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Instrument validation and evaluation of problem-based learning tutorial performance of undergraduate nursing students

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CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

This chapter provides an overview of the study and includes the background to the problem-based approach to teaching and learning together with a description of the philosophy of constructivism. A statement of the problem, the rationale, the purpose and importance of the study are included. The objectives to guide the researcher through the study are set out together with relevant definitions. An overview of the research methodology is described in an attempt to validate an evaluation instrument and assess the performance of undergraduate nursing students in problem-based learning tutorials. Ethical considerations are provided.

1.2 BACKGROUND TO THE STUDY

Nursing education aims at developing the student to meet the nursing needs of society. It further aims at developing and grooming the individual into becoming a knowledgeable, ethical, responsible, caring professional who will administer health care to members of society from before birth to beyond death, in a safe and professional manner. In addition, nursing education socializes the student into functioning effectively within a group such as the multidisciplinary health team. Clinical practice is carried out in a demanding work environment, filled with uncertainty in a constantly changing society.

There are many health care challenges professional nurses face in South Africa in the 21st century. These challenges include the rapid changes in information and technology together

with the increase in population owing to geographical migration of people from all parts of Africa, many of who require urgent medical attention. Diseases such as tuberculosis and epidemics of the communicable diseases of cholera and viral haemorrhagic fevers are seen. An increased workload is placed on professional nurses resulting from an increased population requiring health care. Added to this is the 'brain-drain' of registered nurses leaving South Africa to take up employment in countries across the globe.

According to statistics that were set out by the South African Nursing Council (SANC) on 31st December 2007, the population of South Africa was established at being 47 849 800 people and the population of registered nurses was 10 372. These statistics show that there were 461 people to every one registered nurse in South Africa. In 2006 the statistic was 336 people to every one registered nurse in South Africa. Between the years of 2006 and 2007 there has been an increase in the number of people to every one registered nurse. Furthermore, SANC statistics show that there was an increase of 2 497student nurses from 2006 to 2007. One must judge this increase in relation to the thousands of people migrating from South Africa's neighbouring states particularly in the latter part of 2008 many of who presented with health problems. In addition, the HIV and AIDS epidemic not only increases the physical and emotional risks placed on professional nurses, but also impacts on the financial resources of a health budget requiring the nurse to 'make do' with available resources, mainly staff, equipment and medical supplies. This adds to the stress and anxiety experienced by the nurse.

In the rural areas of South Africa professional nurses are often required to practise without the assistance of health care professionals from other disciplines and are expected to make decisions that will provide a positive outcome for the patient. These nurses are required to be

in possession of clinical reasoning skills and a motivation to keep abreast of new medical information amongst other things. They are involved in carrying out primary health care with few resources and many patients, the majority of whom are illiterate owing to poor education. Health education to such a community becomes a challenge. When selecting a model appropriate to nursing education, one must take all these factors into account together with the view that the model will enable professional nurses to meet the challenges they will face in health care in South Africa during the 21st century.

The problem-based learning (PBL) approach is a potential for nursing education that can meet the needs of the South African undergraduate nursing student. This approach to teaching and learning is currently used in the Department of Nursing Education, at the University of the Witwatersrand where it was introduced in 1995. The PBL approach to teaching and learning could provide undergraduate nursing students with the skills required to become self-directed learners, to problem-solve and develop critical thinking skills, make sound decisions, possess good clinical reasoning skills and acquire the motivation to keep abreast of current trends in medical practice.

According to Uys, Gwele, McInerney, Van Rhyn, Tanga (2003:352) the majority of nursing students in South Africa come from a disadvantaged background and the PBL curriculum needs to be evaluated to determine whether this approach is suitable for South African students. Uys et al. (2003) further state that after graduation the demands placed on nurses in developing countries are much higher than in other contexts and the education may need to be different.

Historically, the PBL approach to teaching and learning was, promoted by John Dewey in the 1930s. According to Baker (2000:259) a 'hybrid' problem-based curriculum format that was

combined with the traditional method was introduced at the Case Western Reserve University Medical School in the 1950s. The problem-based learning approach was later refined by Jean Piaget and Jerome Bruner in the 1960s and referred to as an'inquiry approach to teaching science'.

The PBL approach to teaching and learning was introduced into several universities worldwide. In 1969, the McMaster University School of Medicine in Ontario, Canada, was the first rnative approach Master Universit annual summer used in other dis py and Dentistry

Figure 1. m PROBLA

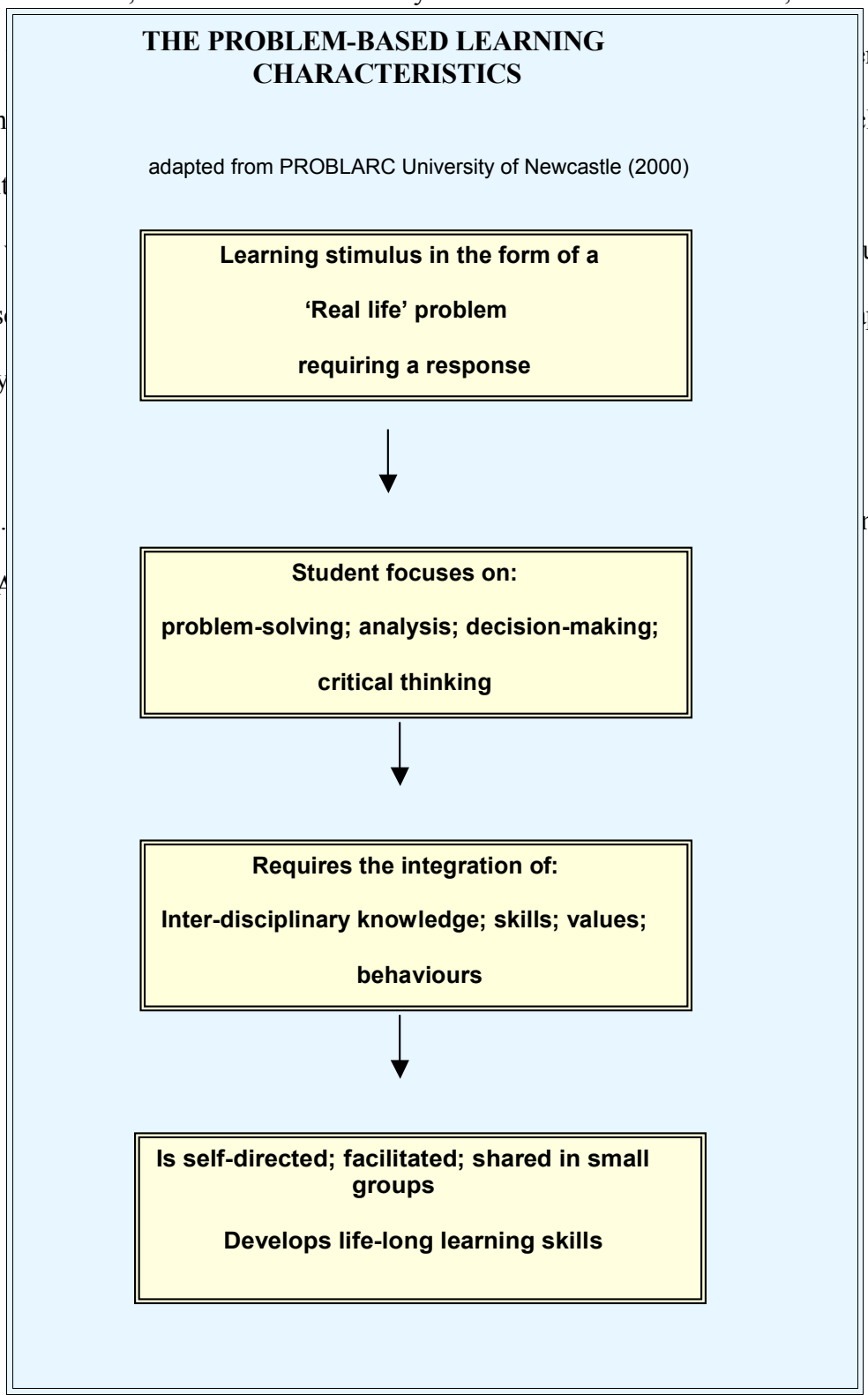


Figure 1.1 The problem-based learning characteristics

This figure further illustrates the basic steps in the PBL process. Firstly, the problem is encountered reflecting a 'real life' situation and requiring a response, utilizing the skills in problem-solving, critical thinking, decision-making, clinical reasoning and identifying learning skills. Together with inter-disciplinary knowledge and self-directed learning,

information is shared with members of the group. The newly gained knowledge is applied to the 'problem' and summarized. (PROBLARC University of Newcastle, 2000)

In sketching the background to the problem-based learning approach two main concepts are presented:

- The problem-based approach to teaching and learning and constructivism
- Requirements for the South African undergraduate nursing students

1.2.1 Problem-based Approach to teaching and learning and Constructivism

Rideout (2001:25) states that a theoretical base to problem-based learning (PBL) may now be claimed. As this approach to learning evolved and discussion increased, more attention has been paid to the connection of PBL with theorists and theories. According to Rideout (2001), John Dewey (1938) in his approach to 'progressive education' said that there was no point to the philosophy of progressive education sounder than emphasizing the importance of the learners' participation in the directing of their own learning process. Rideout (2001) adds that there is a further connection to Bruner's theory of discovery or inquiry learning that when learners actively participate in the process, learning is enhanced.

The work of Lev Vygotsky (1978) as stated by Rideout (2001) describes constructivist epistemology, its central theme being that knowledge is 'constructed' cognitively by the learner during interaction and participation with the learner's social community. Learning takes place through social interactions with individuals having greater knowledge and it is through questioning, assistance and continuous feedback that the learner is able to perform independently and with competency. Baker (2000:260) suggests that PBL is consistent with constructivism. The philosophical view of constructivism is that knowledge is not absolute it

is constructed by the learner. Knowledge is therefore based on world-view and previous knowledge. Baker (2000) further adds that PBL reflects three of the primary principles of constructivism:

1. Understanding comes with our interaction with the environment.
2. Cognitive conflict stimulates learning.
3. Knowledge evolves through social negotiation and evaluation of the viability of individual understandings.

Thus, PBL places learning within a social context and the learners, work collaboratively with peers and a more knowledgeable tutor, to ask questions, assist one another and give feedback on the process. In this way knowledge is created, based on what is already known and new ideas are developed.

The problem-based learning model has certain fundamental characteristics. Learning begins with an 'ill-structured' problem, that is a problem, composed of 3–7 parts (the next part is distributed after the previous part has been dealt with) representing a 'real life' situation. In solving this problem, the students focus on thinking skills representing problem solving, analysis, decision-making and critical thinking. The problem-solving process requires the integration of knowledge, skills, attitudes and values. It is a student-centred, facilitated, self-directed learning process that should foster life-long learning skills.

The problem-based learning approach is conducted in small groups known as PBL tutorials. In these tutorials, students are required to demonstrate, amongst other abilities, effective communication skills in expressing themselves, thinking and reasoning in the English language. The communication aspect, therefore, plays an integral part in obtaining a

successful outcome to the group process. Working within a group also enables the students to develop their leadership skills, share resources, be willing to work with group members and value the diversity found amongst the group members.

There are approximately 10 students and a facilitator in each group. The students are presented with a problem, based on a real-life situation and guided through a series of learning activities in order to solve the problem. The group process is based on the principles of group dynamics, for example, forming, norming, storming, performing. In forming the group, its size is taken into consideration. Sullivan and Decker (1992:258) –state that groups with 5-7 members are the most effective and further add that groups with more members seem not to achieve their objectives that well. In the department of nursing education where this study was conducted, large groups of students were divided into smaller groups. Group norms were developed and goals were determined. The group members decided on the appropriate and acceptable behaviour by which the group would function and standards were set. These standards included issues of trust, interpersonal skills, self-confidence, risk, respect and communication.

Cultural and gender sensitivity is addressed. Once a good climate exists within the group, the members move on to the process of storming, collecting information and solving problems. The group will reach the point of performing and decision-making in the effort to meet the goals set out initially. Group members are interdependent, sharing an interest in obtaining a common goal.

Each 'problem' is dealt with over a number of tutorials and in the final tutorial session, evaluation of the group process, the learning resources, the facilitator, the group and the

students is carried out in order to assess its members and increase the performance of the group. As student evaluation forms an integral part of the PBL tutorial, there has been much debate on the type of evaluation that should be done and whether a quantitative or qualitative approach should be used. Without proper evaluation, it is not possible to assess whether educational goals are being met.

Eva (2001:243) describes the advantages of tutorial-based assessment as follows:

- Evaluation based on prolonged and intense interactions among peers, tutor and students
- The opportunity to assess domains of competence that are not readily assessed by more traditional examinations, for example, communication skills, scientific curiosity and respect for peers
- The avoidance of the negative impact of formal examinations

Assessments can take place in the form of facilitator assessment, self-assessment and peer assessment. It is vital however, that these assessments be carried out by means of a valid and reliable evaluation instrument.

1.2.2 Requirements for South African Undergraduate Nursing Students

Undergraduate nursing students are required to meet certain educational criteria before being selected for the nursing programme. Once selected, their education becomes regulated by, the South African Nursing Council (SANC) and the Council on Higher Education. The students complete a four-year programme at a university, where they are required to pass each year in both the theoretical and practical aspects of nursing courses, until reaching the point of registration as qualified nurse practitioners and obtaining a Bachelor of Nursing university degree.

1.3 PROBLEM STATEMENT

Nursing students entering an undergraduate-nursing programme are assumed not to have the skills required for effective group process. This assumption is based on their reluctance to participate in the group tutorials, evidenced by the researcher's observation during tutorials, the percentages achieved on tutorial evaluations and feedback from the students during individual interviews. The students admit that they struggle to express themselves in a language that is not their mother tongue and thinking is often conducted in their mother tongue and then translated back into English. As a result, these students often prefer not to participate during group discussions because of the effort required in understanding, translating and then discussing not only in the English language, but also in relation to the medical genre. The latter, in itself is often difficult for a novice to comprehend. As discussions and teamwork are two of the aspects on which the students are evaluated and which will determine their success in the course, these aspects form an important part of the group process; students must learn to offer suggestions, opinions or get involved in constructive argument, for example. It is therefore necessary to evaluate student performance during PBL tutorials. The results of such an evaluation not only provide information on the appropriateness of the PBL model but also provide information on the students' performance. Such an evaluation must be carried out on a validated instrument developed for the South African context.

1.4 RATIONALE FOR THE STUDY

The rationale for conducting this study is to assess the extent to which the problem-based learning model will enhance the development of skills required by nursing students to function competently as professional nurses. Many of the South African undergraduate nursing students come from disadvantaged backgrounds – financially, emotionally,

educationally and socially – and then have to study in a language that is not their mother tongue. Such students entering tertiary education have to deal with many problems before they can concentrate on their studies. When a South African specific educational curriculum for these students is planned, many facts must be taken into account. In assessing whether the problem-based learning model is appropriate for this group of students, one needs to evaluate the students' performance in the PBL tutorials.

1.5 PURPOSE OF THE STUDY

The purpose of the study was to determine the performance of undergraduate nursing students during PBL tutorials based on a validated tutorial performance evaluation instrument.

1.6 RESEARCH QUESTIONS

- Does the original Tutorial Performance Evaluation Instrument (Annexure A) currently in use possess content and construct validity?
- Is the content of the Tutorial Performance Evaluation Instrument reliable when measuring students' performance?
- What is the student level of tutorial performance as determined by the student and the facilitator?
- What is the level of consensus between the students' self-assessment and the facilitators' assessment, on the students' tutorial performance?

1.7 RESEARCH OBJECTIVES

The objectives of the study were set in two phases:

Phase 1: Instrument validation

Phase 2: Evaluation of student performance in PBL tutorials

1.7.1 Phase 1 Objectives:

- Determine the content validity of the original 38-item Tutorial Performance Evaluation Instrument (TPEI)
- Modify and refine the original 38-item Tutorial Performance Evaluation Instrument
- Determine the construct validity of the modified and refined 38-item Tutorial Performance Evaluation Instrument

1.7.2 Phase 2 Objectives:

- Evaluate the performance of undergraduate nursing students during problem-based learning tutorials on a validated instrument, using self-assessment and facilitator assessment
- Compare student scores in each year of study from first to fourth year
- Determine the inter-rater relationship between student and facilitator tutorial performance scores

Table 1.1 provides an overview of the research methodology in relation to the objectives.

Table 1. 1 Overview of research methodology

Objective	Sample	Data Collection	Data Analysis
To determine the Content Validity of original TPEI	Expert group	Subjectively rate items on TPEI	Calculation of Index of Content Validity

			(CVI)
Modify and refine TPEI	Expert group	The statistical analysis of CVI will determine	Index of Content Validity (CVI)
Determine construct validity of refined TPEI	Researcher	Paired comparisons	Regression analysis
Evaluate the performance of undergraduate nursing students on a validated instrument	Undergraduate nursing students 1st year–4th year	Assessment of student performance in PBL tutorials	Inferential and descriptive statistics
Compare student scores in each year of study	Undergraduate nursing students 1st year–4th year	Assessment of student performance scores obtained in PBL tutorials	Correlation coefficients
Determine the inter-rater relationship between student and facilitator scores	Facilitators and nursing students	Comparison of student/ facilitator performance scores in PBL tutorials	Correlation coefficients

1.8 DEFINITION OF TERMS

Construct validity /weighting:

Extent to which a score is interpreted as representing the underlying construct

Content validity:

Extent to which the instrument includes all the elements relative to the construct that is being measured

Evaluation:

Measure the value or importance of something using a detailed appraisal

Facilitator:

An educator who may be or may not be a subject specialist who assists and provides the student with the necessary means to solve the 'problem' and guides the process given during a PBL tutorial

Problem-based learning (PBL):

A student-centred, self-directed, facilitated process of problem-solving using a 'real life' situation as a stimulus for the learning; takes place in small group tutorials

PBL tutorial:

A small group learning session made up of up to 10 students and a facilitator

Tutorial performance:

The performance of students during PBL tutorial sessions in meeting the required standards listed as items on a tutorial performance evaluation instrument

Undergraduate nursing student:

A student admitted to a university for the purpose of obtaining a degree in nursing. After successfully completing four years of study, the student graduates with a Bachelor of Nursing degree.

1.9 OVERVIEW OF DESIGN AND METHODOLOGY

A quantitative research approach was used to inform the overarching design that was descriptive and comparative in Phase 2 of the study. Phase 1 employed statistical techniques for instrument validation and refinement.

The research methods refer to the methodological perspectives of the study and address the research questions and objectives, the samples and sampling, data collection, instruments and procedures, data analysis and measures of validation and reliability.

1.10 SIGNIFICANCE OF THE STUDY

The validity and reliability of the evaluation on students' performance in problem-based learning tutorials, will lead to accurate feedback being given to the students. This feedback will direct the students along the right path to achieve the educational goals they have set for themselves. Reliable evaluation of the students' performance can, in turn, offer valuable information regarding the facilitators' skills in the group process, the teaching materials and the teaching methods. Furthermore, reliable evaluation on the students' performance allows for a dependable assessment of the curriculum used in their education. It also assists organizers to decide whether this method of teaching is suitable for the students and in particular the South African undergraduate nursing student.

1.11 ETHICAL CONSIDERATIONS

According to Burns and Grove (2001:191-213) research requires expertise, diligence, honesty and integrity. To generate sound scientific knowledge, ethical research is essential and the researcher has an ethical responsibility to protect the rights of human subjects. Ethical clearance is necessary before commencing the study to avoid research misconduct involving human subjects.

