makes sense to me now. . . . (ZCL4:4)

Facilitator: It comes alive. It becomes real when you actually see it.

Student: Yeah because you can couple it to something whereas if you just learn the facts it doesn't . . .

Facilitator: . . . Dry book knowledge

Student 4: . . . . So reading for tests and all which is mostly cramming. But yeah I would say mostly the pathophysiology and indications helped me most. Then of course a you doing for tests and stuff you have to read in advance because there is so much minute information needed that's specific for tests. But understanding the work wise for pathophysiology and clinical indications that's what helped me. (ZCL4:4)

Facilitator: That is crucial. Okay. And in terms of the notes do you actually just use what we give to you, do you supplement it. You obviously use mind maps a lot.

Student 4: I look at the notes you give us, but I can't really make sense of them. I have to write my own notes so I just use what you give us as a guide. (ZCL4:4)

Facilitator: They're very skeleton, what we give you.

Student 4: So we have to go back to the Katzung and some . . . . (ZCL4:4)

Facilitator: Do you use the textbooks?

Student 3: Yeah, I also . . . Like I go through the notes and then to sort of get what we must, actually sort of the topics that we must know and then go into the textbooks and then make notes from the book and then use the diagrams that are there, to then understand the whole, to actually see the mechanisms you know on the pictures where the diagrams and the conditions where they try and explain because a lot of the time they show that sort of the patho, then they show like opioids work on this path you know when they have the little name and have an arrow exactly which part of the pathway it acts on and that those diagrams like for me make a big difference yah. (ZCL4:3)

Facilitator: There is a wealth of information in the diagrams.

Student 3: And you like go into the textbook, and if you don't go into the textbook I for myself like I find that I miss out if I don't know that background information, then I get to a test and if I don't know the background information like it doesn't . . I don't know what to apply because I can't make sense of it sometimes yah. (ZCL4:3)

Facilitator: Okay

Student 4: Another thing with respect to the hospital rounds and clinics. I think it would be a good idea if they started earlier on, because now, like for this year, in my case, I spent more time trying to enjoy hospitals because I can't like back out of the reading of Pharmacology.

So maybe if that is integrated before like second or third year then people would just like know how to manage their time and stuff. Probably for me that was a bit of a hassle, managing the time and going to hospitals and coming back home and trying to open textbooks in the learning and then we have other modules to prepare for. Portfolios and etc. So it was a bit of a juggle. (ZCL4:4)

Facilitator: Fourth year . . . . The secret to fourth-year is time management. Without a doubt. Yes we going to in the new curriculum we going to have a full year of community and clinical placement for the third years, not just those few that you do at the end now. We actually going to build in a full year, which is what you saying.

Student 1: What really helps, the clinics and the report backs that we have. Even if, I don't know if, from third year also it could be integrated that even if the students don't actually go to hospitals or places, if they could be given case studies that are similar and then having to report back on them. It just brings the diseases and the drugs and everything together, much better than just reading in a chapter and understanding it in that sense. So kind of like what the students from America came and did those kind of settings where you get given a disease or a condition and then you discussed it in class is very, very helpful, and it just brings things together. (ZCL4:1)

Student 2: I found that working in the Pharmacy, having to do our hours from second year. That for me was a really big help because you get to apply what you learn in the lecture is when you go and work. At the Pharmacy that I'm working I'm lucky because I work a short evening shift, so I can work during the week while I'll be going to lectures during the day. When you see the drug class that you doing in the lectures and you see it in practice, it sticks a lot more than just learning it out of the textbook. (ZCL4:2)

Facilitator: Because you seeing it now actually as a product the halfway step. You seeing it you dispensing it, and it's becoming real, although you don't always have a patient always there was well it definitely I think helps because it's not just that unknown name in a book. It's, it's to make it real, which obviously helps. Do you find that the way you study and approach Pharmacology has changed from second year, to now in fourth year? The way you go about it

Student 1: Completely (ZCL4:1)

Facilitator: In what way

Student 1: This year, like I said it's a lot of integration and everything just comes together and makes a whole lot more sense. When you go physically to the sites and hospitals and even when you are studying things fit because now, you see we did hypertension in second year but now we are doing arrhythmias in fourth-year, but then drug classes, beta-blockers, calcium channel blockers, they all fit together, we can see "oh this is for this and also this and everything is so connected but in second year it was very abstract, everything was standing on its own, thats where I had a little bit of confusion because I used to approach it like it's just like any other . . chemistry or anything else, but it's actually not. There's a lot of integration that needs to be done, there's a lot of . . . . Background information and application. Unlike other stuff like he said, you can cram for a test tomorrow and learn it and pass and pass for it but then the stuff won't stick if you don't understand the reasoning behind the stuff. (ZCL4:1)

Facilitator: So it's changed quite a bit . . . .

Student 3: It's changed a lot (ZCL4:3)

Student 3: If I look at the classes or the topics that I did really well in is when I started early in advance and sort of got a whole background to the topic, like maybe looking at sort of, the

disease and looking at the diagrams and everything. (Interruption . . Someone walks in) But then if I look at a topic that I didn't maybe do well in it was at a time where I sort of didn't have enough time so then I do parrot style learning to then just be fine for the test, but then if I look at hospital where I maybe came short in a few diseases or conditions or whatever its where those sort of tests I didn't have the background to you know, to actually, so like sometimes I do really well in one test and then get to the next test and because of the difference in the way I came or I prepared myself I saw a big difference in the mark, I would say. (ZCL4:3)

Facilitator: And do you feel, we talking about your approach and about how you go about studying Pharmacology and whether it's changed from second year to now, the way you go about it. For example between, fourth-year is really so different. Between second and third year did it change at all? You think , the way you went about, or . . .

Student 4: No, I don't think it changed because it was more or less the same, you need to learn in advance. We didn't have practical scenarios. All we had were those . . . The practicals or simulated stuff but that didn't really make sense. It was just still, you take examples . . . (ZCL4:4)

Facilitator: It was still a paper exercise.

Student 4: Yah, just copy/paste kind of. You want to know what myalgia is but if you don't have, if you don't make the effort to look for it in the dictionary you just write myalgia and you just leave it and move on. Like now in fourth-year you go to hospital and you actually see what it is. You probably going to see a patient with such condition as example perhaps. Then it clicks. Okay so then you can go back to the drug and then you relate everything. (ZCL4:4)

Student 5: It's like everything comes to life when you go the hospital. (ZCL4:5)

Facilitator: And your approach from second year to third year to . . . ?

Student 5: Second to third year we were a bit more mature like we know when, where you like lag behind and then you like try to focus on these areas. Like how to study. But in terms of the studying it's just the same thing. But from fourth-year then it really changed, because then the approach is different, then when we see we remember it more, and then we try to remember it like from our past knowledge applied, instead of like going back and then trying to apply it. So it's like we don't know what we're going to like see when we in the medical ward. We don't know what we're going to see, so we trying to wrack my mind, where did we see that, and then apply it, and in it's like it comes to life. (ZCL4:5)

Facilitator: So you all basically reckon that the actual, the real life scenario is what actually helps to integrate everything and it really grabs your interest and it gets. . . .