After the study was presented to the Department of Nursing Education, permission to conduct the study was granted by the Head of Department of Nursing Education, Faculty of Health Sciences, University of the Witwatersrand. Further permission was granted to access

students' scores obtained by the students in problem-based learning tutorials and to utilize the original Tutorial Performance Evaluation Instrument. A research proposal for the study was presented to the Postgraduate Committee and the Human Research Ethics Committee of the University of the Witwatersrand for clearance.

Approval of candidature was obtained from the Postgraduate Committee for this study to be conducted. This permission was granted on 3rd June 2005 (Annexure B).

Approval of protocol was obtained from the Postgraduate Committee for this study to be conducted. This permission was granted on 2006/06/08 (Annexure C).

The Committee for Research on Human Subjects (Medical), University of the Witwatersrand, granted the researcher ethical clearance and permission for this study to be conducted according to Protocol Number M060116 (Annexure D).

An information letter was sent to an expert group inviting them to take part in Phase 1 of the study. The letter described the research, what their involvement would be and the approximate time they would spend on the study (Annexure E). They were informed that participation was voluntary and that they could discontinue participation at any stage. Some of the experts requested a meeting with the researcher. This was done to clarify certain aspects and to discuss the involvement in relation to time frames.

In Phase 2 of the study an information letter and consent form (Annexure F) was sent to the students, explaining the research study. The consent form requested their written consent to allow the researcher to access their tutorial performance evaluation scores and allow these

scores to be published in this study. They were informed that their names, student numbers and year of study would remain anonymous.

The facilitators gave verbal permission for their evaluation scores on the student performance to be used in the study.

The self-assessments carried out by the students as well as the facilitator assessments and the assessments following consensus agreement were official evaluations and the scores attained would become a part of the students' year mark. For the purpose of this research, all that was required was to access the ratings and scores of the self-assessment, facilitator- assessment and the assessment following consensus agreement of students' tutorial performance. The students' confidentiality and their anonymity were endorsed. Students' names that featured on the evaluation instruments were replaced by codes. An opportunity was also provided for the students to ask questions and seek clarification concerning the study. They were told that participation was voluntary and that they could withdraw from the study at any point.

All raw data were kept in a locked cupboard in order to protect confidentiality. Data will be destroyed at the completion of this study.

1.12 CONCLUSION

This chapter focused on the introduction, background and rationale for the study. The research problem and study objectives were articulated. Contextual definitions were set out and an overview of the methodology given. The significance of the study together with the ethical considerations required to conduct this study were described.

The following chapter provides the reader with a review of the literature specific to the study.

1.13 OUTLINE TO THE STUDY

Since this study was conducted in two phases, the layout will be presented as follows:

Chapter One: Overview of the Study

Chapter Two: Literature Review

Chapter Three: Research Methodology: Phase 1

Chapter Four: Data Analysis: Phase 1.

Chapter Five: Research Methodology: Phase 2.

Chapter Six: Data Analysis: Phase 2.

Chapter Seven: Discussion, Main Findings, Recommendations, Limitations, Conclusion.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter a review of literature is presented that provides a theoretical basis for the study together with a dialectical framework of discussion that includes the following:

- Problem-based learning
- The undergraduate nursing student

The literature review synthesized available interdisciplinary, international and national literature.

The following five approaches were used to identify relevant literature in both problem-based learning and the undergraduate nursing student: a computerized search of the university library catalogue, Pubmed a service of the National Library of Medicine and the National Institutes of Health; current textbooks and journal articles and the Google search engine using keywords such as 'problem-based learning', 'nursing' and 'problem-based learning in Health Sciences';

2.2 PROBLEM-BASED LEARNING

Problem-based learning will be discussed under Historical Perspectives of PBL and the PBL Process.

2.2.1 Historical Perspectives of PBL

Savin-Badin (2000:1) states that many of the principles used in the problem-based learning approach can be identified in earlier styles of teaching. Problem-based learning can be traced back to early forms of learning where there was a demand for diversity in problem solving. Students under the guidance of Socrates were presented with problems that required questioning. The questioning enabled Socrates to assist these students to explore their assumptions, values and the inadequacies of their proffered solutions. PBL furthermore,

reflects the views of John Dewey, the proponent of progressive education. ‘There is no point in the philosophy of progressive education which is sounder than its emphasis upon the importance of the participation of the learner in the formation of the purposes, which direct his activities in the learning process' (Dewey, 1938:67).

According to Rideout (2001:25), the theoretical and practical base for the problem-based learning approach can now be claimed based on the theories of Dewey and Bruner, in spite of this method being perceived as having non-theoretical beginnings. A further theoretical perspective is found in the work of Lev Vygotsky who describes constructivist epistemology. Baker (2000:260) states that the problem-based learning approach is also consistent with constructivism, the latter having a philosophical view that knowledge is not absolute; knowledge is constructed by the learner and based on previous knowledge.

Three principles in the problem-based learning approach can be compared with the three primary principles of constructivism:

1. Understanding comes from the interaction with the environment.
2. Cognitive conflict stimulates learning.
3. Knowledge evolves through social negotiation and evaluation of the viability of the individual understandings.

In problem-based learning, understanding and learning come from interaction and discussion within group tutorials. Van Berkel and Dolmans (2006:730) agree that problem-based learning can be regarded as a constructivist approach to learning that emphasizes learners’ active engagement in their learning and thus in constructing networks.

According to Quinn (2005:49) in the early eighties, Mouton and Blake described a concept that was referred to as synergogy – the theory behind the problem-based approach to teaching and learning. Synergogy is an approach to learning that capitalizes on the best features of both pedagogy and androgogy. It is described as being an approach to learning that is systematic, in which the members of small groups learn from one another through structured interactions. This method has four fundamental differences from other approaches:

1. It uses learning materials managed by a learning administrator rather than having a teacher who might be seen as an authoritative figure.
2. Students take responsibility for their own learning through active involvement with other students.
3. It rests on the premise that learning that arises from teamwork is greater than that done by the individual alone (the principle of synergy).
4. The planned interaction with colleagues acts as a motivator for learning.

In 1969 the problem-based learning approach was introduced as an alternative method for physicians and implemented at the McMaster University in Canada by the physicians Barrows and Tamblyn and according to Savin-Badin (2000:1), Barrows based his approach to learning on two assumptions:

1. Learning through problem situations is better than memory-based learning.
2. Problem-solving skills rather than memorization are needed when dealing with patients.

Twenty-one years later, in 1990, the PBL approach was introduced into certain nursing schools and subsequently spread into other health sciences. According to Baker (2000:259), the McMaster model of presenting the entire educational programme with PBL was subsequently implemented at universities in the Netherlands, Australia and the University of New Mexico. By 1991, various aspects of problem-based learning had been implemented in about 100 of 126 medical schools in the United States as well as Canada, United Kingdom, the Middle East and Asia. By 1994, the problem-based learning model was adopted in several nursing schools in Australia, United Kingdom, South Africa and China. By 1997, problem-based learning was implemented in schools of occupational therapy, social work, dentistry, pharmacy and in 1998 in physical therapy. By the year 2000, only seven United States nursing schools were identified in the literature where problem-based learning was still used in selected courses.

2.2.2 The PBL Process

In a description of the characteristics of the problem-based learning curriculum, knowledge, skills, attitudes and values are based on 'real life' situations, where the students' focus is on problem solving by analysis, reflective thinking, critical thinking and decision-making. It requires an integration of inter-related knowledge and further focuses on verbal and non-verbal communication, reading and writing skills, the ability to work within a team, self-directed learning and a motivation towards learning. The students, therefore, require the ability to apply an integration of multidisciplinary knowledge, skills and behaviours.

Rideout (2001:27) describes the implementation of the PBL approach over a period of 30 years from the time that it was first developed. This includes using PBL in large groups of twenty or more students, rather than the usual five or ten, using peers as facilitators in place

of faculty, and dealing with a new problem each session rather than using a single problem as the focus of learning for several sessions. The original process as described by Barrows and Tamblyn (1980) remains the most commonly used where students meet weekly or twice weekly in groups of five to ten with a facilitator present. In an environment that is conducive to learning, the facilitator actively coaches the students to take responsibility for their learning. Evaluation of the students, the facilitator, and the PBL process is usually conducted at the end of each problem.

2.2.2.1 The Facilitator

According to Ling and Jee (2007:1), the role of the teacher has changed from following the didactic to a facilitatory approach. This approach may be summed up as follows:

- Teachers act as facilitators who provide the students with guidance in developing the skills required to perform effectively in group tutorials, instruction on how to develop content knowledge and give feedback regarding the students' performance
- The teacher's role is supportive and no longer directive
- The teacher facilitates a collaborative construction of knowledge
- Facilitators question and probe how the students reason and process information while supporting positive interpersonal relationships in the group.
- Students are thus guided through their own processes of critical thinking, problem-solving and decision-making to arrive at conclusions

Lekalakala-Mokgele and Du Randt (2005:5) conducted a study to assess facilitation as a teaching and learning strategy. The study concluded that students experienced the facilitation process negatively in the beginning. They were at first dissatisfied and felt that they were

expected to do the facilitators' work. But once the role of the facilitator was explained to them, they adapted to this method of self-directed learning and became more positive.

It is clear that more research is needed on the role of the facilitator in the nursing education environment. Lynyk-Child, Crooks, Ellis, Ofosu, O'Mara and Rideout (2001:117) support this notion and state that it is not only students who struggle to understand the concept of facilitation; facilitators also experience a certain amount of difficulty.

Gilkison (2003:6-14) states that at the time of the inception of the problem-based learning model in Canada, Barrows saw the ideal PBL tutor as being a group facilitator rather than a subject matter expert. It is still debatable whether the best PBL tutors need to be subject experts. Gilkison (2003) conducted a study to establish the techniques used by 'expert' and 'non-expert' tutors who acted as facilitators in problem-based learning tutorials. Observation of a medical facilitator in PBL tutorial Group A and a non-medical facilitator in PBL tutorial Group B was carried out. The study concluded that similarities were observed in the interventions used by both tutors. The medical tutor spoke more frequently, initiated more topics for discussion and used techniques to raise awareness more often than the non-medical tutor. The latter concentrated more on managing the group process. The tutors in both groups showed positive aspects in that both groups were able to raise students' awareness.

Lekalakala-Mokgele (2006:61) describes the experiences of facilitators in a study conducted to identify the challenges faced by PBL facilitators. Some of the emotions experienced include the difficulties involved in facilitating coupled with a fear of loss of control, a lack of knowledge and the anger of learners. Some facilitators see this as a challenge with

advantages such as self-development and learning to manage group dynamics and in the end prefer facilitation to lecturing.

According to Murray and Savin-Badin (2000:107), for PBL to succeed a sound programme for staff development is required. At the University of Dundee, PBL facilitators were orientated in the PBL approach in workshops that took place a year before the PBL approach to teaching and learning was introduced. Although the available literature indicates that there has been limited research into the process and outcomes of staff development, the latter should be a key component of any PBL programme.

Johnston and Tinnings (2001:161) refer to a group reflective practice strategy for facilitator development as a better way to prepare teachers to meet the demands of problem-based learning. Van Berkel and Dolmans (2006:730) later conducted a study testing the influence of tutoring competencies on problems, group functioning and student achievement in PBL. The authors conclude that tutorial competencies have a positive effect on the learning of students and suggest that it would be worthwhile to include these competencies in staff development.

The effectiveness of the facilitator in PBL tutorials, was also highlighted by Ling and Jee (2007:13) who conducted a small-scale study on 25 students to obtain the students' perceptions of good PBL facilitation. In the findings on what contributed to their learning, the students stated that good facilitation comprises the facilitator's ability to demonstrate and model thinking strategies, help them define questions, develop higher thinking skills and assist and guide them through the group process. They required constructive feedback, affirmation and encouragement. Ling and Jee also note that final- year students require

minimal help with self-reflection and group processes. When the researchers compare this deduction with the previous research conducted by Neville (1999) and Wilkie (2000), they recognize that different age groups and situations require different tutor behaviour to facilitate student learning. There is no doubt that the stimulation given to students by a good facilitator has a direct impact on student learning and group functioning.

2.2.2.2 The Group Process

An important principle of problem-based learning is to encourage critical thinking and problem solving by presenting a small group of students with carefully constructed problems. According to Baker (2000:260), the ideal size of group is 6-9 students with a facilitator present.

The tutorial session begins with a *problem.* Rideout (2001:23) explains that the problem forms the starting point of the learning endeavour and is presented in a scenario that reflects a 'real life' situation. The students are given the problem prior to any form of input; it is presented in parts and distributed at different times. Subsequent parts contain more information allowing the students to 'build on' to the information gathered from the previous parts of the problem. They have to find out for themselves what they need to know in order to solve the problem and information is acquired by using cognitive skills such as problem solving, analysing, critical thinking and decision-making. With self-directed learning, the students are therefore, required to use prior knowledge to structure new information in order to solve the problem.

Baker (2000:260) states that it is important to understand that PBL differs from other problem-centred methods in two key ways: the problem is presented first before students

have learned basic knowledge and it is presented in progressive stages, stimulating the students to seek additional information. Once the problem has been given to the students one assumes, that they have the skills for knowing and applying the problem-solving process, that they are able to apply their critical thinking skills in setting problem-solving objectives and that they are able to make sound decisions. One again assumes that they will embark upon self-directed learning and be motivated to learn.

The task of the student group is to discuss the problems and produce explanations for the phenomena. This is done once the students are able to identify their learning needs in an interactive process. With motivation and self-directed learning, they apply newly gained knowledge to that which is already known for presentation and discussion within the group. Learning is therefore active, integrated and shared within the group. The collaboration that takes place among the students is the prerequisite for effective group functioning. Van Berkels and Dolmans (2006) state that successful small-group functioning appears to support the underpinnings of the constructivist approach that students benefit from tutorial groups where there is a stimulation of active and collaborative learning.

Certain conditions, such as the stimulation given to the students by the facilitator, have a direct impact on the success of group functioning. As van Berkel, Dolmans (2006:730) believe that group functioning is determined by the quality of the problems, they suggest that courses be offered to staff on developing problems that are likely to promote active and self-directed learning.

Nieminen, Sauri and Lonka (2006:64) also believe that a student's commitment to learning may increase in a well-functioning group. This in turn may enhance group attendance and

study success. They further add that empirical studies reveal that the quality of group functioning has a positive effect on test results. Literature sources, therefore, generally agree that successful learning outcomes in PBL are dependent on successful group functioning or tutorial performance (Savin-Baden, 2000; Van Loggerenberg-Hattingh 2003; Knight, 2004; Niemenin, Sauri & Lonka, 2006; Visschers-Pleijer et al, 2006).

Furthermore, for group work to be successful, according to Willis, Jones, Bundy, Burdett, Whitehouse, O'Neill (2005:495), students need to have both behavioural skills (communication and teamwork) and cognitive skills (ability to analyse a problem). These skills determine the PBL outcomes. Students display distinct behavioural skills when their conceptualisation of what is considered an effective group tutorial is seen in their ability to interact and communicate with one another while their cognitive skills are visible in their analysis of the problem.

The information shared by students in group tutorials during the discussion and reporting phases is determined by their ability to utilize available resources, demonstrate an understanding of concepts and theories and be in possession of good communication skills required to carry out an effective discussion. Students are compromised in their communication skills when the language in which they are studying is not their mother tongue. In a 2004 study conducted at the University of Nottingham to obtain second-year medical students' views about a reflective portfolio assessment of their communication skills, 97% thought that their communication skills needed improving. Rees and Sheard (2004:127) state that nearly all of the 178 undergraduate medical students that had an assessment of their reflective portfolio communication skills examined at the University of Exeter, Plymouth, thought that their communication skills needed improving. At the Dokuz

Eylul University School of Nursing, communication-skills training are organized as part of the problem-based learning curriculum. This training runs for the full four years of the course.

Amongst South African students, English is often a second and sometimes a third language. Verbal communication is thus often compromised by the students' feelings of inadequacy in expressing themselves. Whilst good communication skills play an important role in the discussion process in the group tutorials, skills such as problem-solving and critical thinking also need to be developed. Choi (2004:1) examined the metacognition, critical thinking, and problem-solving process of nursing students who had undergone PBL during the semester. The metacognition and problem-solving processes were assessed by questionnaires using pedagogics. Critical thinking was measured by the CCTST (California Critical Thinking Skill Test form 2000). The study concludes that PBL has a positive effect on students.

This view is borne out by Fichardt, Becker, Viljoen, Botma and Bester (2003:60) who state that PBL enhances the gathering of information from various sources and increases the ability to consider problem solving from various viewpoints. The above researchers further add that educators throughout the world realize that integrated curricula reflect the real world and students learn – with practice – how to integrate theory appropriately to stimulate higher thinking skills. One can thus clearly attribute certain advantages for the students in the PBL approach to teaching and learning.

Rideout, (2002:3) describes PBL as being more effective than the conventional approaches to learning and maintains that PBL facilitates greater student motivation, breadth of interest, learning satisfaction, confidence with clinical functioning, knowledge acquisition, use of a variety of learning resources and self-directed work.

While Savin-Baden (2000:3) supports the view that problem-based learning can and will make a difference to students, the researcher believes that the reality of these differences in students' lives has not been well articulated, To establish whether the skills required for a PBL method are being successfully developed, it is essential to carry out accurate evaluations on the students.

2.2.2.3 Evaluation

Evaluations not only reveal results on the students' educational and personal growth, but also on the quality of the educational design and the effectiveness of the facilitator. The PBL curriculum emphasizing small-group work, assessment of the individual together with the process of working in small groups has been the subject of many research studies. According to Uys et al. (2003:352), most of the South African students admitted to nursing programmes are from disadvantaged backgrounds. It is thus important to assess whether problem-based curricula are appropriate for this group.

The demands on graduate nurses in developing countries are higher than in other contexts and nursing education might need to be different. It is, therefore, necessary to evaluate the educational programme that has been developed for the training of nurses. Evaluation of the students' performance in such a programme is necessary to establish strengths and weaknesses in both the students' performance and the educational programme.

Should the students not possess the attributes and level of skill necessary for effective functioning within PBL groups a facilitator would presume that at the least these skills can be

developed. Das, Mpofu, Dunn, Lanphear (1998:411) state that evaluation of self, peer, tutor and the tutorial process form an integral part of the PBL tutorial.

The researchers Das et al. (1998) conducted a study, the sample of which included 64 first-year medical students. PBL tutorial sessions were conducted, with each session lasting two hours. Problems were presented to small groups of students and in the final tutorial session, time was set aside for evaluation of self, peer, tutor assessment and the tutorial process. The same evaluation form was used for the self and the tutor assessments. When tutors and students discussed congruence between the self and tutor assessments at the end of the evaluation process, they noticed that statistically significant differences were present in all of the categories.

The scoring, on these two assessments was described by tutor and students as beneficial to the students noting that the evaluation clarified the objectives of PBL tutorials. Tutors described how it provided an opportunity to help students who were less confident and those who were overconfident.

In this study the evaluation of students was carried out using self-assessment and facilitator assessment where Das et al. (1998) highlight the importance of being able to assist both the overconfident and less-confident students. According to Reiter, Eva, Hatala, Norman (2002:1134), primary care medical professionals may have little opportunity to judge and be judged. However, assessing oneself and others is a central skill in maintaining professional competence as a physician. This statement clearly applies to all health professionals working in primary care.

It is necessary to give students constant feedback on their progress within the tutorial groups, with both formative and summative evaluations. Formative evaluation is used to measure and assess the behaviours and skills of students during the learning process and is essential to assist the students in improving their skills within the classroom. The literature generally agrees that successful learning outcomes in PBL are dependent on successful group functioning or tutorial performance (Knight, 2004; Niemenin, Saure & Lonka, 2006; Savin-Baden, 2000; Visschers-Pleijer et al, 2006). In the view of Rideout (2001:215), any evaluation system adopted in the PBL curriculum must assess the development of particular skills and abilities and not only the accumulation of knowledge. These skills include critical analysis and application of knowledge, self-awareness, self-directed learning and teamwork.

The assessment can take place in the form of peer assessment, self-assessment and facilitator assessment. The accuracy of the self-assessment ability of students enrolled in a PBL programme was tested at the University of Ottawa in 2002. A self-assessment questionnaire was given to 70 students who voluntarily participated in the study. The study concludes that the students in the third year of a self-directed PBL, four-year medical programme demonstrated poor accuracy in the self-assessment score in relation to their own performance.

According to Reiter et al. (2002:1135), the development of successful tutorial assessment tools is one of the most difficult challenges for educators working within the PBL philosophy. They further state that the PBL tutorial is a place where one can discover the strengths of personal characteristics and this allows students a chance to develop and understand their own abilities. The tutorial also allows for interactions among the students

and the facilitator. It is a resource that seems to be ripe with information to guide decisions about a student's ability together with the student's ability to perform a self-assessment.

It is assumed that the skill of self-assessment should emerge naturally. Reiter et al. (2002:1135) maintain that it is now recognized that acquiring skills in self-evaluation is a pre-requisite for continuing learning for every doctor and that students should be helped to develop these skills. Reiter et al. (2002:1138) further add that at the McMaster University of Health Sciences MD programme, 36 students were provided with a relative ranking assessment tool listing seven domains of competence together with definitions. They concluded that the relative ranking instrument does not prove to be a reliable measure of tutorial performance. One of the problems responsible for this result is that these were first-year students who did not have enough time in medical school to assess their abilities accurately and reliably. Whilst the problem-based learning model does have advantages for student learning, there are clearly certain challenges in this approach.

2.3 CHALLENGES OF PBL

At the University of Melbourne, Azur (2001:391) discussed the challenges, barriers and educational outcome issues of problem-based learning. It was suggested that the one question that should be asked before implementing a new educational innovation is whether the costs of changing the curriculum and maintaining the new programme are justified in terms of learning effectiveness and efficiency. Problem-based learning is a resource intensive way of teaching students and requires much liaison and that in it-self is time consuming.

Murray and Savin-Baden (2000:107) argue that for PBL to succeed a sound programme of staff development is required. Workshops need to be organised to train staff into a changing

role from Lecturer to Facilitator. This in itself impacts on the financial budget and is time consuming especially if the workshop runs over three to four days.

The cost versus outcome has been set out by a group of authors from the University of Delaware who describe the institutional costs of PBL instruction. They describe how classrooms have to be refurbished. Costs are involved in hiring outside consultants who assist with faculty development in PBL instruction. Faculty members require training. Additional demands are placed on faculty time especially when the PBL programme is in the early phases. Whilst these costs can place a financial burden on the faculty, it is interesting to note the view taken by the authors. The authors state that these costs are mitigated by the way in which PBL contributes to the definition of instructional productivity.

2.4 UNDERGRADUATE NURSING STUDENT

The discussion on problem-based learning includes a historical perspective, the facilitator and the PBL process. To engage in dialectic reasoning one has to include the undergraduate student in the discussion. In this instance, this discussion takes place under its own heading as a result of its importance to the PBL outcomes.

In the South African context, there are many variables that exist amongst undergraduate nursing students. It is a known fact that in South Africa most of the students admitted to nursing programmes are from marginalized backgrounds, where ethnic diversity and cultural complexities exist. According to Knight (2005:1), these are students faced with a situation where minimal learning has taken place over many years.

Furthermore, their cultural circumstances have had a negative impact on their exposure to scientific terminology and their general reading and writing skills are poorly developed. These are students who require a great deal of academic support and – already compromised – they enter tertiary education and study in the English language, a language that is not their mother tongue and of which many have a less than satisfactory understanding.

English is the academic language in many of the universities, with second language students being referred to as L2 learners. These students are able to converse in English at a social level, but struggle with English at an academic level. Studies conducted by Holtzhausen (1999:2) on the education of African students show that they lack the experience needed in a Western curriculum. Foley (2004:63) maintains that students may not always succeed in higher education owing to their not being fluent in the English language. In the university where this study was conducted the official teaching medium is English and for the purpose of this research, English is referred to as a second language although to some students, English is a third or fourth language.

The students are also faced with having to understand and communicate in the medical genre, presenting a language of its own. For many of these students, grasping the new language of the medical sciences in their tertiary studies becomes the aim of survival. Knight (2005:1) questions the proficiency required in the English language for health science students to succeed academically and achieve excellence in their careers. Students show competency in the oral language, but struggle in the reading and written language and Knight hypothesizes that proficiency in the English language affects the degree of their performance in Health sciences.

In a certain national university ‘weak’ students are channelled into a foundation programme. These are students without exemption who are rated ‘at risk’ and within a year of bridging support are able to achieve the level of exemption. The PBL approach to learning should benefit students who are not proficient in the English language as this programme offers an environment in which the students feel safer when working in small groups. Furthermore it helps to promote social interaction and indirectly assists them to improve their language skills.

Table 2.1 shows the percentage of L2 learners in the first-year intake of undergraduate nursing students

Table 2. 1 Percentage of L2 learners in the first-year intake of undergraduate nursing students

Year	L2 Learners
2005	97%
2006	95%
2007	90%
2008	100%

The above table clearly shows that in the years from 2005 to 2008 from 90% to 100% of the students were L2 learners. These statistics represent the university where this research study was conducted.

The struggle that many of the students face in not being able to express themselves adequately in the English language is reflected in the following statement: 'It was particularly

hard for me as a black woman sitting and understanding the pain of those students going through emotions of not being able to say what you want to say, feelings of being inadequate'. (Lekalakala-Mokgele, 2006:64).

The above statement is one that all facilitators in South Africa have experienced. Not only is the English language a problem to students in tertiary education, one has to understand the primary and secondary level of education that these students have been subjected to. Conrick (1994:237) states that for twelve years at school students have been indoctrinated in the educational behaviourist theory thereby limiting their development of self-directed learning and problem-solving. These students were moulded in the traditional lecture- based, content-oriented learning background, where the skills required for a problem-based learning approach such as communication, working within a team, critical thinking, decision-making, problem-solving, self-directed learning and a motivation towards learning are usually not well developed. Historically, students have been faced with many years of rote thinking and rote teaching. They enter tertiary education and struggle with skills in problem-solving, critical thinking and self-directed learning. Students have to adapt as they make a transition from traditional learning behaviours to the self-directed, student-centred approach.

When the first democratic government was elected in 1994, a new curriculum for secondary school education was developed and referred to as outcomes-based education (OBE). At the end of 2008 the Grade 12 students were the first group of students writing the OBE examinations. The OBE model has certain principles similar to the PBL model. However, there is much debate as to whether the OBE model will be continued for secondary school education. If continued, OBE could have a beneficial impact on students who are faced with the PBL model at university nursing schools.

Added to the language problem these students face, one has to take into account the issue of gender equality and the pattern of patriarchy in society. According to Kirkwood (2008:1), South Africans live in a male-dominated society wherein males make the decisions and women have little bargaining power. Khuele (2005:1) describes patriarchy as being defined and interpreted by many various angles but the common thread running through all the interpretations is male domination. Khuele (2005:1) adds that it is seen by some as being rooted in tribal societies and reinforced by cultural values derived from male dominance. Furthermore, patriarchy has penetrated all aspects of human thinking and is perceived as an unchangeable phenomenon as opposed to a socially constructed one. This way of thinking, impacts, on many areas of social interaction. In PBL tutorials, a female student is expected to challenge or argue a point with a peer, to disagree or give a better point of view. If male students are present, they often dominate the discussion as female students lack the courage to disagree with them. The researcher has observed that prompting of a female student to challenge the point often produces a negative result.

The gender demographics are changing. The nursing profession, once a profession where only female students were trained to become registered nurses, is now a profession offering training to both males and females. Statistics obtained from the South African Nursing Council on gender demographics on nursing students are represented in Table 2.2**.**

These statistics represent nursing students in the Gauteng Province of South Africa. This is the province where the research study was conducted and the statistics include undergraduate nursing students.

Table 2. 2 SANC gender demographics of nursing students

YEAR	FEMALE	MALE
2002	84%	16%
2003	86%	14%
2004	86%	14%
2005	86%	14%

Smith (2006:263) states that in the United States of America a goal has been set to increase the number of male students into nursing programmes. He describes the male students' experiences as a numerical minority and how their maturity and life experiences help them cope with the challenges that they face. He adds that each participant described an incident where the client refused to be seen by a male student.

The barriers perceived by the male student are also described by O' Lynn (2004:233) who affirms that there is no history of men in nursing nor has there been a male faculty. In the textbooks the nurse is always referred to as 'she'. There is no mentorship programme for males. In conclusion, nursing programmes should offer a networking system for male students in each year of study. Faculty should create a facility for these students to be able to share their problems. The language in textbooks should be representative of both male and female genders.

Compounding the problems already discussed is the legacy left by the political history of South Africa. Following years of discrimination, humiliation and feelings of inferiority as individuals, South African students are now expected to show self-confidence in the performance of their skills, tasks and language. Many of the students have confided their feelings of inadequacy and fear of failure to the researcher and facilitators.

According to Pace Marshall (2006:243), the American Nurse Association in 1986 issued guidelines on cultural diversity in the nursing curriculum. The question arose as to what the theoretical underpinning of cultural training in nursing education was and twenty years later the question is still being asked and concludes by stating that the journey and transformation should continue. The purpose of another study undertaken by Amaro, Abriam-Yago and Yoder (2004:248) was to determine ethnically diverse nursing students' perceptions of educational barriers. They state that little has been documented in literature regarding educational barriers for the above-mentioned students. These students vary in terms of their needs, problems, barriers and the amount of assistance they need. Yoder (1996:319) set out four categories of student problems or needs as follows:

- Personal needs, such as financial support and child-care
- Academic needs for tutoring, study skills or study groups
- Language needs
- Cultural needs, such as ethnic role models and an understanding of the cultural conflicts they face

The above problems and needs may be related to students of any ethnic group. In the focus group studies of Hispanic students conducted by Villarruel et al. (2001:245), the following educational barriers were cited: financial burdens, institutional barriers, perceived discrimination by faculty and peers, accents or English as a second language and cultural values such as the importance of the family and prescribed gender roles.

Amaro et al. (2004:249-253) conclude that their study results are consistent with the four categories described by Yoder (1996). They further add the following barriers faced by the students:

- Personal needs, mainly lack of finances, insufficient time, family responsibilities and language difficulties. Nearly all the students identified language as the primary barrier in their education. Translating from English to their primary language and back to English was time-consuming. One student reported that it took a long time to study, read and write. Taking notes and communicating with instructors was a problem
- The prominent academic needs were study workload, the need for tutoring and study groups
- The cultural needs included communication, assertiveness and the lack of ethnic role models. Participants indicated that for some cultures it was considered rude to be assertive or ask questions of your teacher

The perceived barriers found amongst the students in the Yoder (1996) and Amaro (2004) studies are similar to the barriers found amongst the nursing students in South Africa.

Another aspect involving the South African student is that not only school leavers enter a nursing programme. Older men and women are being accepted as undergraduate students. According to the statistics of the South African Nursing Council (2006) on the commencement of training, an age analysis that included all students registered in 2005 showed that the mean age was 27 years. The minimum age was 17 years and the maximum

age was 56 years. These statistics include both male and female students. In 2007 the sample of first-year students in this study presented a mean age of 23 years.

2.5 CONCLUSION

Nursing faculties have an important role to play in helping students achieve success in nursing programmes. They need to address the challenges students face and assist them in coping with these challenges. Furthermore, the importance of selecting an educational model in the education and training of the South African undergraduate nursing student is of great importance. This chapter dealt with a literature review on the problem-based learning model that is presently being used in certain national universities in South Africa. This review covers certain of the advantages and limitations to this teaching and learning approach. The literature review further covers some of the aspects on the South African undergraduate nursing student.

The next chapter provides the methodology used in Phase 1 of the study.

CHAPTER THREE

RESEARCH METHODOLOGY: PHASE 1

3.1 INTRODUCTION

This chapter describes the research methodology of Phase 1 of the study: Instrument Validation. This includes the research design, the study setting, the sampling process and sample criteria together with the data collection procedures.

3.2 RESEARCH DESIGN

A quantitative research approach was used as the overarching Phase 1 study design that employed statistical techniques for instrument validation and refinement.

Burns and Grove (2001:808) describe quantitative research as a formal, objective, systematic approach to describe and test relationships and to examine cause and effect.

In Phase 1, quantitative methods were used to examine relationships among variables, the latter referring to the items featured on the tutorial performance evaluation instrument. To enhance the rigour of the study the researcher applied precise attention to detail and accuracy

in the measurements obtained during the collection of data. The research process was conducted in specific steps that were constantly examined for weaknesses.

3.3 RESEARCH METHODS

Research methods refer to the methodological perspectives of the study to address the research questions. These methods include decisions about the population, samples and sampling, data collection, instruments and procedures, data analysis together with measures of validity and reliability Burns and Grove (2001:37).

3.3.1 Population and Sample

A population refers to 'All elements (individuals, objects, events or substances) that meet the sample criteria for inclusion in a study, sometimes referred to as the 'target population'. (Burns and Grove, 2001:806). Polit and Beck (2004:289) describe the study population as 'the entire aggregation of cases in which a researcher is interested'.

In Phase 1 of the study the researcher was interested in a target population of academics involved with teaching PBL tutorials for undergraduate students in selected Health Sciences degrees in two universities in the Gauteng Province (N=12). This target population comprised experts in the PBL approach to learning and teaching. Sampling of experts can present with a challenge and affect the outcome of the results. According to Keeney et al. (2001:196), results can be biased by the composition of the expert panel.

3.3.1.1 The Sampling Method

Purposive sampling was used to select the participants referred to as the expert group that would participate in rounds one, two and three of the Delphi technique. This group was

chosen from different disciplines in Health Sciences: Nursing Education, Occupational Therapy, Dentistry and the Graduate Entry Medical Programme. These are disciplines that have adopted a problem-based learning approach in selected courses. The intention to select experts from these disciplines was essential in providing experienced facilitators and coordinators in problem-based learning. The expert group comprised eight participants (n=8) who agreed to participate in the study.

According to Lynn (1986:383), the number of experts who are accessible and agreeable to take part in the study should not be fewer than three (n=3). However, a minimum of five experts (n=5) would provide a sufficient level of control for chance agreement.

3.3.1.2 Sample Eligibility Criteria

It was essential that the participants in the expert group be experts in the field of problem-based learning. Their expertise was assumed if they complied with the following specific criteria:

- Experience of at least four years in the facilitation and/or coordination of PBL tutorials
- Expertise in small group dynamics
- In possession of a higher degree and actively involved in the education of students in a Health Sciences degree programme

The demographic data on the expert group is presented in Table 3.1.

Table 3. 1: Demographic data on the expert group

Expert Code	Academic Qualifications	Experience
01	BA (Cur), BA (Cur) (HONS) MA (Cur), D (Cur). Professor. PhD	-Coordinator PBL 6 yrs -Facilitator PBL 6 yrs -
02	Nat. Dip OT, MSc. OT, Professor	-Coordinator PBL 12 yrs -Facilitator PBL 12 yrs
03	BA (Cur) MSc.(Nursing), PhD	-PBL workshop - Australia -PBL workshop - Holland, -PBL workshop - Canada -Facilitator PBL 6 yrs
04	BA (Cur), BA (Cur) (HONS) MA (Cur), PhD	-Facilitator PBL 7 yrs -Facilitator small group dynamics
05	B.SocSc (Nursing), Dip Adv. Nurs.Sc. BA (Cur). M.Ed.	-Curriculum change MBBCh and Graduate Entry Medical Programme -Trains PBL, facilitators, produces facilitator guides -Facilitator PBL 6yrs -Evaluates PBL process
06	Specialist Prosthodontist Full Professor	-Introduced PBL in Dept Oral Health Science -Facilitator PBL 6 yrs
07	Specialist Prosthodontist BDS M.Sc Dent. Mdent. Professor	-Introduced PBL in Dept Oral Health Science -Facilitator PBL 6 yrs -Facilitator training
08	B Sc. Hons. B.Ed Hons, M Ed	-Director/Coordinator Graduate Entry Medical Programme -Development PBL curriculum

		-Trains PBL facilitators

3.3.2 Data Collection Techniques

Data were obtained using three consecutive rounds in a Delphi survey. In the third round, the Subjective Judgement Model was used and data were collected using paired comparisons on visual analogue scales.

3.3.2.1 The Delphi Technique

According to Burns and Grove (2001: 436) this technique is used to measure the judgements of a group of experts for the purpose of making decisions, assessing priorities or making forecasts. Experts do not meet and the opinions of individuals cannot be altered by the persuasive behaviour of a few people at a meeting. A questionnaire is given to the experts for their opinions and returned to the researcher. Results are analysed and summarized. The outcome of this analysis is then returned to the experts with a second questionnaire that is returned to the researcher for a further analysis.

In the following paragraphs the distinguishing characteristics of the Delphi technique are discussed by examining the opinions of various writers in the literature on the subject. According to Polit and Beck (2004:238), the Delphi technique is a method of problem solving and is used to measure the judgement of a group of experts who are asked to complete a series of surveys thereby generating ideas on a given topic. Consensus is achieved

among individuals who do not meet, remain anonymous to one another and could be geographically distant. Keeney et al. (2001:200) state that consensus does not imply that the answers are correct; results are experts' *opinions* and not irrefutable fact. Polit and Beck (2004:238) further add that in the Delphi technique the experts are required to complete several rounds of questionnaires. The responses to each round of questionnaires are analysed and summarized. A new questionnaire is then returned to the experts. The process of response, analysis, feedback, response continues until consensus is reached. In this study a consensus Delphi was not required and a decision Delphi was used.

Powell (2003:376) describes the Delphi technique as a series of sequential questionnaires interspersed by controlled feedback seeking reliable consensus of opinion from a group of experts. Furthermore, the Delphi serves as a useful tool for solving problems in health care settings. The Delphi methodology can be confusing and it can be difficult to distinguish between the lack of methodological rigour and the fact that the Delphi comes in different guises. The application and interpretation of this method is varied. Mead and Mosely (2001:4) proposed the term 'Delphi approach' as apposed to 'Delphi technique'. Powell (2003:377) describes the strengths and weaknesses of the Delphi technique, its main advantage being the achievement of consensus in an area of uncertainty; the feedback between rounds that is able to broaden knowledge and stimulate new ideas and its being a quick, efficient and cheap way to generate knowledge from an expert group. It is a democratic and structured approach that combines the collective wisdom of experts. The anonymity afforded the expert group could lead to a lack of accountability on the views expressed. The success of the study is determined by the expertise of the participants making up the expert panel and their ability to make valid contributions.