Student 4: Let's say for example asthma, you have to see if the patient is characterised with bronchoconstriction. If we sitting in class the first time we don't know what is bronchoconstriction, what is that. Then we would say, no you use salbutamol, it's a beta agonist, maybe it relaxes smooth muscle etc. But still it doesn't make sense it's always just part of learning. But until you see the condition and then you say "no, we have to open up the airways, how is that going to work", and then we bring in the drugs and then you see the results. In the hospitals you see the patients with the nebulisers and immediately, almost immediately you can see the patient is resuscitated and then everything works out, unlike just the power of learning bronchodilatation, you got your mark finished and klaar. (ZCL4:4)

Student 5: Apart from that you like bring everything together, like its an overall picture, instead of like just chapters in small boxes, you like put everything together, so this links how

to this other chapter, oh this it's used in that other chapter as well, so why is that. So it brings everything together, like now I can see the overall picture of why we studied everything. But in second year and fourth-year it was just like we did not say how this is second year work, we are not going to be asked about that that's third-year work, that's antibiotics, that's got nothing to do with other medication but it's not actually that. A patient is treated with everything possible to treat conditions. It's not about treating only a disease it's about treating a patient with all the medication that we know. (ZCL4:5)

Student 3: I think doing the conditions together with the Pharmacology makes, it will make it more easier to understand, because then we can understand the condition and then we know, you know, what the symptoms are and what we actually treating. Then we'll see diagrams of, you know, whatever's going wrong and what this medicines actually treating, instead of just having sort of points, this and this symptoms and this is what we treating . . . (ZCL4:3)

Facilitator: So obviously just listening to you, that what would make it a bit more real is if we showed you a little snippets of video along the way . . . A person who has asthma, or a person who is this or a . .

Student: Or hypertension

Facilitator: Yeah . . Hard to show hypertension . . .

Student 2: If I, it was weird if during the course of Pharmacology if I knew a friend who had asthma, I would automatically study the section a little bit more harder and it would stick more because I could relate everything to her, or even like for example if I had, I used to have really bad acne, so when it came to anything in terms of something that I might have experienced or the drugs that I might have had to take, it sticks a lot more and you have that practical assurance then, or the practical relation . . (ZCL4:2)

Facilitator: Yeah you've seen . . .

Student: Yes

Facilitator: Sort of, it's that touch thing, that, you know, if you do something you remember, far, far better. Yes you may have a cool drink if you want . . .

Student 1: The rounds are actually it is so effective that once you've seen a condition in hospital, even if you never go back to studying it, you remember it. Even for the open book we had recently, I was speaking with another classmate and she was telling me how just from her round at EDH she could remember the whole section on psychosis and she . . The hospital rounds actually just helped her answer that question perfectly because you know she had seen the patient, she had seen the scripts, she had seen how the conditions are managed and so, yeah, once again it just helps you, it sticks a whole lot more when you actually seen it or been there or if you . . . (ZCL4:1)

Facilitator: And you see the whole picture, not just a little section in isolation. I think thats obviously very much . . . Yeah I think second year you feel lost almost because you doing these . . .. Because I always look at the second years at the beginning of the year and you start doing kinetics and dynamics with them and they are drowning, and then by the end of second year they actually getting it, some, the majority get it together, but it takes a lot of integration, because It's a whole new language that you have to learn along the way, as well as that. So tell me in terms of studying Pharmacology, do you think it's affected you, did you hear anything about Pharmacology before you got into second year and started Pharmacology and did that affect, . . . Do you think that affected you and your approach and your attitude to it.

Student 1: Yes, totally. People always have bad things to say, even if something isn't bad, they'll just try and find the bad side of it. Coming into Pharmacology, I was enthusiastic and I

really loved the subject, but people were like "no it's so hard, and it's difficult and people fail it" and was all this negativity towards Pharmacology, which gives you this initial stress and now you start worrying, even though the thing makes perfect sense when you go through it, you have this mental block . . . "It's hard and I'm going to fail" and people say it's this and that. Yeah that was a big challenge for me. Just listening to people and friends . . . Bad advice. (ZCL4:1)

Facilitator: You've built up this whole thing about it.

Student 1: Yes you build up a big mountain, and now . .. (ZCL4:1)

Student 5: But it kind of depends as well, for some people like just telling them it's going to be difficult like it just gives them another approach. Then they say "no, then I'm going to concentrate more on this subject, in terms of the other subjects they try to neglect. And then Pharmacology they say "no Pharmacology is like a difficult subject so let me try and work harder on it" and like, like I would take it as a challenge. Okay it's difficult so let me rather tackle this first and then see what's difficult and then afterwards you realise no but it's not that difficult. If people had said "no everything is fine and you going to pass", then people would have neglected it and taken it like normal, yeah like casually. At the end perhaps they wouldn't work through it so much. So it kind of has its advantages and disadvantages. It's personal how it works on people. But I think that the initial stress is important to actually know that "okay this is a difficult subject, let me rather tackle it like more in depth and then get it going". And then as soon as you know how you doing it and then to just the way you want to do it. (ZCL4:5)

Student 4: I think in my case and probably a lot of other people, Pharmacology wasn't an issue. The problem was the chemistries, because now in second year there is this thing that if you fail three modules you can't make it to third year. And now you already have two

chemistries to take care of things first semester and you just look at Pharmacology as a year module, so you say I will look at it a bit later. So our priority then was the chemistries, but still trying to balance that when the first results chemistries come you flunked and then the first result for Pharmacology comes you flunked then you kind of messed in the brain and then you don't even know what to do. So I think the problem was the chemistries, in my case. But then where to reach a break, like, work for the chemistry, work for the Pharmacology, just try and make a balance. But then it was just the chemistries, that was the problem. (ZCL4:4)

Student 5: If we could have done more problems in second year in chemistry, then we would like, the chemistry of the drugs we study in second year. Now in third-year . . In fourth year we do the drugs that were studied in third-year. So if we had studied it all along the way . . . (ZCL4:5)

Facilitator: The integrated method ..

Student 5: Yeah it would have made more sense because then we study the chemistry of how it works, on the other, like you study how it works in the body, and then everything comes together. But like second year chemistry was like "what is going on". (ZCL4:5)

Student 4: So if you try to understand what is going on there and you don't understand the language of Pharmacology, now you just lost between the two buildings. (ZCL4:4)

Facilitator: I can understand that. You're be pleased to know in the new curriculum we are integrating med-chem into clinical Pharmacy, so you going to start off with pathophysiology. Say you do respiratory first, you start off with the pathophysiology, then you going to do in terms of molecular activity of the mechanism and then you have the medicinal chemistry coming in there, and you have the Pharmacology, and you will have a practice of respiratory,

you know, all the counselling, in the same module, and your even have the pharmaceutics of the special formulations, the inhalation formulations. All within one module. So you going to do everything. It will also I think avoid a lot of duplication.

Student: We should delay our studies for a few years.

Facilitator: Unfortunately it's always like that isn't it. You don't want to go back . . . They only starting in 2013 with first year. But yeah, I think it might help. Tell me in . . . so would you say that your approach to studying Pharmacology is different to your approach to studying other subjects.