According to Schell (2006:440), the Delphi technique provides important expert insights into a topic. Results do not reflect irrefutable fact; only expert opinion. Whilst the Delphi technique is time-efficient for the experts who are not asked to attend formal meetings, this technique is time-consuming for the researcher. Questionnaires have to be analysed, summarized and new questionnaires prepared. All questionnaires for this project were hand delivered to and collected from the experts. The researcher chose not to use the email facility in order to protect the identity of the individual experts and to ensure confidentiality.

The Delphi technique has advantages according to Hardy et al. (2004:98); it is considered cost and time-efficient and in the second and third rounds it allows the participants to consider the opinions of the other experts. Powell (2003:379) discusses the scientific merit of the Delphi technique and bases it on the Lockean notion of the function of human experience and agreement as a basis of truth. The above researcher states that scientific merit of the findings in such a study can be compared with the term 'goodness criteria' that was proposed by Heshusius in 1990 (Powell 2003), and rests on the justification of decision-making and rigour in conducting the study:

- If something is good it will be recognized as such. One does not require criteria to prove this but should stay true to the context of the study
- Criteria separate fact from fiction

During Round Three of the Delphi survey the Subjective Judgement Model was used.

3.3.2.2 The Subjective Judgement Model

The Subjective Judgement Model describes a process of weighting entities on various levels of a hierarchy. Entities (units) can be requirements, features, objects and modules. In this

study an entity (unit) refers to the content items on an evaluation instrument. This weighting can be carried out using matrices or vertical/horizontal linear scales and is represented by ratio scales.

Crawford and Williams (1985:387) describe the contents of a paper on how Saaty 1977 – 1983 presents an Eigenvector (EV) procedure for analysing matrices of subjective estimates of the utility of one entity relative to another. The procedure is an effective tool for analysing hierarchical problems where the dependence of the entities at one level on the entities in adjacent levels is estimated subjectively. Despite the absence of a formal proof that the procedure has desirable qualities as an estimator of the underlying relative utilities, the process has gained an active following. The paper derives a comparable estimate, the geometric mean (GM) vector (also known as the logarithmic least squares method or LLSM) that can be applied to hierarchic problems in exactly the same way but is developed from statistical considerations. It is shown to be optimal when the judges' errors are multiplicative with a lognormal distribution.

The GM shares the desirable qualities of the EV and is preferable to it in several important respects. Crawford and Williams (1985:389) further describe how Saaty's examples clearly show that the study of interactions among various levels of a hierarchy depend heavily upon an assessment of the ranked importance of objects at each level relative to objects in the level above. They add that according to Saaty the basic building blocks in a hierarchy are the ratio scales measuring the relative importance of objects at a given level. They further state that one would like assurance that the estimates of the ratio scales are well grounded in statistical theory and that they work well empirically. Crawford and Williams (1985:387) iterate the importance of the ratio scales in the study of hierarchies. They suggest that on each level of a

hierarchy there is a ratio scale for the value of objects at that level relative to any object at the next level up. When the ratio scales are combined multiplicatively they give a view of the entire hierarchy. Furthermore, despite the absence of formal proof concerning the qualities as an estimator, it is said that this process has gained an active following.

To obtain ratio scales on the value of objects on each level of the hierarchy, each object has to be weighted relative to a second object. This process is referred to as paired comparison and was carried out in Phase 1 of the study by comparing each item with a second item featuring on the evaluation instrument.

3.3.2.2.1 Paired Comparison Analysis

According to Miranda (2001:87), paired-comparisons estimate the size of *n* entities by asking one or more experts to judge the relative largeness of the entities rather than providing size values. He further adds that although this method is not new it has received little attention in the literature. Social science researchers use this method for measuring when an accepted measurement scale or a measurement instrument is not available.

The aim of such analysis is to weight entities in order to develop ratio scales for each entity relative to the entity above on a hierarchy. It therefore allows one to assess the ranked importance of entities, objects or items. In this study, it allows the researcher to assess the ranked importance of the content items on an evaluation instrument.

In the early writings of David (1963:4-9), he states that the method of paired comparisons was introduced in embryonic form by Fechner (1860) and after considerable extensions, made popular by Thurstone (1927). It is a method widely employed by psychometricians. In

the simplest paired comparison experiment, several judges examine a pair of objects. Each judge is then asked to state which of the two objects is preferred. Only the preference is noted and not the strength of preference.

David (1963) refers to another method of estimating subjective scales using pair-wise comparisons. This method calls for the preference of the object together with the degree that such an object is preferred over the other. A preference scale is then based on an eigenvector analysis of the matrix of pair-wise comparisons. The paired comparison analysis employed in this study was carried out using judgement matrices or the linear model of visual analogue scales.

3.3.2.2.2 Visual Analogue Scales

Many methods have been developed for constructing scales of measurement based on subjective data. According to David (1963:4), Churchman and Ackoff (1954) were the pioneers of estimating scales of value for decision problems. In the 1950s, Wells and others later applied the Churchman and Ackoff method in military decision problems and it is currently being used as a tool in the air force in many countries including South Africa, as a method to establish long-range planning.

Burns and Grove (2001:436) describe the use of the linear model. Data are recorded on visual analogue scales (VAS). The scale is 100mm in length with right-angle stops at each end. The line may be horizontal or vertical. Bipolar anchors are placed beyond each end of the line and not underneath or above the line before the stop. The experts are asked to place a mark through the line at a position that represents their judgement of the given phenomena. A

measurement in millimetre using a ruler is taken of the distance between the left end of the line and the mark placed by the expert.

Burns and Grove (2001:436) further state that a problem in scaling procedures was the difficulty of obtaining fine discrimination of values. The visual analogue scale sometimes referred to as magnitude scaling appears to resolve this problem. They further add that this technique seems to provide interval-level data, and some researchers argue that it provides ratio-level data: 'Although visual analogue scales have been used in clinical and research settings since the 1920s, their use in nursing is more recently evident' (Wewers and Lowe 1990:227).

The VAS began to appear in the literature with increasing frequency in the 1960s. Although originally conceptualised as a method to be used for the evaluation of individuals by assessment raters, the use of the graphic rating method, more specifically the VAS or GRS has been extended to the rating of subjective phenomena' (Wewers and Lowe 1990:233).

Figure 3.1 demonstrates a flowchart on the Delphi technique sequence that was used.

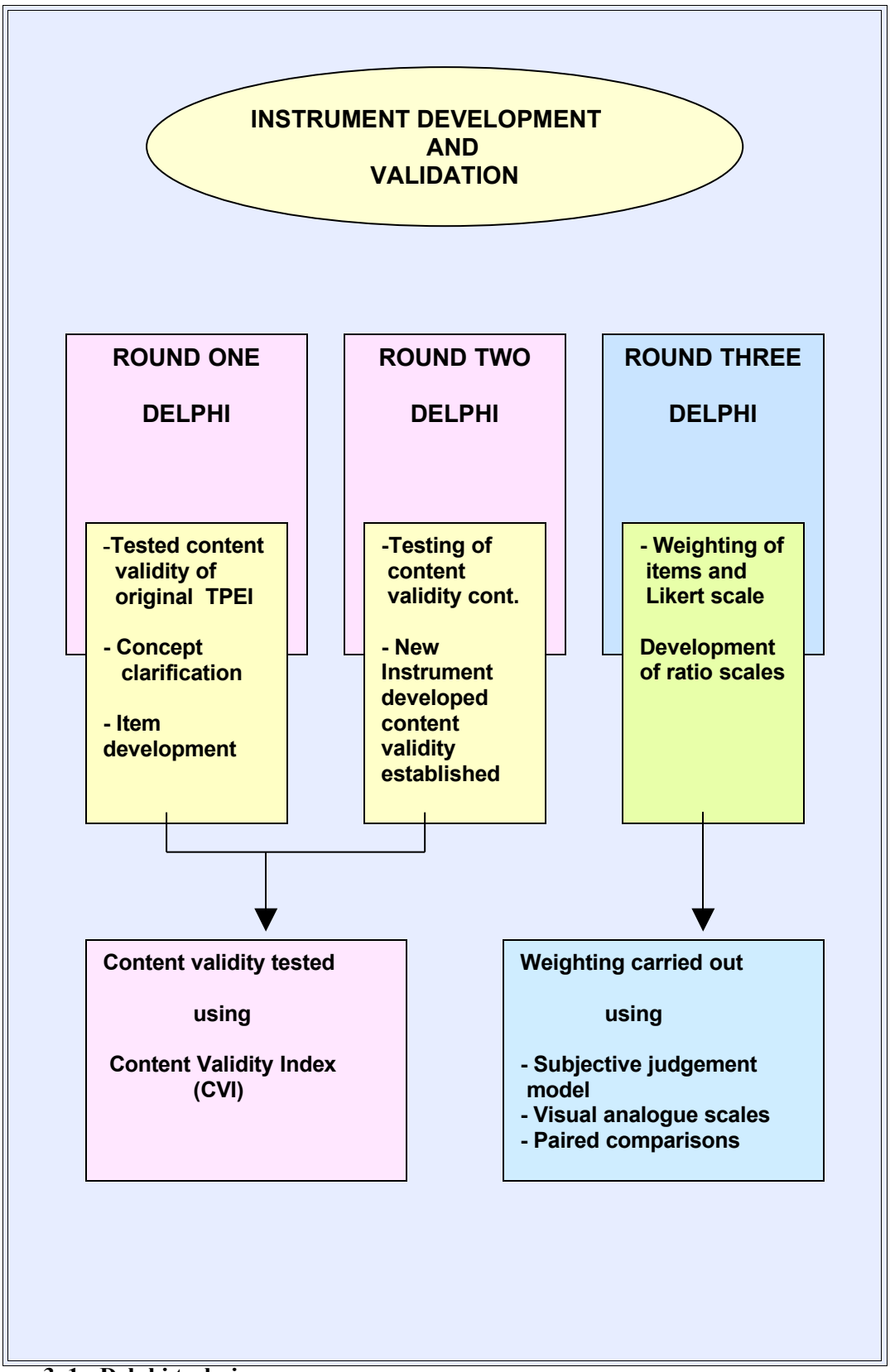


Figure 3. 1: Delphi technique sequence

3.3.3 Data Collection Procedure

Data collection served to determine the content validity of the original tutorial performance evaluation instrument (Annexure A). This instrument was used for student evaluation during PBL tutorials and considered to be a good starting point to work from. An expert group was asked to test the content relevance of all the main items and sub items featured on this evaluation instrument.

Round One of the Delphi Technique commenced with the testing of the content validity of the original tutorial performance evaluation instrument (Annexure A). A questionnaire referred to as the Round One questionnaire developed by the researcher, included all the items found on the original tutorial performance evaluation instrument. The experts examined each item on the questionnaire. Concept clarification and item development were carried out; new items were included and a number of items were excluded. Certain of the items were refined and modified. The Round One questionnaire was analysed and summarized by the researcher and a second questionnaire was developed.

The Round Two questionnaire contained all the new items deemed worthy for inclusion on an evaluation instrument. Many of the items from the original tutorial performance evaluation instrument were excluded from the questionnaire. The experts examined each item on the questionnaire that was subsequently analysed and summarized by the researcher. This led to the early stages of development of a new evaluation instrument referred to as the Tutorial Performance Rating Instrument (Annexure I). At the end of Round Two all the experts rated each item as ‘very relevant’. Content validity was therefore established.

Before commencing Round Three, a pilot study was conducted to test whether the item content and rating scale together with descriptors on the newly developed Tutorial Performance Rating Instrument. (Annexure I) were understandable to the sample of undergraduate nursing students and problem-based learning facilitators who participated in the pilot study. The usability of the instrument was tested by the same sample.

In Round Three of the Delphi survey, construct validity of the Tutorial Performance Rating Instrument was established by using the Subjective Judgement Model to carry out subjective weighting of all items on the questionnaire rated as 'very relevant'. The weighting of one item against another was carried out using paired comparisons on visual analogue scales. Data derived from the weighting led to the development of a ratio scale represented in a percentage against each item and the rating of the Likert scale. This allowed the items on the Tutorial Performance Rating Instrument to be formulated into a hierarchy relative to the percentage of each item.

Stage one (developmental stage) and stage two (judgement-quantification stage) were carried out during rounds one and two of the Delphi survey. During both stages, however, it was necessary for a certain amount of development to take place. Domain identification and item development were carried out. The results from data obtained ultimately led to the development of a new instrument referred to as the Tutorial Performance Rating Instrument.

3.3.3.1 Round One Survey

Round One of the Delphi Technique survey commenced with the testing of the content validity of the original tutorial performance evaluation instrument (Annexure A). A questionnaire referred to as the 'Round One' questionnaire was developed by the researcher

and included all the items found on the original tutorial performance evaluation instrument. The procedure used was drawn from the work done by Lynn (1986). The researcher used Lynn's two-stage model, as this model describes the structured process of instrument validation. Lynn (1986:383) describes the first stage, the development stage, as having three steps: domain identification, item generation and instrument formation. The objective was to test the content validity of the original Tutorial Performance Evaluation Instrument where items were already in place and all three of the steps in the first stage identified by Lynn were, therefore, not carried out. The individual experts in this study were asked to accept or reject the items on the evaluation instrument that were already in place.

Lynn (1986) further describes the second stage: the judgement-quantification stage as having two steps. These steps require the individual experts firstly to determine that each item has the required content validity and secondly determine that the content of the entire instrument has the required content validity. These steps were carried out in this study.

Lynn (1986:382) states that using a two-stage process to determine and quantify content validity is fundamental to the validation of evaluation instruments. The most widely used quantification of content validity is the Content Validity Index (CVI), which rates the relevance or importance of the questions on an instrument using an ordinal rating scale. A four (4) point rating scale should provide the instrument developer with sufficient delineated information upon which to calculate a meaningful CVI. 'A four (4) point rating scale is preferable because it does not include the ambivalent middle rating common in odd numbered rating scales' (Lynn 1986:382).

The first round questionnaire is usually unstructured in order to obtain an open response from the expert group, with subsequent rounds being more specific, thereby seeking quantification of earlier findings. In this study, the Round One questionnaire was specific and based on the main-items and sub-items from the original Tutorial Performance Evaluation Instrument but did allow for the identification of themes elicited by the members of the expert group who were addressed in the subsequent rounds. At this point the validation of the original Tutorial Performance Evaluation Instrument was carried out. Whilst the subjectivity of the first round items on the questionnaire supplied to the experts could be questioned, the experts were given the option of excluding existing items and including new items or changing any of the items.

A Round One questionnaire and instructions to the expert group (Annexure G) developed by the researcher, listed all the main-items and sub-items featured on the original Tutorial Performance Evaluation Instrument (Annexure A). The 4-point rating scale against which each of the items would be rated is illustrated in Table 3.2

Table 3. 2: The 4-point rating scale (Lynn, 1986)

1	Not relevant
2	Unable to assess relevance without item revision or item in need of such revision that it would no longer be relevant
3	Relevant but needs minor alteration
4	Very relevant

Under each group of main items a space was allocated for ‘comments’. Here, the individual experts were able to comment on the items that featured in that group of main-items. Suggestions were made regarding the inclusion of new items and the alteration of existing items.

The members of the expert group were each given a Round One questionnaire and a Round One instruction list (Annexure G). The instruction list described the questionnaire as being made up of seven (7) main items under which were the related sub items. They were asked to rate each main-item and sub-item by placing a tick in one of the rating columns marked 1, 2, 3 or 4. The individual experts were then asked to give an opinion under ‘comments’ on how the item should be revised if such an item were rated a three (3) requiring only minor alteration. They were asked to list under ‘comments’ any item that in their opinion had been omitted and should be included in the Round Two questionnaire. Furthermore, they were asked to consider a suitable rating scale that could be used and would serve to rate each of the sub items against during student assessment. The date for completion of the questionnaire was reflected in the instructions.

The responses to the Round One questionnaire were returned and were analysed and summarized. Items that received a rating of four and were seen as very relevant remained and were carried forward to the Round Two questionnaire. Items that were rated three (relevant but in need of minor alteration) were altered according to the experts' opinions. This alteration was carried forward to the Round Two questionnaire. New items added were also carried forward to the Round Two questionnaire. Items that scored a one (not relevant) or a two (unable to assess relevance without item revision or item is in need of such revision that it would no longer be relevant) were excluded from the Round Two questionnaire.

In relation to a suitable rating scale, the experts decided that an even-numbered rating scale should be used for the rating of each sub item on the PBL tutorial evaluation instrument. A 4-point scale (0 – 3) was decided upon.

0 – Poor

1 – Limited ability

2 – Improved ability

3 – Good ability

An even-numbered scale was chosen to avoid the middle rating found in an uneven numbered scale.

3.3.3.2 Round Two Survey

Testing of content validity continued in Round Two. A Round One questionnaire (Annexure H) was compiled based on the experts' ratings and comments in Round One; items that were rated four (4) and deemed relevant during the Round One survey. These items are presented in black print and those rated three (3) and had a minor alteration done are presented in blue print. Furthermore, all the new items suggested by the experts were included and presented in blue print.

Following a period of twenty-one (21) days, the Round Two questionnaire and instruction list was delivered to each expert from the same expert group that participated in round one of the survey.

The instructions firstly gave an explanation on how the Round One questionnaire had been rated by the expert group to ascertain the relevance of each item. The Round One

questionnaire displayed all the items that had been added to the questionnaire by the experts who felt that these items needed to be included.

The experts were again requested to place a tick in the rating column 1, 2, 3, 4 against all items colour-coded in blue print. The items in black print had been scored in round one but were left on the questionnaire to enable each expert to peruse the questionnaire with its complete list of content present. These items featured in black print were rated a four (4) in the previous round and were not to be rated again in this round.

All Round Two questionnaires (Annexure H) were returned and then analysed and summarized. The items rated a one (not relevant) or a two (unable to assess relevance without item revision or item is in need of such revision that it would no longer be relevant) were deleted from the questionnaire. The majority of the items in this round received a rating of four (4). These remained on the questionnaire as these items were seen as 'very relevant'. Certain items received a rating of three (3). The alterations were of a grammatical nature. In one instance, an item was featured in two different groups of main items. Once corrected, these items received a rating of four (4) as per the experts' instructions. It was, therefore, not necessary to continue with another round of the Delphi technique to test content validity. All the items had now been rated four (4) and had been deemed 'very relevant' by all the experts. During Round Two, the experts made their decision on the rating scale against which each item would be rated.

The experts suggested that all items on the evaluation instrument should be rated against a 4-point (0-3) rating scale. It was decided that this method would be a suitable way of assessing the students against the criteria on the evaluation instrument and should provide the students

and the facilitators with an accurate picture of the degree of student competence. Many rating scales give degrees of competence from 'poor to excellent' or 'very poor to very good'. It was decided that the highest rating of three (3) on the Tutorial Performance Rating Instrument would not refer to 'excellent' but rather to 'good'. 'Good' describes the standard that one expects from a final year student. It was necessary for the assessors to have a description of what the various ratings on the scale meant so that an assessor (either the student or a facilitator) would be able to understand what level of competency was meant by each of the ratings. This allowed the assessor to supply the appropriate rating for a student's performance against each criterion (sub item).