Student 3: Yeah well mine I think. Pharmacology I try to then look at the condition and the . . . . Try to get a much more, of an understanding behind, before I actually go and do all the detail, to have an overall picture and then do the detail, and then some of the other subjects it's more like sort of parrot style learning, because I spend so much more time on the Pharmacology that sometimes the other subjects, they aren't as, so the, I don't find them as sort of integrated as Pharmacology, where you really have to have a good understanding. Like a lot of other subjects, if I can take pharmaceutics for example, it's facts you have to know about a mill . . . . It's sort of the way it gets asked as well, it makes you . . Okay I must learn these facts and stuff like that. So it's not as applied as Pharmacology is sometimes yah. (ZCL4:3)

Student 2: With Pharmacology you have to do a lot more understanding than actually parrot fashion, because there is no way that you can study Pharmacology parrot fashion, it's just not going to work. Specifically when you working as a pharmacist once you qualified, you going to have to remember all this knowledge, so you can't remember your list of five reasons why this and that, so you have to . . . You have to understand why it would cause that, so you can

think up maybe the possible side-effects, because you understand the underlying reason or how it works. Yeah with pharmaceutics you can't do that. (ZCL4:2)

Facilitator: You just learn the facts

Student 5: And then it also becomes like also more visual, for Pharmacology, in the mechanism of action I would look for like videos and stuff and try to like visualise how it actually works, but like pharmaceutics, like they say it's more factual and you can try to like get an overall picture, but you know it's not like for long, like you wouldn't use it in real life, but for Pharmacology you try to go that extra mile, look for some videos, look for some pictures, look for some like mind maps nice colourful, like mind maps that will actually relate, and then you can relate and remember more. But for other subjects you like don't really need to like always get the visual picture. (ZCL4:5)

Facilitator: Okay, is there anything else any of you, as we just sort of end off, would like to say about Pharmacology, studying Pharmacology, anything like that. We've said a lot . . .

Student 3: I think when I sort of realised this whole disease and Pharmacology went together, as (name) said when those American students and they gave us the one presentation on the DKA, and he said you know, you asked us why would I give potassium, and then he explained the mechanism of why, like we were taught that but then when he explained the mechanism together with the disease then I realised okay that obviously makes complete sense but if you haven't sort of made the link yet between . . (ZCL4:3)

Facilitator: You never make the link . . . .

Student 3: Yeah and I think that is with the hospital program, DiPiro was like .. . . (Laughter) I just love that book now. (ZCL4:3)

Facilitator: Yeah it is . . . . It's an excellent book. I think you . . . NMMU students are actually quite lucky and fortunate because you finish your Pharmacology, most of the classes, it's hard, it makes the course hard, but you finish it virtually by the end of third year, you just have a few left, and then in fourth year you have the opportunity where you can just integrate and apply. Otherwise you would be going, leaving where you were at the end of third year, in your Pharmacology knowledge. Most other institutions just to Pharmacology in third-year and fourth year.

Student 3: I think if you are looking at a person who would want to go into clinical Pharmacology, to go to an institution like that, you would be massively disadvantaged, I feel, because then you would have to then go to hospital and then learn all that stuff, and now where we have done it, had the opportunity, we'd be so much more prepared to go into that sort of line of work and we'd be prepared . . . . (ZCL4:3)

Facilitator: I can tell you that I have been told, and I was at a table on two different separate occasions with other academics and the people didn't really know which university we were all from, and this was someone who was very high up in the Department of health in the Free State, and they said they like the NMMU students, because NMMU graduates can function in the workplace, they can apply their knowledge, and I thought that was really nice and I think it comes from what you saying. Then someone else from National Department of Health told me that as well. They like employing the NMMU graduates.

Student: that's nice to know

Facilitator: So .... .your name is out there .. . . You must just continue it.

Student 3: I think that's just what the hospital program, that's what creates the interest for us to maybe then think of a clinical sort of role because now we understand what it's about and

if you good at applying stuff like that, then you know it could be like a possible career thing for you if you haven't sort of been applying that before you go into the workplace, you get to a clinical setting and you like "I can't do this" (ZCL4:3)

Facilitator: And actually, I'm going to switch this off now because I'm going to talk to you, this really is just additional.....

APPENDIX H

SI Group Discussion Transcripts

H1: Group discussion May 2011 Group 1 Transcript

H2: Group discussion May 2011 Group 2 Transcript

H3: Group discussion May 2011 Group 3 Transcript

H4: Group discussion May 2011 Group 4 Transcript

H5: Group discussion October 2011 Group 1 Transcript

H6: Group discussion October 2011 Group 2 Transcript

H7: Group discussion October 2011 Group 3 Transcript

H8: Group discussion October 2011 Group 4 Transcript

H9: Group discussion October 2011 Group 5 Transcript

H10: Group discussion October 2011 Group 6 Transcript

H1: Group discussion May 2011 Group 1 Transcript

Student 1: As I was saying, I think cycloplegia would be a decrease in the ability of accommodation and it's caused by a weakening in the contracting ciliary muscle. (INT1:1)

Student 2: Yah, yah. (INT1:2)

Student 3: What about where they say the second important ocular effect of anti-muscarinic drugs is to weaken the contraction of the ciliary muscle or cycloplegia. So what I was thinking is that cycloplegia is the weakening of contraction right and it's caused by antimuscarinic drugs. (INT1:3)

Student 2: Yah okay (INT1:2)

Student 2: I also think we can say it is the weakening of contraction of the ciliary muscle, which results in the loss of, is it accommodation? Yah (INT1:2)

Student 1: But isn't that. . . Caused by accommodation, ability for accommodation, which is caused by weakening of ciliary muscles, by your . . . . . (INT1:1)

Student 2: Yah I think everything fits in that category. (INT1:2)

Student 4: According to the text here they say "the second important ocular effect of an antimuscarinic drug is to weaken the contraction of the ciliary muscle, or cycloplegia, meaning that this is, this is, first line explains what cycloplegia is . . . (INT1:4)

Student 3: That is weakening of the ciliary muscle . .(INT1:3)

Student 4: So now what causes it should be a different thing. (INT1:4)

Student 3: So what causes it? (INT1:3)

Student 4: Okay so according to this result, and that, this is the result . . . . (INT1:4)

2 minutes

Student 3: Results in loss of . . . . Caused by antimuscarinics. (INT1:3)

Student 4: Yah whatever (INT1:4)

Student 3: So do we agree that cycloplegia, do we agree that cycloplegia is the weakening of contraction, because one of the, some are thinking cycloplegia is weakening of contraction, some are thinking its loss of accommodation, caused by weakening of contraction. . (INT1:3)

Student 4: No, okay, okay let's check which one comes first. Let's just explain what accommodation is. (INT1:4)

Student 3: What is accommodation? (INT1:3)

Student 4: Okay I don't know what accommodation is but I don't really know how to explain. (INT1:4)

Student 2: To change like your, to see near objects and far objects. (INT1:2)

Student 4: So is it the change of the diameter of the iris right? (INT1:4)

Student 3: Yah (INT1:3)

Student 3: The diameter of the lens . . . so that you can see near objects. (INT1:3)

Student 4: And where the ciliary muscles are located, if we having this, this as the lens . . . (INT1:4)

Student 3: The ciliary muscles are located at the two ends . . . (INT1:3)

Student 3: So this is the ciliary muscles right, so when they contract it means they pull the lens, so then accommodation occurs, right. So if these are weakened it means accommodation

is . . . . . What? Is not achieved. So what comes first, it's the weakening, before the accommodation. (INT1:3)

Student 4: So what is cycloplegia. (INT1:4)

Student 3: It's the weakening . . . . . No, it's the loss of, it's the final thing, it's the loss of accommodation, caused by weakening. (INT1:3)

Student 2: If we are not sure I think we can just say it is the weakening of the contraction of the ciliary muscles, which results in loss of accommodation. What you think? (INT1:2)

Student 1: Yah, but then what does the question say? (INT 1:2)

Student 3: I think we are kind of deviating here, we've read from the textbook. It explained to us what the weakening of the ciliary muscle is, and after that it just mentions the name of the disease called cycloplegia, so any other thing, like not being able to have a proper accommodation, maybe most people that we look at as maybe being longsighted and the one very close they cannot see that's a different thing altogether. (INT1:3)

Student 4: So what I am just thinking is cycloplegia is the same as this weakening, then antimuscarinics cause cycloplegia, which results in loss of accommodation. (INT1:4)

Student 5: So it is the cause and then the result. (INT1:5)

Student 3: There is the cause , the condition, then the ... (INT1:3)

Student 5: There is the cause and the result. (INT1:5)

Student 3: So we think cycloplegia is the weakening . . . . (INT 1:3)

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5 minutes

H2: Group discussion May 2011 Group 2 Transcript

Student 1: But what were we talking about? (INT2:1)

Student 2: I was talking about the relationship between the antipsychotics, antidepressants and antihistamines. The antidepressants and antipsychotics are like sympathetic effects because they will increase noradrenaline and adrenaline levels in the body, and antimuscarinic would do the same, would have the same kind of sympathetic increase of adrenaline in the body, because Muscarinic effects are like . . . . . (Can't understand the words) . . . . Effects and stuff like that. So antimuscarinic would be the same sympathetic effects like the antidepressants and antipsychotics and here they asking like why is it that you have the same kind of side effects. I think for them to have the same kind of side-effects, they should first have the same effect, because side-effect is not like opposite effects, but adverse effects. So because they have the same kind of sympathetic effect, the side-effects will also be common. (INT2:2)

Student 1: So what you're saying is these things act in the same manner that this works, that and antimuscarinic works. (INT2:1)

Student 2: No not like the same mechanism, but like having the same effect. (INT2:2)

Student 3: But how does this come in to play? (INT2:3)

Student 1: what is an antihistamine by definition? (INT2:1)

Student 3: I know that histamine first of all is what causes allergy, the release of histamine, and if I'm not mistaken, if it causes allergy it should be a neurotransmitter. (INT2:3)

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2 minutes

Student 2: Antihistamine is released by the cells of the body, by the cells in the blood, by the mast cells. (INT2:2)

Student 3: By the eosinophils, or something like that in the blood. (INT2:3)

Student 1: And like antihistamines would like prevent it, so . . . . . (INT2:1)

Student 2: But I think the relationship between allergy and depression, and being down and stuff like that . . . . . (INT2:2)

Student 1: You know what I was thinking, first thing I could determine, because this thing, these two particularly increase the noradrenaline levels, right , by blocking the reuptake, so if you have more noradrenaline in your system then it goes and it binds to the Alpha two receptor for the muscarinic receptor. It binds to the . . . . Let's check the neuro effector junction. You've got the neuron and then you've got the effector. Let's say it's not masked. An antimuscarinic would bind to the receptor, to the muscarinic receptor and you get, and reduce the muscarinic, and reduce the parasympathetic effect. (INT2:1)

Student 1: . . . . It's reduced (INT2:1)

Student 1: But if you've got a lot of, on the presynaptic you've got the Alpha two receptor, the pre-synaptic receptor of the Alpha two receptor . . . . . (Can't understand the words) . . . . . In the cholinergic system the presynaptic neuron results in a decrease in the acetylcholine. So there is a higher level of adrenaline in circulation, of the catecholamine in circulation and combine to the Alpha two receptor, presynaptic Alpha two receptor of the cholinergic neurons. Am I making sense. . . . . Okay let's start again. You've got the cholinergic neuron, right, and . . . . What's it called? The neuron that uses acetylcholine . (INT2:1)

Student 3: Cholinergic neuron . . . (INT2:3)

Student 1: . . . Cholinergic neuron, but this thing is presynaptic regulation by Alpha two receptor. So we see that binding of the Alpha two receptor in this neuron results in a decrease of the acetylcholine released. So an agent like the tri-cyclic antidepressants, that increases the circulating catecholamine levels, there is more catecholamines that binds to their Alpha two receptor, and inhibit the acetylcholine release. If the level of acetylcholine is reduced, doesn't that have the same effect of releasing the parasympathetic effect, as does an antihistamine? (INT2:1)

Student 2: Wait a minute, the Alpha two, what does it do? It reduces acetylcholine? (INT2:2)

Student 1: Yes acetylcholine (INT2:1)

Student 2: I thought it reduces nor-epinephrine. (INT2:2)

Student 4: I don't know about that one. (INT2:4)

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5 minutes

H3: Group discussion May 2011 Group 3 Transcript

(For 25 seconds cannot determine any coherent discussion. Very noisy)

Student 1: . . . . This is the eye, with circular muscles and radial muscles. So when these radial muscles constrict . . . . It's long like this and then it constricts and at the same time when they relax this circular muscles . . . . . So they act in opposites, when the radial muscles are constricted, the circular they are relaxed and when the circular muscles constrict the radial muscles relax. (INT3:1)

Student 2: Yah (INT3:2)

Student 3: So constriction of radial muscles leads to dilation of the pupil? (INT3:3)

Student 2: Yah (INT3:2)

Student 1: Of which sympathetic action is dilation of pupils. (INT3:1)

Student 2: Yah (INT3:2)

Student1: That means constriction of pupils is parasympathetic. (INT3:1)

Student 2: So what are we . . . What are you trying to tell us? (INT3:2)

(Laughter)

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2 minutes

Student 2: . . .But you can see that. Increase in sympathetic . . . (INT3:2)

Student 4: You are trying to . . . . . And treat it. (INT3:4)

Student 4: You're trying to treat that . . . . (INT3:4)

Student 4: That is what your problem is... (INT3:4)

Student 4: Yah because you have concluded it. (INT3:4)

Student 4: Okay, what is drug X (INT3:4)

Student 1: . . . . . I'd say an anti-muscarinic. Atropine is the only one I know, or I remember. (INT3:1)

(18 seconds of mumbling)

Student 3: . . . . To prevent the constriction of radial muscle . . (INT3:3)

Student 1: in general we are trying to reduce parasympathetic effects, because those three, the three disorders of parasympathetic, increased parasympathetic effects . . . . . (INT3:1)

Student 3: increased parasympathetic effect? (INT3:3)

Student 1**:** yah (INT3:1)

Student 3: constricted pupil, if the pupil is constricted it means the radial muscles are dilated, are relaxed. (INT3:3)

Student 2: yah (INT3:2)

Student 3: if the radial muscles are relaxed, is it, is it . . . . Cholinergic or sympathetic? (INT3:3)

Student 1: Just from the fact that the pupils are constricted, it's parasympathetic (INT3:1)

Student 2: Yah (INT3:2)

Student 3: It's parasympathetic (INT3:3)