Although all the items had been rated four (4) at the end of Round Two of the Delphi survey, a number of changes had been made in the original Tutorial Performance Evaluation Instrument in terms of main items and sub items as well as the rating scale against which each item was rated. It was, therefore, decided to use the changes to develop a new instrument made up of seven (7) main items and thirty-four (34) sub items and a 4-point 0-3 rating scale. This instrument was referred to as the Tutorial Performance Rating Instrument (Annexure I). Content validity of the above instrument had been determined. The descriptors of the 4-point 0-3 rating scale on the Tutorial Performance Rating Instrument are provided in (Annexure J).

Assessments made by human observers are subjective and, therefore, subject to error. In deciding on a 4-point (0-3) rating scale, certain factors that influence rating were taken into account. An even-numbered scale was used to prevent the tendency of rating students around the 'mean'. Of the four, only one unfavourable appraisal was used in order to reduce the error of leniency.

The experts further suggested that the main items, sub items and the 4-point (0-3) rating scale should be weighted one against the other. It was stated that as some items carry more weight than other items, they should not be valued as whole numbers. By apportioning a weighting to the items, the assessment would be more credible.

The weighting of the items and the rating scale was carried out in Round Three of the Delphi technique using the Subjective Judgement Model.

Before the commencement of Round Three of the survey it was decided to conduct a pilot study on the newly developed Tutorial Evaluation Rating Instrument. The aim of the pilot study was to ascertain whether the above-mentioned instrument was usable and understandable to the user. The item content, 4-point rating scale (0-3) and descriptors were tested. Problems identified were noted. The problems were addressed before the instrument was used in phase two of the study.

3.3.3.3 Pilot Study

Burns and Grove (2001:806) describe a pilot study as a smaller version of the proposed study to develop or refine methodology. In this instance, the pilot study served to test the comprehension and usability of the Tutorial Performance Rating Instrument.

At this point the above-mentioned instrument was still in the early stages of development. The construct validity had not yet been tested. Before commencement of the testing of the construct validity, the researcher wanted to ensure that the wording used in the content of the instrument was understandable to the students and that the instrument was user-friendly. A

sample of undergraduate nursing students (n=64) and problem-based learning facilitators (n= 5) participated in the pilot study conducted in September 2006.

One of the limitations of a pilot study is detecting problems or difficulties that could be related to a small sample. It was, therefore, decided to use the total population (n=68) of nursing students. Students (n=68) 100% and facilitators (n=5) 100% agreed to participate in the pilot study.

The Tutorial Performance Rating Instruments (Annexure I) and the descriptors were given to facilitators to carry out an assessment of the performance of first- to fourth-year nursing students during problem-based learning tutorials. The students were also asked to conduct a self-assessment of their ability during these learning tutorials.

The completed assessments were handed back to the researcher. Each assessment carried out by the facilitators and the students was calculated to a percentage by the researcher. From these percentages a mean score was derived on each group of students for each year of study. A mean score represented both the facilitator assessments and the student self-assessments. The result of the findings revealed that the correlation of mean score between facilitator and the students in fourth year differed by 9% higher in favour of the students. The mean score differed by 10% higher in favour of the second- and third-students. The greatest difference was 24% higher in favour of the first-year students.

A graph representing the mean score from first-year to fourth-year students is presented in Figure 3.2 – Figure 3.5.

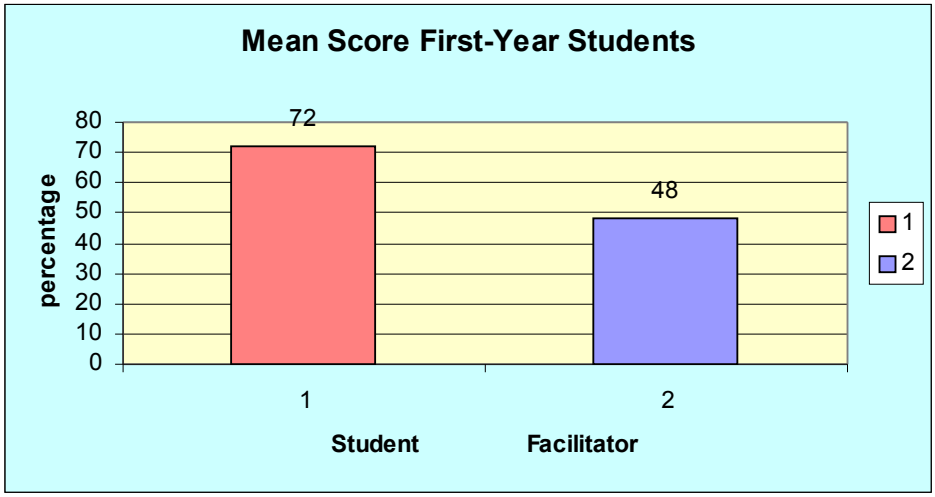


Figure 3. 2: Pilot study mean score first-year students

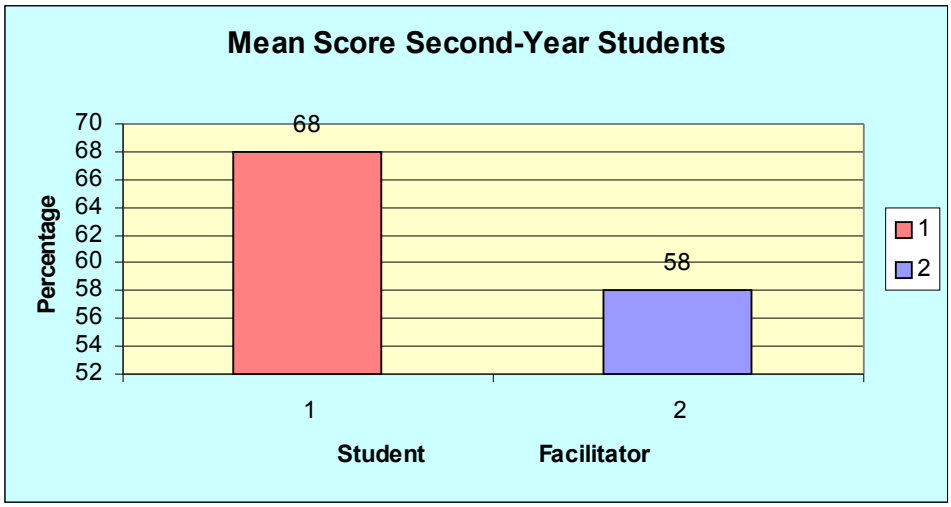


Figure 3. 3: Pilot study mean score second-year students

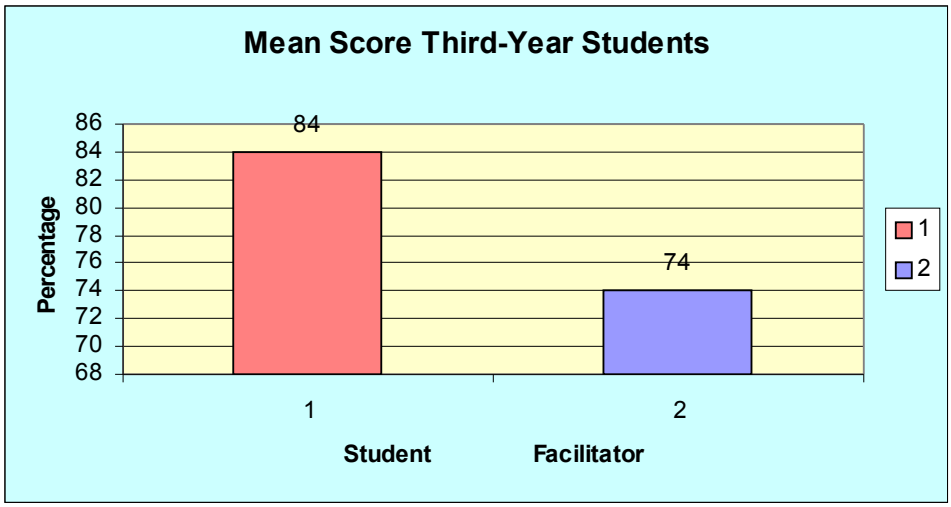


Figure 3. 4: Pilot study mean score third-year students

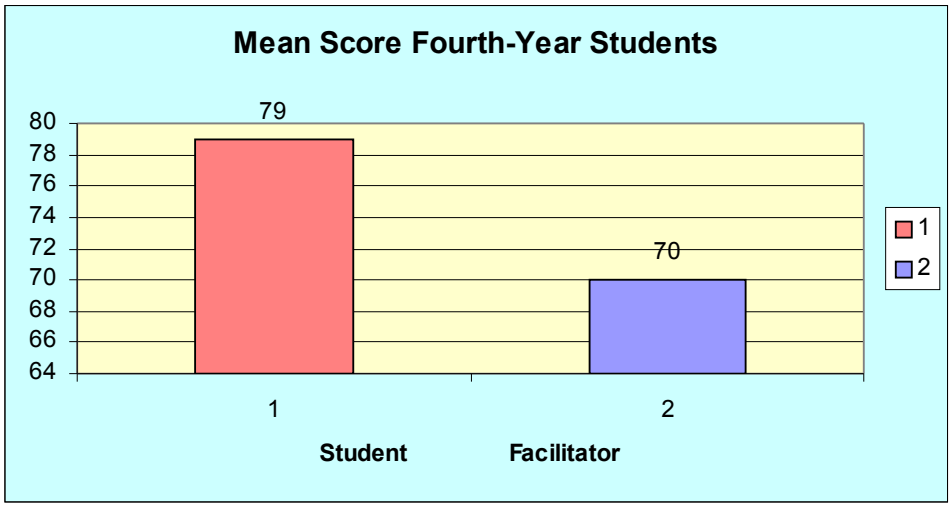


Figure 3. 5: Pilot study mean score fourth-year students

These results clearly indicate a difference between the self-assessment and the facilitator-assessment ratings carried out by the students and the facilitators from first to fourth year of study. The first-year students appeared to have the most difficulty in carrying out a reasonably accurate self-assessment. However, the percentage difference was less in the remaining years of study.

Feedback revealed that the item content and the rating scale together with the descriptors were understandable to students and facilitators. The instrument was not difficult to use. The problem, however, was that students rated themselves much higher than the facilitators rated them. The further they progressed into their studies the less evident this problem became.

The individual's ability to be accurate regarding self-assessment not only impacts on performance in problem-based learning tutorials but also on their work as a health professional. Self-assessment allows a person to identify any knowledge deficit that can impact on the care of the client. Chaves et al (2006:31) state that tutor instruction and modelling of self-assessment are critical when establishing lifelong learning habits.

It was decided that all students from first to fourth year and in particular the first-year students, needed more information on the process of self-assessment in order to obtain a more accurate result. This information was given to the students before commencement of phase two of the study. The researcher spent time with each group of students giving them feedback regarding the results of the pilot study. She oriented the students in the process of self-assessment, emphasizing the importance of being realistic and accurate during a self-assessment.

The item content, Likert scale together with the descriptors of the Tutorial Performance Rating Instrument was tested during the pilot study and found to be easy to use and the wording understandable to both students and facilitators.

Further development of the instrument was carried out in Round Three of the Delphi survey.

3.3.3.4 Round Three Survey

The construct validity of the Tutorial Performance Rating Instrument (Annexure I) was determined during the third and final round of the Delphi survey. According to Polit and Beck (2004:714), construct validity is defined as the degree to which an instrument measures the construct under investigation. Polit and Beck (2004:425) further state that it is a challenging task to validate an instrument in terms of the construct validity. They set out key questions relating to construct validity: for example,

- What is the instrument measuring?

The Tutorial Performance Rating Instrument measures the performance of undergraduate students in PBL Tutorials.

- Does it adequately measure the abstract concepts of interest?

The Tutorial Performance Rating Instrument contains minimal abstract concepts.

After completion of the round two survey, the content validity of each item, the seven constructs (main items) and those of the entire instrument, were determined following the decisions and judgements made by the expert group. Whilst the content of the Tutorial Performance Rating Instrument possessed validity, the expert group required each main item, sub item and the 4-point (0-3) rating scale to be weighted. The weighting process carried out

during the round three survey is – for the purpose of this study – defined as the 'construct validity' based on honouring the decisions and judgements made by the expert group.

The weighting of all the main items, sub items and the 4-point (0-3) rating scale on the Tutorial Performance Rating Instrument was done using the Subjective Judgement Model.

A pair-wise comparative weighting was carried out and each pair of items was displayed on a 100mm linear visual analogue scale (VAS) so that each expert could do a comparative pair-wise weighting of one item compared with a second item. Weights were established by modelling relative scores from each individual from the expert group who gave a subjective weighting to the various main items and sub items to identify the relative importance of these items within the given hierarchy. An example of a visual analogue scale is reflected in Figure 3.6.

The same expert group that participated in rounds one and two of the Delphi survey participated in Round Three. An interval period of twenty-one (21) days lapsed between rounds two and three.

(A) Personal Growth v. **(B)** Leadership

AB **0mm** |————————————————/———————— | **100mm**

Figure 3. 6: Example of a visual analogue scale

(The scale is merely an example and does not necessarily represent 100mm)

- The AB refers to the comparison of construct (main item) A – Personal Growth versus Construct (main item) B – Leadership.

- The distance between 0mm to the mark placed by the expert is the weighted measurement of Personal Growth when compared with Leadership.
- An accurate measurement in mm. between 0mm. to the expert's mark will be carried out by the researcher on all the visual analogue scales and sent to the statistician for conversion to ratio scales.

Twenty one (21) visual analogue scales were developed for main items and seventy-nine (79) visual analogue scales were developed for sub items. In total there were one hundred (100) units or visual analogue scales. Each unit represented two items on which a paired comparison analysis (weighting) was completed. A list of one hundred (100) units – visual analogue scales together with an instruction list – was assigned to each expert (Annexure K). A paired comparison weighting of the main items and sub items was carried out. The experts were further asked to weight the 4-point (0-3) rating scale that would be used to rate against the items on the evaluation instrument. The weighting of the rating scale was carried out on a 100mm visual analogue scale. Each expert was asked to place a mark on the VAS where he or she perceived the ratings of 0-3 should be.

An example of a visual analogue scale illustrating the weighting of the rating scale is reflected in Figure 3.7.

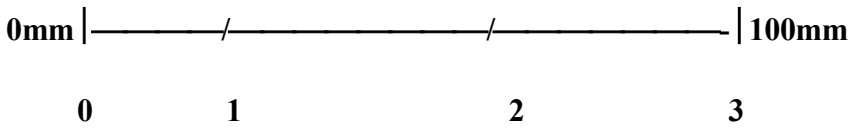


Figure 3.7: Example of weighting on the rating scale

(The scale is merely an example and does not necessarily represent 100mm)

When using paired comparison analysis, one may be faced with certain mathematical terminology. An *item* is referred to as an *entity*. The weighting is therefore, compared by using one entity against a second entity. One visual analogue scale (*unit)* is referred to as an *element.* For the purpose of this research the terminology *item* and *unit* was used.

At the end of Round Three of the survey, the data were returned to the researcher. The expert group had given their subjective judgement on the weighting of all items on the visual analogue scales. The experts had furthermore given their subjective judgement on the weighting of the rating scale.

Each visual analogue scale was accurately measured in millimetres from the 0mm to the expert's marks representing the points 1, 2 and 3 of the 4-point (0-3) rating scale. The measurements for each unit were entered on a computer-based spreadsheet under codes 01 – 08, representing each of the eight experts in the expert group. The data that featured on the spreadsheets represented the weightings measured in millimetres of all the main items and sub items (n=800) together with the weighting measured in millimetres of the 4-point (0-3) rating scale (n=8). Data were sent to the statistician for statistical analysis and were developed into ratio scales and then into percentages.

3.4 VALIDITY AND RELIABILITY

According to Burns and Grove (2004:45), validity of an instrument is determined by the extent to which the instrument reflects the construct that is being examined. They further add that no instrument is completely valid and that one should measure the degree of validity rather than whether the instrument is valid or not. Testing validates the use of the instrument and constructs for a specific group of people.

During the first two rounds of the Delphi survey, the content validity of the Tutorial Performance Rating Instrument was tested and determined. The third and final round of the Delphi survey determined the construct validity of the instrument based on the decisions and judgements of the expert group.

Reliability concerns the consistency with which the measurement technique measures a concept. Only once the instrument has been used is one able to test its reliability. This will be discussed in chapter six.

3.5 CONCLUSION

The research design was chosen based on the purpose of the study and the objectives that were set for Phase 1 of the study. This influenced the methodology.

Phase 1 of this study described in detail a process by which the validity of the original Tutorial Performance Evaluation Instrument was tested and the new Tutorial Performance Rating Instrument was developed. The process was conducted using the Delphi technique and the Subjective Judgement Model.

A pilot study was conducted before the third and final round of the Delphi survey and after content validity had been determined, with a sample of undergraduate nursing students and facilitators. The purpose was to test the usability of the content on the Tutorial Performance Rating Instrument. Changes to the instrument could be made before the final round in the Delphi survey commenced.

The third and final round of the Delphi survey carried out the weighting of all the main items, sub items and the 4-point (0-3) rating scale on the Tutorial Performance Rating Instrument.

The next chapter presents the results from the data obtained during Phase 1 of the study.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS: PHASE 1

4.1 INTRODUCTION

According to Burns and Grove (2001:794) Data analysis includes the processes through which raw data sets obtained during the data collection phase are reduced to an understandable format to be displayed in an organized manner to carry out analysis and to obtain results.

Data were collected in three rounds of a Delphi survey using quantitative methods. The process involved an expert group (n=8) that utilized the members' knowledge to make judgements on the relevance of items that were featured on the original Tutorial Performance Evaluation Instrument. They further decided on items that should be included in an assessment-rating instrument that would be used in problem-based learning tutorials to assess students' performance. The first part of the data gathered led to the development of the Tutorial Performance Rating Instrument (Annexure I). Further data were organized and with the assistance of a statistician, data were analysed that provided ratio scales and subsequent unique percentages for each main item, sub item and each number on the rating scale of the Tutorial Performance Rating Instrument. The calculation of these percentages, were computed on a specifically developed computer-based programme.

This chapter describes the approach to data analyses and the results in Phase 1 of the study. Results are represented in tables. The development and use of the computer-based tutorial performance evaluation programme is described.

4.2 APPROACHES TO DATA ANALYSIS

The approach to data analysis was influenced by the objectives of Phase 1 of this two-phased study to validate the original Tutorial Performance Evaluation Instrument. Data collected from the questionnaires were captured in the EPI-INFO database that was formulated specifically for the coding and data entry of the questionnaire content. The data were checked for accuracy.

4.2.1 Determining Content Validity

Determining the content validity of the original Tutorial Performance Evaluation Instrument commenced with domain and item relevance. This relevance was combined with ascertaining whether the content was representative of the instrument and ensuring that the main items had been represented appropriately. The expert group (n=8) comprised content domain experts who agreed to follow the procedure set out to rate the main items and sub items on the above-mentioned evaluation instrument. Furthermore, there were enough experts on the panel to provide a sufficient level of control for chance agreement.

Analysis was carried out using the Content Validity Index (CVI) assessing the experts' judgement of item relevance on the original Tutorial Performance Evaluation Instrument. Each item was judged on a 4-point scale (1 = not relevant to 4 = very relevant). The CVI for the total instrument is the number of items rated as either a 3 or 4. A CVI score of 0.80 or greater indicates a good content validity. Following two rounds of the Delphi survey a new instrument – the Tutorial Performance Rating Instrument – was developed.