Student 1: You see when, when you sympathetic your pupils dilate (INT3:1)

Student 3: Your pupils dilate, then to the mechanism of action right? What I'm asking right, is it more cholinergic or is it more of a sympathetic and parasympathetic? (INT3:3)

Student 1: Huh? Is it cholinergic or parasympathetic . . .? (INT3:1)

Student 3: Are we using more of cholinergic receptors or more of alpha and beta receptors. (INT3:3)

Student 1: Its alpha receptors for the eyes (INT3:1)

Student 3: Alpha and beta receptors for the eyes? (INT3:3)

Student 1: Alpha receptors for the eyes . . .(INT3:1)

Student 3: Alpha receptors in the eyes right? (INT3:3)

Student 2: But don't you also have muscarinic receptors in the eye? (INT3:2)

Student 1: In the eye (INT3:1)

Student 3: If you have muscarinic receptors, what I'm saying is, if it's muscarinic receptors, the eye it's relaxing, if it's relaxing it means it's being inhibited. So the radial muscle is relaxing, leading to . . .(INT3:3)

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5 minutes

H4: Group discussion May 2011 Group 4 Transcript

Student 1: So what must we do now? (INT4:1)

Student 2: Just do your thing (INT4:2)

Student 1: Okay guys . .okay guys we now at question three. The question asks "a patient walks into the pharmacy with constricted pupils, increases in exocrine secretions and diarrhoea, which is increasing parasympathetic effects. You give him drug X, you give drug X, what are you trying to diagnose? You trying to diagnose myasthenia gravis, right. Myasthenia gravis, um. What is drug X? Drug X is edrophonium. So what effects are you expected to see? So, if you give edrophonium to diagnose myasthenia gravis, edrophonium is an ACh inhibitor, ACh enzyme inhibitor, which will inhibit that enzyme of ACh, therefore increasing ACh at synapses. (INT4:1)

Student 2: Yah (INT4:2)

Student 1: Therefore it will improve myasthenia gravis. (INT4:1)

Student 2: Yah (INT4:2)

Student 1: But the test is if you administer edrophonium, and the muscle contraction improves, then the patient does not have myasthenia gravis, but if there is no improvement, then that, that indicates that the patient has myasthenia gravis. (INT4:1)

Student 2: No the other way around. (INT4:2)

Student 3: Yah (INT4:3)

Student 2: . . . . . No the other around (INT4:2)

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2 minutes

Student 3: My problem is, these symptoms that we have, they can either be myasthenia gravis or cholinergic crisis. So my question is why are we going for myasthenia now? (INT4:3)

Student 2: I also have that question (INT4:3)

Student 5: you know what . . . .(INT4:5)

Student 5: . . . . What the lecturer is saying in class, when somebody comes into the pharmacy they will be having those symptoms, hey, you'll be wondering if they have cholinergic crisis or myasthenia gravis, so the only way to find out is to use this drug. (INT4:5)

Student 5: Yah (INT4:5)

Student 2: Is that the problem? Is that the problem you had? (INT4:2)

Student 3: What is it? What are you trying to diagnose? (INT4:3)

Student 5: I'm trying to diagnose whether it's cholinergic crisis or myasthenia (INT4:5)

Student 2: Okay (INT4:2)

Student 2: Yah (INT4:2)

Student 2: I think there we . . . . (INT4:2)

Student 5: Because they are not to send symptoms (INT4:5)

Student 2: Yah (INT4:2)

Student 1: So we are diagnosing if the patient has cholinergic crisis or myasthenia gravis. (INT4:1)

Student3: We are trying to diagnose the two, yah (INT4:3)

Student 3: Between the two, we are confused between the two as a pharmacist. So the only way to find out is to use this info. (INT4:3)

Student 3: If the situation worsens . . . (INT4:3)

Student 1: It's cholinergic crisis . . .(INT4:1)

Student 3: And if it improves its myasthenia with a (INT4:3)

Students 1: Yeah yeah (INT4:1)

Student 1: If the situation improves its myasthenia gravis (INT4:1)

Student 1: Yah now we . . . . . (INT4:1)

Student 4: Physically we do know what the difference is, we are trying to diagnose between the two we are trying to come up with, with which one is which one (INT4:4)

Student 3: Yah you already have the, yah (INT4:3)

Student 1: So the drug is edrophonium, eh (INT4:1)

Student 3: Yah (INT4:1)

Student 4: What if it's reducing, then your answer is the same. If its myasthenia gravis you know, you expect the patient to improve . . .(INT4:4)

Student 1: Yah (INT4:1)

Student 2: Yah, that's . . Yah I agree (INT4:2)

Student 4: But if it's that, then we would expect this (INT4:4)

Students 1: Yeah (INT4:1)

Student 2: . . . . And tackle it from that perspective (INT4:2)

(mumbling for 13 seconds)

Student 1: I think we didn't do this . . . .(INT4:1)

(more mumbling for 11 seconds)

Student 4: . . . . Myasthenia gravis . . . . (INT4:4)

Student 3: Okay (INT4:3)

Student 2: Insomnia . . . (INT4:2)

Student 1: . . . Insomnia . . . . (INT4:1)

Student 2: Right, insomnia. Insomnia is a disease that someone finds difficulty in sleeping, you awake the whole time, that's insomnia . . . . . So Eddie is saying, yah. Eddie is the same patient with myasthenia gravis , huh, right? He complains that he's not sleeping, would it be a good idea to giving him a sedative? What is? A sedative is a sleeping pill, ne (INT4:2)

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5 minutes

H5: Group discussion October 2011 Group 1 Transcript

Student 2: Hydrogen potassium pump ATPase inhibitors (END1:2)

Student 1: Okay so they bind irreversibly to the H potassium ATPase pumps and that's why they don't . . They have such a long duration of action, even though their half-life is so short. (END1:1)

Student 2: And why are they effective, like why would you choose them over other ones like over . . . (END1:2)

Student3: Cause it's non-selective, it doesn't have to bind on the ACH receptors or the . . umm (END1:3)

Student 2: It doesn't matter what is the cause of the H plus, it just inhibits the H+ (END1:2)

Student 1: It's like the last stage so doesn't matter whats causing it, it's just going to stop it. (END1:1)

Student 3: So it's direct. (END1:3)

Student 2: And she said if they bind irreversibly, one get permanent anti-acidity. (END1:2)

Student 1: No, yes, no (END1:1)

Student 3: Because after five days the receptors replenish, they up regulate, even though the other hydrogen receptors have been blocked, more are being created, because the body has this ability, amazing ability to regenerate receptors. (END1:3)

Student 2: And like taken one hour before the meal. Why is that important. (END1:2)

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2 minutes

Student 3: Because umm well peptides in the stomach activates umm it activates . . . What's that thing, what's that enzyme . . . . Gastrin production. (END1:3)

Student 2: Yes you said like after the meal because, because after a meal the stomach has too much acid produced, so you have like the drug will act on a lot of acid . ..(END1:2)

Student 3: So it's less effective because .. . . (END1:3)

Student 2: It's more effective because there's more acid to act against. More acid is produced. This is when you eating food, then you increase like the acidity . . .(END1:2)

Student 1: Because of . . it stimulates that I'm trying to say (END1:1)

Student 2: Yah (END1:2)

Student 1: So that's good, you must eat an hour . . . . I mean take the medicine and hour before you eat (END1:1)

Student 2: Yah (END1:2)

Student 1: So that it can act just-in-time for when you eat. (END1:1)

SI Leader: umm so you take it on, is that the protease inhibitors .. . . .

Student 2: Yah. (END1:2)

SI Leader: Protein pump inhibitors, PPI's, yeah that's right

Student 3: That's cool (END1:3)

SI Leader: So what did you want to say about the other thing . . .

SI Leader: Did you umm, did you talk, you know, about the whole corticosteroids thing and asthma, do you know the whole rationale behind it?

Student 1: We did the .. . . the corticosteroids, or the aspirin? (END1:1)

SI Leader: The first one . . .

Student 1: Aspirin sensitivity also and the corticosteroids. (END1:1)

Student 1: The aspirin one I'll answer. So aspirin only in like less than 10% of patients that it basically has a problem. (END1:1)

SI Leader: Yeah but it does happen, so you have to counsel the patient whenever he comes to the Pharmacy and tell him that . . . .

Student 1: That it could have some . . .(END1:1)

SI Leader: Any asthmatic patient that comes to umm aspirin, you have to measure the risk versus benefit factors and only after that if he really needs it . Then you have to. . But if you

look at like someone comes in for a chronic aspirin dose you really have to like protects around I think the antiplatelet effects on the cardiovascular diseases which is like 850 mg, you have to consider an asthmatic patient, in that case you know, the chances of him developing bronchospasm is quite high.

Student 1: But even with them, because their prostaglandins won't be . . . (END1:1)

SI Leader: You see what actually happens is that . . . Can I borrow paper . . . Okay see what happens yah is that this is Arachidonic acid and umm when there is any vascular wall injury or something like that yah you get arachidonic acid, which will then produce prostaglandin and your peroxidases right? Now what happens is that ummm

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5 minutes

H6: Group discussion October 2011 Group 2 Transcript

Student 1: . . . So which means that bronchospasm in the beta two agonism, results in bronchodilation. (END2:1)

Student 2: But usually given that you want to relieve and avert an acute attack, then after the acute attack has been alleviated, you give a steroid. . . .(END2:2)

Student 1: A steroid . ?? (END2:1)

Student 2: hmhm . . You give a corticosteroid. This is an allergy reaction and anti-inflammatory mediators are being released, kind of like asthma right, you give a corticosteroid to beat the LTD, and all those things. (END2:2)

Student 2: So in asthma therapy, right, the main therapeutic drug which is usually given for long-term therapy, is corticosteroids. If conditions are getting worse, let's say for a five-year-old, less than five-year-old, if conditions are getting worse like if the asthma not controlled, what do you do.? (END2:2)

Student 1: . . After administering corticosteroids? (END2:1)

Student 2: The kid is on corticosteroids but his asthma is not controlled . . . . (END2:2)

Student 1: You add a long acting beta agonist . . .(END2:1)

Student 2: Less than five years old you are not allowed to add a long acting beta agonists. (END2:2)

Student 3: What about theohylline? (END2:3)

Student 2: You are not allowed to use theohylline either (END2:2)

Student 3: Older than five years? (END2:3)

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2 minutes

Student 2: Slow-release theophylline and . . . . . Are contraindicated for less than five years. (END2:2)

Student 3: Oh less than five years. (END2:3)

Student 2: I think, I think they can take the leukotriene inhibitors, (END2:2)

Student 1: So leukotriene inhibitors right? (END2:1)

Student 2: Hmm, leukotriene inhibitors, receptor blockers and antagonists or you can step up, I think it can step off using oral corticosteroids. (END2:2)

Student 1: Oral corticosteroids? (END2:1)

Student 3: It's the first step. (END2:3)

Student 2: You can either step up or you can add a leukotriene. Stepping it up I think it is better because monotherapy increases compliance. (END2:2)

Student 1: Ok, I didn't know that one – so long acting beta agonists and theophy;lline are not for children under age of 5 years. (END2:1)

[Speak for about 10 seconds – cannot understand conversation]

Student 2: And there is this trick about administering, when administering an inhaler. That process . . . . Remember the process? (END2:2)

Student 1: Extend their lead, tilt your head backwards, at a 45° angle, exhale, and as you inhale, you pump the thing, and then you inhale with it, and then you hold your breath for . . . (END2:1)

Student 2: 10 seconds . . .(END2:2)

Student 1: 10 seconds .. . (END2:1)

Student 2: For the particles to settle . . . .(END2:2)

Student 1: .. And then you exhale . And then you wait for . .. (END2:1)

Student 2: 15 minutes (END2:2)

Student 1: 5 minutes and then do it again. (END2:1)

Student 2: Wait, so you have to wait and do it two or three times, two or three more times . . (END2:2)

Student 1: But you need to give two puffs, you can't. . .(END2:1)

Student 2: You don't do two puffs immediately . . .(END2:2)

Student 1: No, like no it needs to be 1, 2, 3, hold it (END2:1)

Student 4: Because it's just going to be a waste. (END2:4)

Student 3: Why must you hold your breath? (END2:3)

Student 1: Because when you inhale, not, you don't, like only 10%, 10 or 20% of thing gets to . . 10 or 20% of what you inhale gets to the , . . yah , that's 10 or 20% if you use...(END2:1)

Student 4: . . . 90% (END2:4)

Student 1: That's 10 to 20% if you use a good technique, so there are always probabilities that you might not use (END2:1)

Student 3: Less . . . (END2:3)

Student 1: Yah, that's where you must use a good technique. (END2:1)

Student4: You say only 20, 10 to 20% will go to .. .(END2:4)

Student 1: If you use a good technique, a very good technique only 10 to 20% might get into the lungs . .(END2:1)

Student 4: . . . Lungs, But what will happen to the other .. .(END2:4)

Student1: Normally it will stick to the mouth, it might stick to the mouth or some of it might be . . . .(END2:1)

Student 3: . . . Or GIT (END2:3)

Student 1: Or GIT, or some of them you actually exhale, because that is why you say wait for 10 seconds for some of the small particles . . . Some Of them will settle onto the site, but not all of them, because you actually exhale and exhale some of them like when you exhale you exhale some out the mouth. (END2:1)

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5 minutes

H7: Group discussion October 2011 Group 3 Transcript

Student 1: Okay maybe we can start by discussing that mechanism of action under asthma. (END3:1)

Student 2: . . . Under asthma. (END3:2)

Student 1: Yah, the one I was talking about. (END3:1)

Student3: Glucocorticoids mechanism of action. (END3:3)

Student 2: So if we should get asked the question about mechanism of action, how . . [cant understand a couple of words]. . Inhibit the generation of leukotrienes and prostaglandins and mediators involved in glucoside . . (END3:2)

Student 2: You should know everything .. . . (END3:2)

Student 1: Okay like at the end, what okay. . . (END3:1)

Student 2: Okay remember, I think you should just remember, picture that thing you know from COX, you know that thing going to leucotrines . . . (END3:2)

Student 3: Leukotrienes and then the prostacyclin, yah. (END3:3)

Student 2: So if you picture that now. . Okay . . . [mumbling] the generation of the leukotrienes and prostaglandins and mediators involved in, I don't know how to say, but this . . .you just have to know . .. (END3:2)