4.2.2 Determining Construct Validity

For the purpose of this study, the construct validity was determined by ascertaining the weighting on all the items featured on the evaluation instrument. Construct validity was determined based on the judgements of the expert group. Their opinions and judgements were honoured. A disadvantage of the Tutorial Performance Rating Instrument was that when the composite score was calculated, all items carried an equal weight. To add more credibility to the composite score, a weighted score incorporating weights for main items (constructs) (WC) and weights for sub items (WI) were needed. The Subjective Judgement Model was used to achieve this. The expert panel judged the relative importance of one item versus another in a pair-wise linear fashion on 100mm visual analogue scales. Each expert was given 100 visual analogue scales. The measurements in millimetres on each of the VAS was entered onto an Excel spreadsheet and sent to the statistician. Following statistical analysis, the measurement on each VAS was weighted and converted into a ratio scale thereafter presented in a percentage. A hierarchy in terms of the importance of one item against the next was developed relative to the percentage for each item.

Crawford & Williams (1985:388) refer to entities (items) Mi1, Mi 2 – Mi18 that are comparable and when used in planning achieve some goal. These entities (items) all possess varying degrees of some common value measured in ratio scales and are applied to various levels of a hierarchy. When combined multiplicatively, they provide a view of the entire hierarchy. The ratio scales are obtained by applying regression analysis to the data sets. Regression analysis is conducted to make predictions about phenomena. In a simple (bivariate) regression one is able to predict the variance in the value of each dependent variable (x) based on the value of an independent variable (y) in the paired-comparisons of items. In the case of this study x= second item on a VAS and y= first item on a VAS in a

paired comparison. Linear regression is used to predict the value of a dependent variable by determining a straight-line fit to data thereby minimizing any deviations from the line. Phase 1 of the study collected data on linear visual analogue scales. The results in a regression analysis are expressed in correlation coefficients (an index of the degree to which variables are related) and the regression coefficient can be exponentiated and standardised to add up to a percentage as was done in Phase 1 of the study.

4.3 THE STUDY RESULTS

4.3.1 Content Validity

Round One data collected in the Round One questionnaire (Annexure G) were returned to the researcher by the expert panel after a period of 14 days. The expert group (n=8) rated all the main items and sub items on the questionnaire as 1, 2, 3 or 4. These ratings are presented in Table 4.1.

The questionnaires were analysed and modified by the researcher as follows:

- All main items and sub items rated a one (not relevant*)* or a two (unable to assess relevance without item revision or item in need of such revision that it is no longer relevant*)* were excluded from the questionnaire
- The individual experts altered the main items and sub items that received a rating of three (relevant but in need of minor alteration). This alteration was based on the judgement of the individual expert and written in the 'comments' section on the questionnaire. Once altered, the item remained in the questionnaire. New items that according to the expert group needed to be included and listed in the 'comments' section were placed in the questionnaire
- Items rated a four (very relevant*)* remained in the questionnaire

Table 4. 1: Expert ratings in Round One Delphi

	EXPERTS	01	02	03	04	05	06	07	08
	Mi 1 GROUP GROWTH	4	3	3	2	2	3	4	3
si 1	Offers facts, suggestions, opinions to others	4	4	3	4	3	3	4	4
si 2	Willing to work with group members	4	4	4	4	4	4	4	4
si3	Offers encouragement and support to group members	4	4	4	3	4	3	4	4
si4	Takes risks in expressing ideas	3	4	3	3	3	2	4	4
si5	Acknowledges contributions from group members	4	4	4	4	4	3	4	4
si6	Willing to share resources	4	4	4	4	4	2	4	4
	Mi 2 LEADERSHIP	4	4	4	4	4	4	4	4
si1	Gives direction	4	4	3	2	4	2	4	4
si2	Suggests opinions	4	4	4	3	3	3	4	3
si3	Takes decisions	4	4	4	4	3	2	4	4
si4	Identifies learning issues	4	4	4	4	4	4	4	4
si5	Identifies resources	4	4	4	3	4	3	1	4
	Mi 3 LEARNING AND TEACHING SKILLS	4	4	3	4	4	4	4	4
si1	Demonstrates use of multiple resources	4	3	3	3	4	4	4	4
si2	Demonstrates ability to integrate resources used	4	4	4	3	4	4	4	4
si3	Contextualizes learning	4	3	3	2	4	3	4	4
si4	Demonstrates the ability to assist others to learn	4	3	1	4	4	1	4	4
	Mi 4 CONTENT OF INPUTS	4	4	4	4	4	3	4	4
si1	Is accurate	4	4	4	2	1	4	4	3
si2	Is up to date	3	4	2	3	4	4	4	3
si3	Is sequential	4	4	3	3	2	3	1	3
si4	Is comprehensive/interdisciplinary	3	3	3	4	3	3	4	3
si5	Integrates legislation ethics, social & physical science	3	3	4	4	4	3	4	3
si6	Evaluates and selects	1	3	4	1	3	3	4	3
	Mi 5 PROBLEM-SOLVING SKILLS	4	4	4	4	4	4	4	4
si1	Defines/delineates problem	4	4	4	3	4	3	4	4
si2	Selects framework/strategy to solve problem	3	3	4	3	3	3	3	3
si3	Designs framework/strategy to solve problem	4	3	4	1	3	3	3	3
si4	Implements solutions or options	4	4	4	3	4	3	3	4
si5	Evaluates the problem-solving process	1	3	4	3	4	3	1	4
	Mi 6 INTERACTION/COMMUNICATION	4	4	4	3	4	4	4	4
si1	Identifies own strengths and weaknesses	4	1	4	3	3	3	4	2
si2	Assumes different roles in the group	4	3	4	4	4	3	3	4
si3	Demonstrates verbal skills appropriate to the situation	4	4	4	4	4	4	4	4
si4	Dem. non-verbal skills appropriate to the situation	4	4	4	4	4	4	4	4
si5	Demonstrates attitudes appropriate to the situation	4	3	4	4	4	2	4	4
si6	Demon. integrity to own values/morals managing	4	1	4	4	3	3	3	4
	Mi 7 CRITICAL THINKING	4	4	4	4	3	4	4	4
si1	Identifies and challenges assumptions	4	4	4	2	4	3	4	4
si2	Demonstrates contextual awareness and thinking	3	3	4	2	4	3	4	4
si3	Explores and imagines alternatives	3	4	4	2	3	3	4	4
si4	Demonstrates analysis (active inquiry) and action	4	3	4	2	4	3	1	4

The items now featured on the questionnaire were arranged into a workable order and developed into a Round Two questionnaire (Annexure H). The same expert group rated the Round Two questionnaire with a time lapse of twenty-one (21) days between the assessments of the Round One and Round Two questionnaires.

The expert group returned data that were collected on the Round Two questionnaires (Annexure H) after a period of 14 days. The rating scale of 1 to 4 that was used by the expert group in the round one survey was again used in the Round Two survey. Each main item and sub item added to the list or amended by an expert and printed in blue ink was rated.

The data from the Round Two survey were analysed and modified by the researcher as follows:

- Items that received a rating of one (not relevant) or a rating of two (unable to assess relevance without item revision or item is in need of such revision that it is no longer relevant) were removed from the questionnaire

- Items that received a rating of three (relevant but needs minor alteration) were altered according to the individual expert's judgement. The remaining items reflected in blue print rated a four (very relevant) and were left on the questionnaire

Table 4.2 represents the ratings on each main item and sub item printed in blue ink following Round Two of the survey.

Table 4. 2: Experts' ratings in Round Two Delphi

	Experts	01	02	03	04	05	06	07	08
	Mi 1 PERSONAL GROWTH	4	4	4	4	4	4	4	4
si 1	Willing to work with group members								
si 2	Offers encouragement, support to group members								
si 3	Acknowledges contributions from group members								
si 4	Able to assume different roles in the group	4	4	4	2	4	3	3	4
si 5	Presents constructive feedback	4	4	4	4	4	4	4	4
si 6	Assists in the setting of ground rules for the group	4	4	4	3	4	4	4	4
si 7	Displays active listening	4	4	4	4	4	4	4	4
si 8	Has a consultative attitude	4	4	4	4	1	3	4	4
si 9	Able to summarize discussion	4	4	4	4	4	4	4	4
si 10	Shows skills in conflict handling	4	3	3	4	4	2	4	4
	Mi 2 CREATIVE THINKING	4	1	2	4	2	3	2	4
si 1	Shows ability in creative writing	4	1	1	3	2	3	1	4
si 2	Shows ability in brainstorming	3	4	3	4	4	4	4	4
si 3	Has skills in drawing	3	3	1	3	2	3	1	4
	Mi 3 LEADERSHIP								
si 1	Shows a caring attitude	4	4	4	4	4	4	4	4
si 2	Shows assertiveness	4	4	4	4	4	4	4	4
si 3	Offers facts, suggestions, opinions to group								
si 4	Demonstrates facilitation skills	4	1	2	4	4	3	1	4
si 5	Takes decisions								
si 6	Initiates the undertaking of tasks	4	4	4	4	4	4	4	4
si 7	Identifies learning issues								
si 8	Moves process forward	4	4	4	3	4	4	4	4
si 9	Assumes different roles in the group	4	4	4	4	2	3	1	4
si 10	Assists in resolving conflict	4	3	2	4	2	3	1	4
si 11	Able to summarize discussion	2	3	4	4	3	4	4	4
	Mi 4 LEARNING SKILLS	4	4	4	4	4	4	4	4
si 1	Should be able to use more than one resource	4	4	4	4	4	4	4	4
si 2	Demon. ability to read around a learning objective	4	4	4	4	4	4	3	4
si 3	Able to understand professional language	4	4	4	4	3	4	4	4
	Mi 5 CONTRIBUTIONS	4	4	4	4	4	4	4	4
si 1	Is comprehensive depending on subject learnt	4	4	4	4	4	4	4	4
si 2	Literature not older than five years	2	2	2	4	2	3	4	3
si 3	Takes into account other disciplines	4	3	4	4	3	3	4	4
si 4	Integrates legislation into discussion	4	4	4	4	4	4	4	4
si 5	Integrates ethics into discussion	4	4	4	4	4	4	4	4
si 6	Integrates health service principles	4	4	4	4	4	4	4	4

Table 4. 2 (cont.): Experts' ratings in Round Two Delphi

	Experts	01	02	03	04	05	06	07	08
	Mi 6 COMMUNICATION	4	4	4	4	4	4	4	4
si 1	Demonstrates verbal skills appropriate to situation								
si 2	Demon. non-verbal skills appropriate to situation								
si 3	Demon. writing skills appropriate to situation	4	4	4	4	4	4	1	4
	Mi 7 PROBLEM-SOLVING SKILLS								
si 1	Manages to identify the problem	4	4	4	4	4	4	4	4
si 2	Selects a strategy to solve the problem	4	4	4	3	4	3	4	4
si 3	Identifies possible solutions to the problem	4	4	4	4	4	4	4	4
si 4	Rates the possible solutions to the problem	4	4	4	4	2	3	1	4
si 5	Discusses the best solution to the problem	4	4	4	4	3	4	3	4
si 6	Implements solutions to the problem								
	Mi 8 CRITICAL THINKING SKILLS	4	4	4	4	4	4	4	4
si 1	Identifies purpose or goal	3	4	4	4	4	4	1	4
si 2	Identifies a problem, question or issue	4	4	4	4	4	4	4	4
si 3	Verbally analyses the problem, question or issue	4	4	4	4	4	4	4	4
si 4	Able to use a frame of reference	3	1	4	4	4	1	3	4
si 5	Uses evidence to support an argument or position	4	4	4	4	4	4	4	4
si 6	Evidence is clear	2	4	4	4	4	1	4	4
si 7	Evidence is accurate	2	4	4	4	4	1	4	4
si 8	Evidence is adequate	2	4	4	4	2	3	4	4
si 9	Conceptual dimensions are clear	3	4	4	3	4	1	1	4
si 10	Reasoning based on clear assumptions	4	4	2	4	4	4	4	4
si 11	Understanding of implications and consequences	3	4	4	2	4	4	4	4
si 12	Proper inference-making	4	4	2	3	4	1	4	4
si 13	Suggests and proposes alternatives	4	4	4	4	4	4	4	4
si 14	Able to explain the conclusion	1	4	4	3	4	4	4	4

It was not necessary to carry out another round of the Delphi survey to rate items as the items needing minor alteration were of a grammatical nature and were altered accordingly. Each individual expert responsible for an item alteration stated that once corrected, that item could receive a rating of four (4). It can, therefore, be said that after two rounds of the Delphi survey all the items on the questionnaire received a rating of four (very relevant). These items were used in the early stages of development of the Tutorial Performance Rating Instrument.

'Stringent methods of determining validity are applied. Content validity, by its nature and definition, demands rigor in its assessment, and its assessment is, in fact critical' (Lynn 1986:385). It was for the above reason that the researcher decided that all items receiving a

rating of one (1) or two (2) in the Round One and Round Two surveys would be rigorously excluded from the questionnaire. Only the items that scored a rating of four (4) and were deemed 'very relevant' were used in the development of the Tutorial Performance Rating Instrument.

The content validity of the Tutorial Performance Rating Instrument was calculated using the Content Validity Index (CVI). Lynn (1986:383) states that if there are five or fewer experts in the expert group all must agree on the content validity for their rating to be considered a reasonable representation of the universe of possible ratings. If there are six or more experts, one or more in disagreement with the others will not affect the content validity of the instrument. Table 4.3 as illustrated by Lynn (1986) represents the proportion of experts whose endorsement is required to establish content validity beyond the 0.05 level of significance. The figures reflected in red represent an acceptable level of content validity.

In this study, the expert panel (n=8) were all in agreement on the content validity of all items on the questionnaire at the end of the Round Two survey. Content validity for all the items on the questionnaire was established to a level of 1.00 (100%). Content validity on the Tutorial Performance Rating Instrument was, therefore, established.

Table 4. 3: Proportion of experts whose endorsement is required to establish content validity beyond the 0.05 level of significance

No. of Experts	Number of Experts Endorsing Item or Instrument as Content Valid								
	2	3	4	5	6	7	8	9	10
2	1. 00								
3	. 67	1. 00							
4	. 50	. 75	1. 00						
5	. 40	. 60	. 80	1. 00					
6	. 33	. 50	. 67	. 83	1. 00				
7	. 29	. 43	. 57	. 71	. 86	1. 00			
8	. 25	. 38	. 50	. 63	. 75	. 88	1. 00		
9	. 22	. 33	. 44	. 56	. 67	.78	. 89	1. 00	
10	. 20	. 30	. 40	. 50	. 60	.70	. 80	. 90	1.00

(Figures reflected in red represent acceptable level of content validity).

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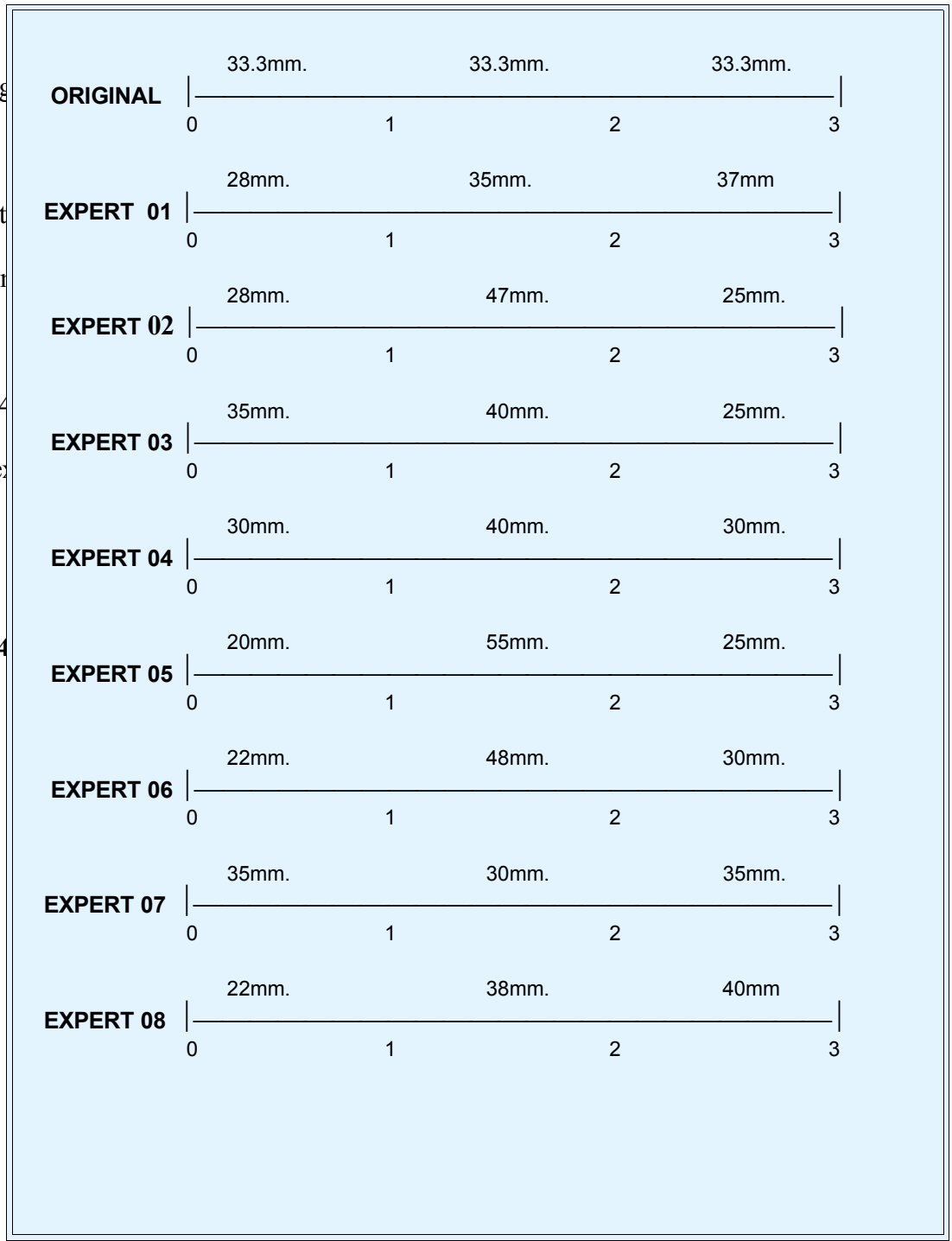
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4.3.2 Construct Validity and Weighting of Items

In Round Three of the Delphi survey, the expert group modelled a weighted score incorporating weights for main items, sub items and the 4-point (0-3) Likert rating scale. The experts were asked to make a pair-wise comparison of one main item against a second main item and one sub item against a second sub item until paired comparisons of all items were made. Data from each expert were collected on one hundred 100mm visual analogue scales and made up as follows:

- Visual analogue scales representing main items (n=21).
- Visual analogue scales representing sub items (n=79).

After data were collected from the expert group (n=8) the total number of visual analogue scales was (n=800). A second set of data collected measured the distance between each point of the 4-point (0-3) rating scale as presented on the visual analogue scales (n=8).

The 800 visual analogue scales weighting on main items and sub items completed by the expert group were returned to the researcher. The researcher measured each visual analogue scale accurately from 0mm to the expert's mark. These measurements were presented in millimetres and entered onto an Excel spreadsheet. The data were sent to the statistician for statistical analysis and mathematical modelling.

These measurements displayed in codes are presented in Table 4.5 for main items and Table 4.6 for sub items.