Student 2: Like for the generation of the leukotrienes, they are from arachidonic acid, so you inhibit the 5 lipo oxygenase enzyme, so it's not converted to leukotriene, is it A2 or A4, and the cytosol . . . (END3:2)

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2 minutes

Student 2: . . . . And when that happens on the leukotrienes you know there are also branches there, when leukotrienes is activated, there is a branch going to this leucocyte, what chemotaxines and bronchoconstriction and vasodilation the effects, so if you block that leukotrienes these whole things are going to be blocked too . . . (END3:2)

Student3: You don't have them, yah (END3:3)

Student 1: So how do you answer it now, what are the outcomes? (END3:1)

Student 2: But they won't be . . .(END3:2)

Student 3: the outcomes , isn't it . . . . (END3:3)

Student 3: The outcome of leukotrienes, isn't it the ones that are involved . . . . (END3:3)

Student 1: What's the mechanism of action like at the end you say what happens, so are these the processes that cause bronchoconstriction, or are they the outcomes of this leucocyte chemotaxis, as you know there are three parts in the mechanism of action, the deviation or the blocking and then the process, and . . (END3:1)

Student 1: Then the results . . . (END3:1)

Student 2: . . . . Then the result, yah. So now here . . . . (END3:2)

Student 2: . . . This here it is what you do and this is what happens. You do this, If you block this one .. .(END3:2)

Student 3: . . . . The leukotriene . . . (END3:3)

Student 2: Okay you block leukotrienes and then you inhibit this leucocyte chemotaxis, so the recruitment and activation of inflammatory cells, they are going to inhibit . . . (END3:2)

Student 1: . . . They block (END3:1)

Student 2 . . . . Yah, because this is the one that recruits and activates inflammatory cells and for bronchoconstriction decreased lumen of bronchi, bronchioles, it like . . If you, if you . . . (END3:2)

Student 1: Which one is being blocked, and in bronchoconstriction what have you blocked? (END3:1)

Student 2: You have . . . this one is responsible for decreasing the lumen of bronchi and bronchioles, so if you block this effect it's not going to happen, and then under vasodilation, the fluid exudation an increased, you are blocking this again. (END3:2)

3:44 minutes

H8: Group discussion October 2011 Group 4 Transcript

SI Leader: Let's talk about the corticosteroids thing I told you about.

Student: 1 Yeah well we are trying to look at the issue of. . (END4:1)

SI Leader: Let me show you. . This is how . . . Can I write here?

Student 1: Yah please go-ahead. (END4:1)

SI Leader: See, this is arachidonic acid, right. . . . . Now when you have a vascular wall injury, or any other kind of injury here, you get arachidonic acid production. Now you look at aspirin; what is aspirin's mechanism of action, what does aspirin . . . What does it inhibit?.

Student 2: COX (END4:2)

Student 1: It inhibits COX by acetylating . . . . (END4:1)

SI Leader: Cyclo-oxygenase . . .

SI Leader: It inhibits Cox, so thats Cox one there. Does it inhibit it reversibly or irreversibly?

Students 1: Irreversibly (END4:1)

SI Leader: Irreversibly . . . Okay. So now . . . And this is prostaglandins right. Now, when you inhibit this, when aspirin inhibits this, right. It will inhibit this pathway, so this path has already been cancelled out, yah. Now as it is inhibiting Cox one, you don't have any production of prostaglandins, but you still have production of this arachidonic acid, which is a precursor to prostaglandins, so what happens is that when there is, this arachidonic acid accumulates, it will shift this pathway in now to a leukotriene, to leukotriene synthesis, okay. Now this leukotriene synthesis is the one that will cause bronchospasm, yah, and then it can trigger an acute asthma attack. You understand that?

Student 2: So you saying like when this place is inhibited, when this place is inhibited, it makes use of . . . (END4:2)

SI Leader: When cyclo-oxygenase is inhibited, it inhibits the prostaglandin production, but there is still production of arachidonic acid, so that will then shift the pathway to leukotriene.

2 minutes

Student 3: So arachidonic to leukotriene here . . . (END4:3)

SI Leader: Which causes bronchospasm and an acute asthma attack.

Student 1: What I wanted to verify, we are told that this is dose-dependent . . . (END4:1)

SI Leader: That's the mechanism of action that is dose-dependent, so at low doses you will actually have an anti-platelet effect, yah. In the sense, in the sense that it will inhibit the thromboxane pathway, here, the platelets, yah. So you have an anti-platelet effect but at high doses you will not have an antiplatelet effect, instead you will have this prostacyclin inhibition here. See no antiplatelet and prostacyclin inhibition.

Student 1: Okay (END4:1)

SI Leader: That's why you limit the dose to about 80 to 150 mg, yah, and for an acute attack, if you want to use it acutely then you would use 300 mg.

Student 1: That's the maximum in the day. (END4:1)

SI Leader: The maximum yah, 300 mg

Student 3: Because we were taught 500 maximum. (END4:3)

SI Leader: Can you use 500?. Well what I know from my knowledge, I think 300 mg for acute

Student 1: We are taught between 75 and 150 maximum and 300 in a day. (END4:1)

SI Leader: Maximum 300 in a day yah . . .

Student 1: To have anti-platelet activity, yah, yah. (END4:1)

Student 1: And the issue of the corticosteroid . . . (END4:1)

SI Leader: Okay what do you know about corticosteroid, you know the body produces cortisol in the body, yah, so you have a normal production of cortisol, which is otherwise known as hydrocortisone, yah. What happens is that when you give a high-dose, first of all the cortisol is produced, it has a feedback system, so now in your normal homoeostasis of your body, when you have cortisol production, already your body will detect "okay I have

enough cortisol so I won't produce any more", so there is that negative feedback that pushes back, you remember from physiology. Now when you have less amount of cortisol, the . . . It feeds . . . There is a positive feedback then that says "okay we need more cortisol, we need to produce more cortisol" and it produces cortisol. Now what happens with high doses of oral corticosteroids now, is when you take them, the body sends a message to the brain saying that, to the hypothalamus saying "we already have enough" so we don't need to produce any. Now, abrupt removal, will then, you see your body thinks " oh there is enough I don't need to produce more". Now abrupt removal will shut down the normal production of cortisol in the body. You understand that part. That's why it is, and that's why I'm not sure, but just find out from your guidelines, I think that if you use them for less than 14 days, you can abruptly take them out but if you use them for more than 14 days you need to taper the dose down slowly.