Table 4. 5: Measurements in mm of main items on the visual analogue scales

Main items	Expert 01	Expert 02	Expert 03	Expert 04	Expert 05	Expert 06	Expert 07	Expert 08
AB	75	43	19	50	82	42	75	33
AC	76	65	22	80	48	34	46	52
AD	68	37	23	48	53	33	32	48
AE	70	72	28	66	55	42	25	45
AF	80	48	30	50	45	29	30	58
AG	90	57	30	37	46	27	30	57
BC	78	42	34	75	14	25	32	62
BD	74	56	34	68	30	38	32	62
BE	80	28	35	70	18	24	32	50
BF	82	20	37	45	22	30	30	60
BG	94	45	24	50	22	25	28	68
CD	79	28	40	26	66	24	29	45
CE	84	29	41	46	55	42	30	48
CF	85	49	41	17	55	48	29	55
CG	95	49	42	17	54	40	29	62
DE	82	39	43	65	57	42	46	50
DF	88	54	45	44	50	33	46	60
DG	95	40	45	40	62	33	25	66
EF	90	44	25	11	37	32	48	62

EG	94	45	25	20	58	42	49	70
FG	95	65	60	45	55	48	49	57

Table 4. 6: Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
A 1-2	87	62	15	50	24	55	26	45
A 1-3	87	57	18	52	56	47	26	50
A 1-4	85	70	18	24	30	48	27	56
A 1-5	84	50	20	20	70	60	28	42
A 1-6	84	53	39	47	50	45	28	47
A 1-7	85	60	20	28	65	46	29	53
A 1-8	86	75	22	48	33	45	30	58
A 2-3	88	46	24	48	56	28	45	50
A 2-4	80	70	25	46	35	30	65	64
A 2-5	80	45	27	47	65	43	45	42
A 2-6	76	83	25	50	32	20	45	50
A 2-7	76	35	27	50	70	22	66	46
A 2-8	74	57	28	50	25	46	66	58
A 3-4	73	72	29	45	60	22	66	58
A 3-5	82	49	30	49	75	55	30	48
A 3-6	84	65	29	50	40	25	32	50
A 3-7	85	30	29	51	75	16	60	45
A 3-8	83	52	30	51	50	47	60	58
A 4-5	85	67	15	50	80	70	70	38
A 4-6	83	65	33	50	60	45	46	46
A 4-7	85	32	35	49	80	36	41	50
A 4-8	76	38	25	50	52	53	46	50
A 5-6	80	40	18	50	25	20	26	54
A 5-7	80	42	18	52	40	16	25	48
A 5-8	83	40	15	50	40	17	26	54
A 6-7	87	30	33	51	55	35	46	47
A 6-8	80	70	33	50	40	65	45	64
A 7-8	80	24	80	54	20	67	47	60

Table 4. 6 (cont.): Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
B 1-2	80	46	42	50	66	55	80	50
B 1-3	84	56	46	51	32	48	62	48
B 1-4	85	32	50	53	55	50	62	56
B 1-5	86	32	30	25	42	37	45	58
B 1-6	79	52	30	35	32	35	46	58
B 1-7	83	48	33	29	50	48	46	60
B 2-3	83	58	32	29	30	25	20	49
B 2-4	83	54	33	52	50	50	24	48
B 2-5	81	56	33	47	49	28	25	56
B 2-6	82	44	35	30	49	32	26	58
B 2-7	84	60	36	48	46	50	26	59
B 3-4	85	35	53	64	62	56	80	45
B 3-5	80	40	35	52	53	55	47	45
B 3-6	80	54	47	63	50	35	45	53
B 3-7	82	41	25	57	62	36	70	60
B 4-5	82	42	28	30	53	45	24	52

B 4-6	82	30	68	25	22	48	24	56
B 4-7	84	66	35	33	50	50	24	56
B 5-6	82	54	36	46	28	48	45	58
B 5-7	80	82	20	30	62	48	24	55
B 6-7	78	57	29	60	66	58	24	56

Table 4. 6 (cont.): Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
C 1-2	85	55	67	60	68	40	25	58
C 1-3	80	73	70	30	33	48	26	60
C 2-3	82	65	69	48	28	50	46	60

Table 4. 6 (cont.): Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
D 1-2	73	38	29	22	33	48	36	60
D 1-3	76	70	45	48	68	70	36	46
D 1-4	77	68	53	48	56	62	15	46
D 1-5	78	75	10	49	54	88	72	47
D 2-3	75	38	35	47	77	68	68	37
D 2-4	78	45	47	45	57	62	45	40
D 2-5	78	46	42	45	52	87	76	40
D 3-4	76	83	38	50	33	50	45	50
D 3-5	75	44	36	48	60	70	76	50
D 4-5	75	58	30	49	50	85	76	50

Table 4. 6 (cont.): Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
E1-2	95	62	68	50	50	47	45	66

Table 4. 6 (cont.): Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
F 1-2	76	35	47	50	60	47	20	35
F 1-3	78	89	45	48	50	47	18	32
F 1-4	78	88	45	47	60	50	20	38
F 1-5	80	84	52	48	58	50	20	42
F 2-3	80	74	54	50	60	50	20	38
F 2-4	80	68	55	46	67	46	22	32
F 2-5	82	60	55	45	66	49	22	32
F 3-4	83	84	55	45	43	49	72	36

F 3-5	83	82	56	48	52	48	74	40
F 4-5	76	34	28	37	72	48	20	50

Table 4. 6 (cont.): Measurements in mm of sub items on visual analogue scales

Sub items	EXPERT 01	EXPERT 02	EXPERT 03	EXPERT 04	EXPERT 05	EXPERT 06	EXPERT 07	EXPERT 08
G 1-2	72	92	48	49	76	48	82	57
G 1-3	80	76	48	37	38	33	72	59
G 1-4	80	34	49	49	60	32	70	60
G 2-3	80	60	50	47	27	30	68	55
G 2-4	78	30	50	37	45	40	75	55
G 3-4	79	33	69	34	80	70	45	58

Descriptors with reference to the codes on main items are presented in Fig 4.1.

Descriptors with reference to the codes on sub items are presented in Fig 4.2.

Example AB = (A) Personal Growth versus (B) Leadership

Main -items	
AB	Personal Growth v. Leadership
AC	Personal Growth v. Learning Skills
AD	Personal Growth v. Content of Inputs
AE	Personal Growth v. Communication
AF	Personal Growth v. Problem-solving Skills
AG	Personal Growth v. Critical Thinking Abilities
BC	Leadership v. Learning Skills
BD	Leadership v. Content of Inputs
BE	Leadership v. Communication
BF	Leadership v. Problem-solving Skills

BG	Leadership v. Critical Thinking Abilities
CD	Learning Skills v. Content of Inputs
CE	Learning Skills v. Communication
CF	Learning Skills v. Problem-solving Skills
CG	Learning Skills v. Critical Thinking Abilities
DE	Content of Inputs v. Communication
DF	Content of Inputs v. Problem-solving Skills
DG	Content of Inputs v. Critical Thinking Abilities
EF	Communication v. Problem-solving Skills
EG	Communication v. Critical Thinking Abilities
FG	Problem-solving Skills v. Critical Thinking Abilities

Figure 4.1: Visual analogue scale descriptors on main items

Sub items	PERSONAL GROWTH
A 1-2	Willing to work with group members v. Offers encouragement and support to group members
A 1-3	Willing to work with group members v. Acknowledges contributions from group members
A 1-4	Willing to work with group members v. Presents constructive interventions and feedback
A 1-5	Willing to work with group members v. Assists and manages ground rules for the group
A 1-6	Willing to work with group members v. Displays active listening
A 1-7	Willing to work with group members v. Shows ability to brainstorm
A 1-8	Willing to work with group members v. Able to summarize discussion
A 2-3	Offers encouragement and support to group members v. Acknowledges contributions from group members
A 2-4	Offers encouragement and support to group members v. Presents constructive interventions and feedback
A 2-5	Offers encouragement and support to group members v. Assists and manages ground rules for the group
A 2-6	Offers encouragement and support to group members v. Displays active listening
A 2-7	Offers encouragement and support to group members v. Shows ability to brainstorm
A 2-8	Offers encouragement and support to group members v. Able to summarize discussion
A 3-4	Acknowledges contributions from group members v. Presents constructive interventions and feedback
A 3-5	Acknowledges contributions from group members v. Assists and manages ground rules for the group
A 3-6	Acknowledges contributions from group members v. Displays active listening
A 3-7	Acknowledges contributions from group members v. Shows ability to brainstorm
A 3-8	Acknowledges contributions from group members v. Able to summarize discussion
A 4-5	Presents constructive interventions and feedback v. Assists and manages ground rules for the group
A 4-6	Presents constructive interventions and feedback v. Displays active listening

A 4-7	Presents constructive interventions and feedback v. Shows ability to brainstorm
A 4-8	Presents constructive interventions and feedback v. Able to summarize discussion
A 5-6	Assists and manages ground rules for the group v. Displays active listening
A 5-7	Assists and manages ground rules for the group v. Shows ability to brainstorm
A 5-8	Assists and manages ground rules for the group v. Able to summarize discussion
A 6-7	Displays active listening v. Shows ability to brainstorm
A 6-8	Displays active listening v. Able to summarize discussion
A 7-8	Shows ability to brainstorm v. Able to summarize discussion

Figure 4. 2: Visual analogue scale descriptors sub items

Sub items	LEADERSHIP
B 1-2	Shows a caring attitude v. Shows assertiveness
B 1-3	Shows a caring attitude v. Offers facts, suggestions, opinions to group
B 1-4	Shows a caring attitude v. Takes decisions
B 1-5	Shows a caring attitude v. Initiates the undertaking of tasks
B 1-6	Shows a caring attitude v. Identifies learning issues
B 1-7	Shows a caring attitude v. Drives the process forward
B 2-3	Shows assertiveness v. Offers facts, suggestions, opinions to group
B 2-4	Shows assertiveness v. Takes decisions
B 2-5	Shows assertiveness v. Initiates the undertaking of tasks
B 2-6	Shows assertiveness v. Identifies learning issues
B 2-7	Shows assertiveness v. Drives the process forward
B 3-4	Offers facts, suggestions, opinions to group v. Takes decisions
B 3-5	Offers facts, suggestions, opinions to group v. Initiates the undertaking of tasks
B 3-6	Offers facts, suggestions, opinions to group v. Identifies learning issues
B 3-7	Offers facts, suggestions, opinions to group v. Drives the process forward
B 4-5	Takes decisions v. Initiates the undertaking of tasks
B 4-6	Takes decisions v. Identifies learning issues
B 4-7	Takes decisions v. Drives the process forward
B 5-6	Initiates the undertaking of tasks v. Identifies learning issues
B 5-7	Initiates the undertaking of tasks v. Drives the process forward
B 6-7	Identifies learning issues v. Drives the process forward

Figure 4. 2 (cont.): Visual analogue scale descriptors sub items

Sub items	LEARNING SKILLS
C 1-2	Should be able to use more than one resource v. Is able to interpret a learning objective
C 1-3	Should be able to use more than one resource v. Demonstrates ability to understand concepts and theories
C 2-3	Is able to interpret learning objectively v. Demonstrates ability to understand concepts and theories

Figure 4. 2 (cont.): Visual analogue scale descriptors sub items

Sub items	CONTENT OF INPUTS/CONTRIBUTIONS
D 1-2	Is comprehensive depending on subject learnt v. Takes into account other disciplines when appropriate
D 1-3	Is comprehensive depending on subject learnt v. Integrates legislation into discussion when appropriate
D 1-4	Is comprehensive depending on subject learnt v. Integrates ethics into discussion
D 1-5	Is comprehensive depending on subject learnt v. Integrates health service principles
D 2-3	Takes into account other disciplines when appropriate v. Integrates legislation into discussion when appropriate
D 2-4	Takes into account other disciplines when appropriate v. Integrates ethics into discussion
D 2-5	Takes into account other disciplines when appropriate v. Integrates health service principles
D 3-4	Integrates legislation into discussion when appropriate v. Integrates ethics into discussion
D 3-5	Integrates legislation into discussion when appropriate v. Integrates health service principles
D 4-5	Integrates ethics into discussion v. Integrates health service principles

Figure 4. 2 (cont.): Visual analogue scale descriptors sub items

Sub	COMMUNICATION

item	
E 1-2	Demonstrates verbal skills appropriate to situation v. Demonstrates non-verbal skills appropriate to situation

Figure 4. 2 (cont.): Visual analogue scale descriptors sub items

Sub items	PROBLEM-SOLVING SKILLS
F 1-2	Manages to identify the problem v. Helps select a strategy to solve the problem
F 1-3	Manages to identify the problem v. Identifies possible solutions to the problem
F 1-4	Manages to identify the problem v. Discusses the best solution to the problem
F 1-5	Manages to identify the problem v. Implements a solution to the problem
F 2-3	Helps select a strategy to solve the problem v. Identifies possible solution to the problem
F 2-4	Helps select a strategy to solve the problem v. Discusses the best solution to the problem
F 2-5	Helps select a strategy to solve the problem v. Implements a solution to the problem
F 3-4	Identifies possible solution to the problem v. Discusses the best solution to the problem
F 3-5	Identifies possible solution to the problem v. Implements a solution to the problem
F 4-5	Discusses the best solution to the problem v. Implements a solution to the problem

Figure 4. 2 (cont.): Visual analogue scale descriptors sub items

Sub-item	CRITICAL THINKING ABILITIES
G 1-2	Identifies a problem, question or issue v. Verbally analyses the problem, question or issue
G 1-3	Identifies a problem, question or issue v. Uses evidence to support an argument or position
G 1-4	Identifies a problem question or issue v. Suggests and proposes alternatives
G 2-3	Verbally analyses the problem, question or issue v. Uses evidence to support an argument or position
G 2-4	Verbally analyses the problem, question or issue v. Suggests and proposes alternatives
G 3-4	Uses evidence to support an argument or position v. Suggests and proposes alternatives

Figure 4. 2 (cont.): Visual analogue scale descriptors sub items

Regression analysis was used to predict the variance in the value of each dependent variable (second item on VAS) based on the value of an independent variable (first item on VAS) in the paired comparisons of items. A linear regression model was fitted to the logarithms of the relative weights obtained during the experts' pair-wise assessment of main items and sub items acting as the covariates and the experts as a fixed effect. The regression coefficients were exponentiated and standardized to add up to 100%. Thus each sub item within a main-

item group was weighted; this weighting being represented in a percentage the sum of which = 100% for that particular construct. Furthermore, each main-item group has its own unique weighting represented as a percentage the sum of which = 100% for the entire instrument. Table 4.9 represents the coefficients, exponentiated coefficients and the standard weight in a percentage of each main-item group and the sub items within each group. Each set of sub items within a main-item group was standardized to be valued out of 100%. This has an advantage as it allows the facilitator to view the student score for each main-item group. Academic support can be given to the student in areas where a low percentage has been obtained. Once the sub items in a particular group have been calculated to an overall percentage out of 100%, the latter will be further calculated in accordance with the percentage specific to that construct. The procedure of calculating these percentages is discussed later.

Table 4. 7: Relative weights of main items and sub items

		Coef.	Exp.(Coef.)	Std Weight %
Mi A.	**PERSONAL GROWTH**	**-0.0206**	**0.9797**	**13.16**
si 1	Willing to work with group members	**-0.0250**	**0.9753**	**11.69**
si 2	Offers encouragement and support to group members	**0.0612**	**1.0632**	**12.74**
si 3	Acknowledges contributions from group members	**0.0858**	**1.0896**	**13.06**
si 4	Presents constructive interventions and feedback	**0.1196**	**1.1270**	**13.51**
si 5	Assists and manages ground rules for the group	**-0.1839**	**0.8320**	**9.97**
si 6	Displays active listening	**0.1237**	**1.1317**	**13.57**
si 7	Shows ability to brainstorm	**0.1163**	**1.1234**	**13.47**
si 8	Able to summarize discussion	**0.0000**	**1.0000**	**11.99**
			8.3423	**100.00**
Mi B.	**LEADERSHIP**	**-0.1486**	**0.8619**	**11.58**
si 1	Shows a caring attitude	**0.0094**	**1.0094**	**14.27**
si 2	Shows assertiveness	**-0.1887**	**0.8280**	**11.71**
si 3	Offers facts, suggestions, opinions to group members	**0.1388**	**1.1488**	**16.24**
si 4	Takes decisions	**-0.1619**	**0.8506**	**12.03**
si 5	Initiates the undertaking of tasks	**0.0953**	**1.1000**	**15.55**
si 6	Identifies learning issues	**0.1273**	**1.1358**	**16.06**
si 7	Drives the process forward	**0.0000**	**1.0000**	**14.14**
			7.0726	**100.00**
Mi C.	**LEARNING SKILLS**	**-0.0168**	**0.9833**	**13.21**
si 1	Should be able to use more than one resource	**0.0180**	**1.0182**	**33.95**
si 2	Is able to interpret a learning objective	**-0.0197**	**0.9805**	**32.70**
si 3	Demonstrates ability to understand concepts and theories	**0.0000**	**1.0000**	**33.35**
			2.9987	**100.00**
Mi D.	**CONTENT OF INPUTS (CONTRIBUTIONS)**	**0.2141**	**1.2387**	**16.65**

si 1	Is comprehensive depending on subject learnt	**0.3465**	**1.4142**	**21.13**
si 2	Takes into account other disciplines when appropriate	**0.4874**	**1.6280**	**24.32**
si 3	Integrates legislation into discussion when appropriate	**0.2619**	**1.2994**	**19.41**
si 4	Integrates ethics into discussion	**0.3019**	**1.3524**	**20.20**
si 5	Integrates health service principles	**0.0000**	**1.0000**	**14.94**
			6.6940	**100.00**
Mi E.	**COMMUNICATION**	**0.0815**	**1.0849**	**14.58**
si 1	Demonstrates verbal skills appropriate to the situation	**0.5671**	**1.7632**	**63.81**
si 2	Demonstrates non-verbal skills appropriate to situation	**0.0000**	**1.0000**	**36.19**
			2.7632	**100.00**
Mi F.	**PROBLEM-SOLVING SKILLS**	**0.2570**	**1.2931**	**17.38**
si 1	Manages to identify the problem	**0.1278**	**1.1363**	**20.66**
si 2	Helps select a strategy to solve the problem	**0.1678**	**1.1827**	**21.50**
si 3	Identifies possible solutions to the problem	**0.2239**	**1.2509**	**22.74**
si 4	Discusses the best solution to the problem	**-0.0716**	**0.9309**	**16.92**
si 5	Implements a solution to the problem	**0.0000**	**1.0000**	**18.18**
			5.5008	**100.00**
Mi G.	**CRITICAL THINKING ABILITIES**	**0.0000**	**1.0000**	**13.44**
si.1	Identifies a problem, question or issue	**0.1201**	**1.1276**	**28.38**
si 2	Verbally analyses the problem, question or issue	**-0.2358**	**0.7899**	**19.88**
si 3	Uses evidence to support an argument or position	**0.0536**	**1.0551**	**26.56**
si 4	Suggests and proposes alternatives	**0.0000**	**1.0000**	**25.17**
			3.9726	**100.00**

Each of the seven (7) (main item) constructs together with the specific sub items relative to that construct was given a unique percentage. It was now possible to rank the main items from the highest percentage to the lowest percentage. Once that was completed, the sub items within each construct were ranked from the highest percentage to the lowest percentage. A hierarchy of main items and sub items was carried out.

Once the students' scores on assessment have been calculated, each main-item construct will be allocated a percentage. The advantage the hierarchy presents is that it enables the facilitator to observe these percentages for each construct and to prioritize and be selective when giving a student academic support.