Student 1: Gradually . . . . (END4:1)

SI Leader: Yeah gradually or slowly, but just confirm that from the thing, yah , okay

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5 minutes

H9: Group discussion October 2011 Group 5 Transcript

Student 1: Yeah, you're right, we have to look into the fact that we are dealing with CHF (END5:1)

Student 2: (can't understand 5 seconds) so the diuretics in CHF they are supposed to . . . In CHF there is accumulation of fluids in the broad . . . (END5:2)

Student: 3 Where exactly? (END5:3)

Student 2: The lungs . . (END5:2)

Student 2: But I know that there is accumulation in the feet (END5:2)

Student 3: but I thought it was in the heart . . . (END5:3)

Student 2: And in the heart . . . I don't know where in the heart (END5:2)

Student 1: In CHF there is fluid retention . . . . (END5:1)

Student 3: . . . . In the whole body . . (END5:3)

Student 1: In the ankles (END5:1)

Student 3: Okay so, and so where does this come in now? (END5:3)

Student 1: This one, furosemide . . . It's a loop diuretic (END5:1)

Student 2: Diuretics, you know that there is .. . There is fluid, there is water retention . . (END5:2)

Student 2: So they are going to reduce what retention . . . . (END5:2)

Student 3: I know the impact of diuretics the kidney, exactly how they work . . . (END5:3)

Student1: In the kidney? . . . . (END5:1)

Student 3: Yah . . . .(can't understand 5 seconds) (END5:3)

Student 3: So does that mean it touches a different area now than CHF . . . . (Laughter) (END5:3)

Student 2: I the same mechanism as in diuretics, but the effect is the one that is beneficial for CHF. The effect of diuretic is the one that is beneficial for the management of CHF. (END5:1)

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2 minutes

Student 3: but now they are asking for the mechanism of action. (END5:3)

Student 2: mechanism of action which is the . . . Looking at the site of action . . . (END5:2)

Student 3: . . . . . the site of action . . . (END5:3)

Student 2: Which is loop . . (END5:2)

Student 1: Not the distal . . . . The ascending . . . The ascending loop of Henle . . . (END5:1)

Student 3: The thick ascending loop of Henle . . . (END5:3)

Student 3: Do we have to explain like the nitty-gritty, like sodium it's what, what . . Sodium, potassium, what, what . . . (END5:3)

Student 1: exactly (END5:1)

Student 2: (expressions of surprise) . . . The last time I read those things it . . . . Was in the oral (END5:1)

Student 3: Okay whoever remembers, please . . (END5:3)

Student 2: I don’t remember (END5:2)

Student 1: what is the transport that they block? (END5:1)

Student 2: isn't it the sodium 2, sodium, 2 chloride, 2Cl minus . . No sodium chloride 2Cl minus. . . Then it will cancel out that way. And then what happens there? It's secreted into the lumen through the organic; what do you call it, organic (don't understand words) (laughter) . (END5:2)

Student 1: What do you call it, I can't remember . . . (END5:1)

Student 3: (explanation in Xhosa) . . To get into the lumen (END5:3)

Student 2: Then explain exactly what happens, then that means it blocks . . (END5:2)

Student 3: Into the lumen wall . . (END5:3)

Student 2: Then it means the furosemide it will block the sodium chloride (END5:2)

Student 3: The salt . . . (END5:3)

Student 2: And then sodium it will be retained in the tubule . . (END5:2)

Student 3: And then water will be subsequently formed. (END5:3)

Student 2: What happens to potassium? (END5:2)

Student 3: And increase urine output . . . (END5:3)

Student 2: And what happens to the potassium? (END5:2)

Student 3: Potassium is retained . . . (END5:3)

Student 2: Blocks this one (END5:2)

Student 3: So blocks this one and causes hypokalaemia (END5:3)

(can't understand five seconds)

Student 2: Okay, should we proceed? (END5:2)

Student 1: Yes (END5:1)

Student 2: Use of hydrochlorothiazide and amiloride. Hydrochlorothiazide is a thiazide and this is a sodium channel blocker . . (END5:2)

Student 1: Amiloride? (END5:1)

Student 2: Under the potassium sparing kind of yah . . So this one is a thiazide, so what can we say about them . . . . Okay what I know is the potassium sparing agents they are normally, they are not normally used as a synergistic effect, normally used for that, not like, they are used on their own . . . . (END5:2)

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5 minutes

H10: Group discussion October 2011 Group 6 Transcript

Student 1: You are saying the thiazide . . . . (END6:1)

Student 2: I was thinking that the thiazides, don't they cause like hy . . .hypo . . .kalaemia? (END6:2)

Student 1: The thiazides: what did you say about the thiazides . . (END6:1)

Student 2: Do they cause hypokalaemia? So if, then if we use it in combination with a potassium sparing, then that means we going to be able to retain potassium. If the effect of amiloride, that means we won't have the hypokalaemia. (END6:2)

Student 1: So you're saying the thiazide, they cause the. . . (END6:1)

Student 2: They cause the excretion of potassium . . . (END6:2)

Student 1: . . Which means someone is going to have hypokalaemia, then from there, I want to pick it from there, then what will happen? (END6:1)

Student 2: So if we use it in combination with amiloride, which is a potassium sparing, that counteracts that affect . . . (END6:2)

Student 1: The effect of hypokalaemia . . . (END6:1)

Student 2: Yes that will counteract that effect . . (END6:2)

Student 1: Of hypokalaemia? . . . . (END6:1)

Student 2: That will balance out the hydrochlorothiazide. (END6:2)

Student 1: Okay, okay (END6:1)

Student 2: Then the, this one . . . . Use of furosemide when the GFR is 80 ml per minute. GFR . . . Glomerular filtration rate, sure I've forgotten that one . . . (END6:2)

Student 1: That one I'm not really sure about it. . . (END6:1)

Student 2: But I remember something . . . (END6:2)

Student 1: We do do it, when we are doing diuretics . . (END6:1)

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2 minutes

Student 2: yes we did it . . (END6:2)

Student 1: with Mrs Boschmans (END6:1)

Student 2: Ah, I forgotten now, but we did it in class, when she was talking about . .. (END6:2)

Student 1: You mean when we were doing diuretics? (END6:1)

Student 2: Yah we did it in diuretics. And then this is use of mannitol for cerebral oedema. It's . . . Mannitol is a osmotic something . . . (END6:2)

Student 1: Diuretic . . . . (END6:1)

Student 2: It's a diuretic . . . (END6:2)

Student 1: Yah (END6:1)

Student 2: What's the class? A osmotic . . . aah . . . But then it like, mannitol it's not absorbed in the brain, it then causes water to move out from the brain cells into the system, so it's like that excess water by the oedema is going to move out of it. (END6:2)

Student 1: Okay, so the excess water is going to . . . . (END6:1)

Student 2: Going to move out from the cells into the system like the potassium salts and then it's going to be transported back to the kidneys to be excreted out . . . (END6:2)

Student 1: Then it will be eliminated, taken out, so that's how it causes the diuretics. (END6:1)

Student 2: Yes it reduces the oedema, because of oedema essentially is accumulation of excess water in cells. (END6:2)

Student 1: Yah . . . This one now. (END6:1)

Student 2: This one I'm not sure about, (name) also might have forgotten about. You have the notes? (END6:2)

Student 1: (Paging, looking for the notes) . . . . (Take 25 seconds to find) This one . . . . . You were saying the, the mannitol, it . . . (END6:1)

Student 2: It's an osmotic diuretic, so it's going to cause water to move out of the cells (END6:2)

Student 1: Of the cells, yah (END6:1)

(take 20 seconds to find relevant info)

Student 2: (reading softly then louder) . . . Yeah it says if you have cerebral oedema that means there is excess water in the brain cells so mannitol, it will be in the vessels and it's going to cause... I have forgotten the term . . But then essentially it means it's going to cause water to move out of the cells into the blood vessels where the mannitol is. Because you know that rule of osmosis where water moves from a high (END6:2)

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5 minutes