The facilitator and student can initially concentrate on domains that are seen to be of greater importance than those of lesser importance. Furthermore, the sub items within each construct feature in a hierarchy allowing the facilitator to prioritise the sub items that should receive greater attention. A representation of this hierarchy is presented in
Table 4.8. The figures in red represent the percentage allocated to each group of main items.

Table 4. 8: Hierarchy of items

	Percentage
PROBLEM-SOLVING SKILLS	17.38
1. Identifies possible solutions to the problem	**22.74**
2. Helps select strategy to solve the problem	**21.50**
3. Manages to identify the problem	**20.66**
4. Implements a solution to the problem	**18.18**
5. Discusses the best solution to the problem	**16.92**

CONTRIBUTIONS	**16.65**
1. Takes into account other disciplines when appropriate	**24.32**
2. Is comprehensive depending on subject learnt	**21.13**
3. Integrates ethics into discussion	**20.20**
4. Integrates legislation into discussion when appropriate	**19.41**
5. Integrates health service principles	**14.94**
COMMUNICATION	**14.58**
1. Demonstrates verbal skills appropriate to the situation	**63.81**
2. Demonstrates non-verbal skills appropriate to situation	**36.19**
CRITICAL THINKING SKILLS	**13.43**
1. Identifies a problem, question or issue	**28.38**
2. Uses evidence to support an argument or position	**26.56**
3. Suggests and proposes alternatives	**25.18**
4. Verbally analyses the problem, question or issue	**19.88**
LEARNING SKILLS	**13.21**
1. Should be able to use more than one resource	**33.95**
2. Demonstrates ability to understand concepts and theories	**33.35**
3. Is able to interpret a learning objective	**32.70**
PERSONAL GROWTH	**13.17**
1. Displays active listening	**13.57**
2. Presents constructive interventions and feedback	**13.51**
3. Shows ability to brainstorm	**13.47**
4. Acknowledges contributions from group members	**13.06**
5. Offers encouragement and support to group members	**12.74**
6. Able to summarize discussion	**11.99**
7. Willing to work with group members	**11.69**
8. Assists and manages ground rules for the group	**9.97**
LEADERSHIP	**11.58**
1. Offers facts, suggestions, opinions to group members	**16.24**
2. Identifies learning issues	**16.06**
3. Initiates the undertaking of tasks	**15.55**
4. Shows a caring attitude	**14.27**
5. Drives the process forward	**14.14**
6. Takes decisions	**12.03**
7. Shows assertiveness	**11.71**

Statistical analysis was carried out on the weighting as judged by the individual experts on each of the 4 points on the (0-3) ordinal rating scale. The results are as follows**:**

Rating 0-1= 28%

Rating 1-2= 69%

Rating 2-3= 100%

Table 4.9 illustrates the scale in its original format with equal weighting.

Table 4.10 illustrates the weighting following statistical analysis.

These tables do not reflect accuracy in measurement but serve merely as examples.

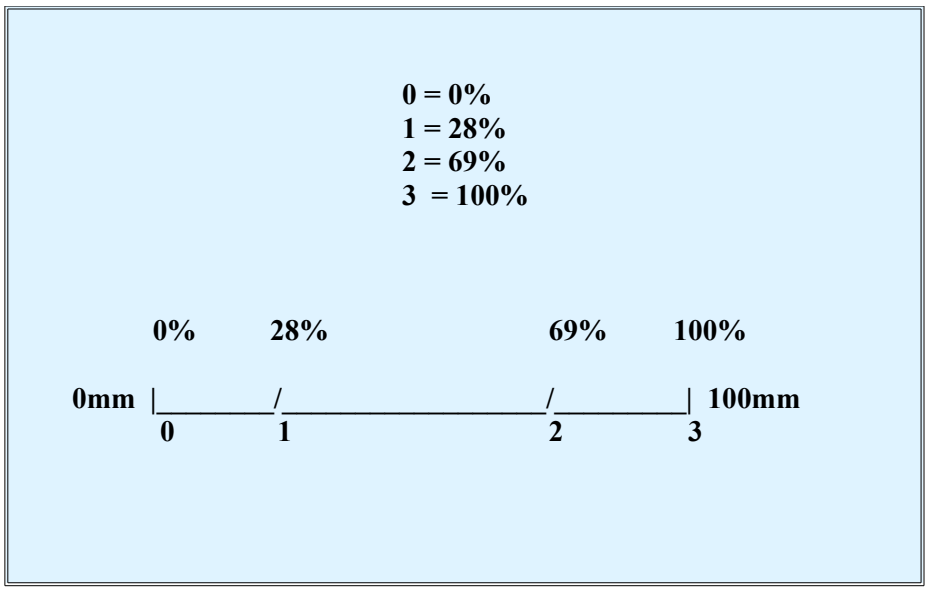
Table 4. 9: Weights (%) on the original Likert Scale

0 = 0%
1 = 33.3%
2 = 66.6%
3 = 100%

0% 33.3% 66.6% 100%

0mm |_____/_____/_____| 100mm
0 1 2 3

Table 4. 10: Weights (%) on the ordinal scale



A unique weighting represented in a percentage was now allocated to each of the seven main-item constructs the sum of which will equal 100%. A unique weighting represented in a percentage has been allocated to each of the sub items within a main-item construct, the sum of which will equal 100%, that is, each construct will carry a total value of 100% and the total value of the seven main-item constructs will add up to 100%. The 4-point (0-3) ordinal rating scale has a unique weighting for each of the four points. Table 4.12 provides the weightings allocated to all the main-item constructs (WC), sub items (WI) and the 4-point (0-3) ordinal rating scale (WS). The process of calculating the (WC)(WI)(WS)/100 would be time-consuming if done manually. Error might occur rendering the composite score inaccurate. The ease and practicality with which the instrument could be used would be determined by the time it takes to carry out and score an assessment and interpret the results.

A computer-based programme was developed to allow for these calculations to be done efficiently, accurately and quickly. The programme allows for the interpretation of results to be meaningful.

4.4 DEVELOPMENT OF A COMPUTER-BASED PROGRAMME

A computer-based programme referred to as the Tutorial Performance Evaluator (TPE) was developed to carry out the calculations of (WC)(WI)(WS)/100. The researcher together with the assistance of a computer programmer developed the software required for the above computer-based programme. The software was developed using Microsoft® Visual Basic V. 6 and is able to run on any Microsoft® windows operating system from Version Windows 98 onwards. The source code will remain the property of the programmer. The software was built based on the unique percentages allocated to each main-item construct and each sub-item. Table 4.11 represents the percentages on the main-item, Table 4.12 represents the percentages on the sub-items and the rating scale and Table 4.13 represents the Tutorial Performance Evaluator (TPE).

Table 4. 11 Percentages allocated to main items

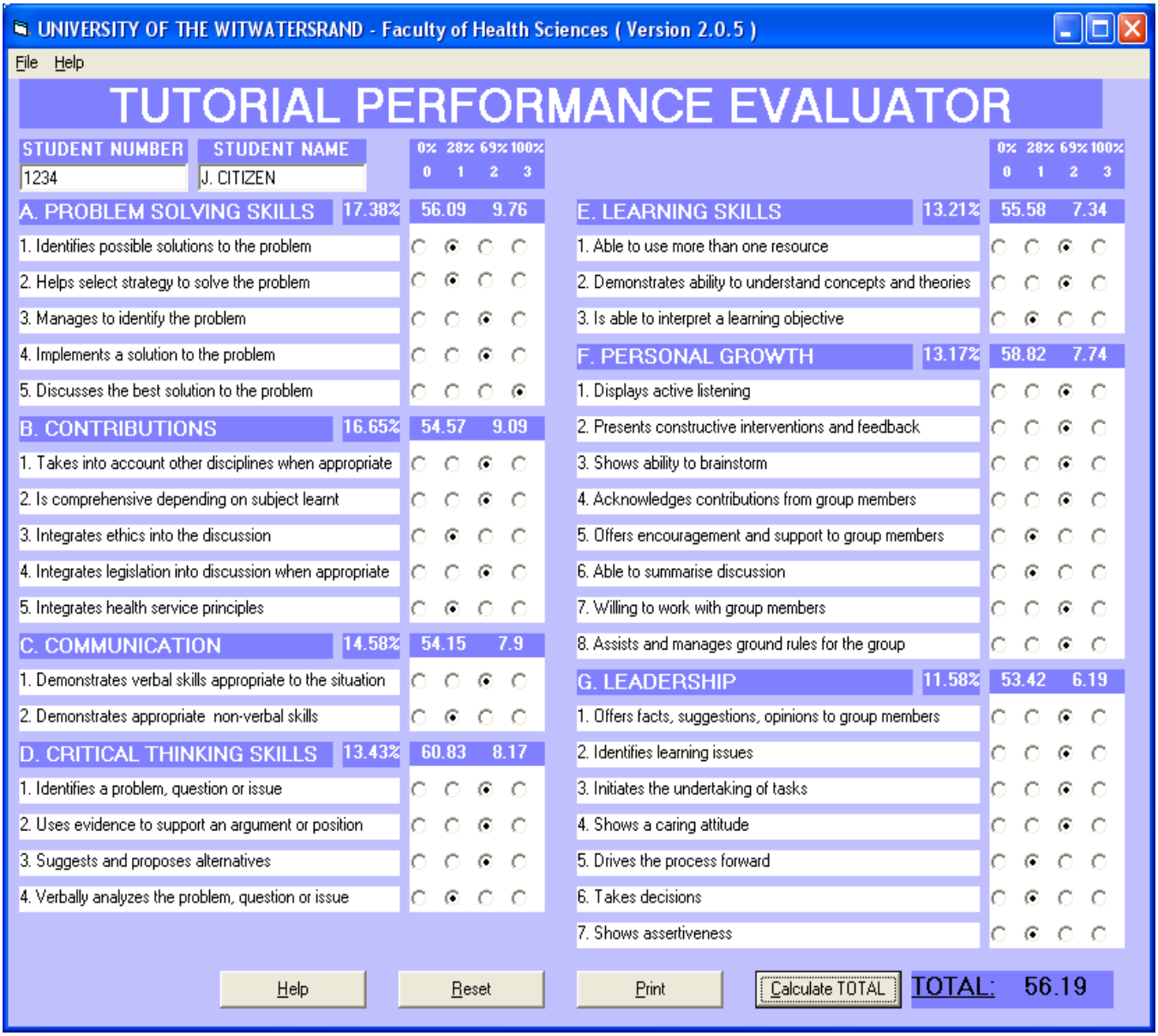
MAIN –ITEM CONSTRUCT	PERCENTAGE
A Problem-solving skills	**17.38**
B Contributions	**16.65**
C Communication	**14.58**
D Critical Thinking skills	**13.43**
E Learning skills	**13.21**
F Personal growth	**13.17**
G Leadership	**11.58**
TOTAL	**100%**

Table 4. 12: Weighting of main items and sub items and relative weights

		0%	28%	69%	100%
		0	1	2	3
PROBLEM-SOLVING SKILLS	**17.38**				
1. Identifies possible solutions to the problem			**6.36**	**15.69**	**22.74**
2. Helps select strategy to solve the problem			**6.02**	**14.83**	**21.50**
3. Manages to identify the problem			**5.78**	**14.25**	**20.66**
4. Implements a solution to the problem			**5.09**	**12.54**	**18.18**
5. Discusses the best solution to the problem			**4.73**	**11.67**	**16.92**

CONTRIBUTIONS 16.65				
1. Takes into account other disciplines when appropriate		**6.80**	**16.78**	**24.32**
2. Is comprehensive depending on subject learnt		**5.91**	**14.57**	**21.13**
3. Integrates ethics into discussion		**5.65**	**13.93**	**20.20**
4. Integrates legislation into discussion when appropriate		**5.43**	**13.39**	**19.41**
5. Integrates health service principles		**4.18**	**10.30**	**14.94**
COMMUNICATION 14.58				
1. Demonstrates verbal skills appropriate to the situation		**17.86**	**44.02**	**63.81**
2. Demonstrates non-verbal skills appropriate to situation		**10.13**	**24.97**	**36.19**
CRITICAL THINKING SKILLS 13.43				
1. Identifies a problem, question or issue		**7.94**	**19.58**	**28.38**
2. Uses evidence to support an argument or position		**7.43**	**18.32**	**26.56**
3. Suggests and proposes alternatives		**7.05**	**17.37**	**25.18**
4. Verbally analyses the problem, question or issue		**5.56**	**13.71**	**19.88**
LEARNING SKILLS 13.21				
1. Should be able to use more than one resource		**9.50**	**23.42**	**33.95**
2. Demonstrates ability to understand concepts and theories		**9.33**	**23.01**	**33.35**
3. Is able to interpret a learning objective		**9.15**	**22.56**	**32.70**
PERSONAL GROWTH 13.17				
1. Displays active listening		**3.79**	**9.36**	**13.57**
2. Presents constructive interventions and feedback		**3.78**	**9.32**	**13.51**
3. Shows ability to brainstorm		**3.77**	**9.29**	**13.47**
4. Acknowledges contributions from group members		**3.65**	**9.01**	**13.06**
5. Offers encouragement and support to group members		**3.56**	**8.79**	**12.74**
6. Able to summarize discussion		**3.35**	**8.27**	**11.99**
7. Willing to work with group members		**3.27**	**8.06**	**11.69**
8. Assists and manages ground rules for the group		**2.79**	**6.87**	**9.97**
LEADERSHIP 11.58				
1. Offers facts, suggestions, opinions to group members		**4.54**	**11.20**	**16.24**
2. Identifies learning issues		**4.49**	**11.08**	**16.06**
3. Initiates the undertaking of tasks		**4.35**	**10.72**	**15.55**
4. Shows a caring attitude		**3.99**	**9.84**	**14.27**
5. Drives the process forward		**3.95**	**9.75**	**14.14**
6. Takes decisions		**3.36**	**8.30**	**12.03**
7. Shows assertiveness		**3.27**	**8.07**	**11.71**

Table 4.13: Tutorial Performance Evaluator



Certain criteria were used in the development of the programme. Refer to Table 4.13 to make the following more understandable:

1. The Tutorial Performance Rating Instrument was copied into the programme in its exact format representing all the main-items and sub-items together with the 4-point (0-3) ordinal rating scale (now referred to as an ordinal scale as the distance between the points are no longer equidistant 0=0%, 1=28%, 2=69% 3=100%).

2. Each of the seven main-item constructs labelled A-G are represented by their own unique weighting. The sum of the percentages of the seven main-items = 100%.
   The construct: Problem-solving Skills represents a weighting of 17.38% of the total 100%. Should the students score a three (3) on all the sub-items within the construct, a score of 17.38% will be reflected, this being the highest percentage for the construct.

2. The sub items within each group of main-item constructs are labelled in a numerical format. Next to each sub-item are four tick boxes representing the 4-point (0-3) ordinal rating scale. The percentage relative to the weighting of each sub-item is reflected behind each tick box and can be viewed by resting the curser next to an empty tick box. The full percentage relative to the weighting of each sub-item is reflected behind the box on the rating scale three (3). The percentages reflected behind the tick-box on the rating scale two (2) = 69% of the full percentage. The percentages reflected behind the tick box on the rating scale one (1) =28% of the full percentage. The percentages reflected behind the tick box on the rating scale naught are (0) = 0%.

3. As each box is ticked with the relevant rating of 0-3 against each sub-item, the percentages are added and each group of main-item constructs is allocated an overall percentage.

Example

A). Problem-solving Skills weighting 17.38%, the student obtains a score of 9.75% out of a total of 17.38% being the weighting for that construct. To tell a student that he/she has achieved a score of 9.75% out of a total of 17.38% is not meaningful. When that score of 9.75% is calculated out of 100% (9.75 ÷ 17.38 x 100) the score becomes 56.09%. This becomes understandable to student and facilitator alike.

4. Once all the boxes have been ticked, the programme calculates an overall total percentage by clicking on the 'Calculate TOTAL' button.

5. The assessment page can be printed out, by clicking on the 'Print screen' button.

6. Once the assessment has been completed, the 'Reset' button clears the scores and a blank evaluation instrument is shown on the screen.

The students' performance in problem-based learning tutorials is evaluated on the Tutorial Performance Rating Instrument as both a self-assessment and a facilitator-assessment. The facilitator collects the completed rating instruments and a one-on-one meeting is held with the student to compare the ratings on the self-assessment and the facilitator-assessment. The student and the facilitator reach consensus on the ratings of each item on the Tutorial

Performance Rating Instrument. The ratings are entered as raw data into the computer onto the Tutorial Performance Evaluator and converted into percentages.

4.5 CONCLUSION

This chapter presented the data analysis and results in Phase 1 of the study. In the process of validating the original Tutorial Performance Evaluation Instrument, a new evaluation instrument referred to as the Tutorial Performance Rating Instrument was developed. The content validity of the latter was determined. Weighting (%) on all the items on the Tutorial Performance Rating instrument was carried out. A computer-based programme was developed to compute the calculations required by the weighting (%) on all the items of the instrument. Construct validity was determined based on the judgements of the expert group. Their opinions and judgements were honoured.

The next chapter presents the methodology in Phase 2 of the study.

CHAPTER FIVE

RESEARCH METHODOLOGY: PHASE 2

5.1 INTRODUCTION

This chapter describes the research methodology of Phase 2 of the study: evaluation of the undergraduate nursing students in PBL tutorials. The description includes the research design, the study setting and sampling process together with the data collection procedures.

5.2 RESEARCH DESIGN

A quantitative research approach was used to answer the research questions relevant to Phase 2 of the study that employed statistical techniques to evaluate the performance of undergraduate students in problem-based learning tutorials. The process was able to describe and test relationships of variables. According to Burns and Grove (2001:39), the control involved in quantitative research involves the imposing of rules to decrease the possibility of error. These rules are referred to as the research 'design'.

A descriptive, comparative design was used: 'A descriptive design may be used for the purpose of developing theory, identifying problems with current practice, justifying current practice, making judgements or determining what others in similar situations are doing' (Burns and Grove 2001:248). During this phase a descriptive design allowed for problems to be identified and judgements made regarding current practice related to problem-based learning tutorials.

The following comparisons were made in each of the four years of study

- Between the student self-assessments and the facilitator assessments
- Between the students in each year of study
- Between groups of students in each year

Each student conducted a self-assessment on his/her performance during problem-based learning tutorials. The facilitators carried out a similar assessment of each student within that particular facilitator's groups. The performances were rated on the Tutorial Performance Rating Instrument (Annexure I) – the validated instrument developed in Phase 1 of the study. These ratings were then entered into the computer on the computer-based Tutorial Performance Evaluator (Annexure M).

5.3 RESEARCH METHODS

Research methods refer to the methodological perspectives of the study to address the research questions related to Phase 2 of the study. These include the population, samples and sampling, the research setting, data collection, instruments and procedures, approach to data analysis as well as measures of validity and reliability.

5.3.1 Population and Sample

The target population comprised undergraduate Bachelor of Nursing students and PBL facilitators. The students were invited to participate in the study after being given written information on the purpose and plan of the research. Those who agreed were asked to give written consent. The final sample comprised the total population of students (n= 53); 28% of the students were in the first year of study; 40% in the second year; 15% in the third year and

17% in the fourth year. Figure 5.1 shows a pie graph representing the percentages of students from first to fourth year of study.

Figure 5. 1: Distribution of students from first to fourth year of study

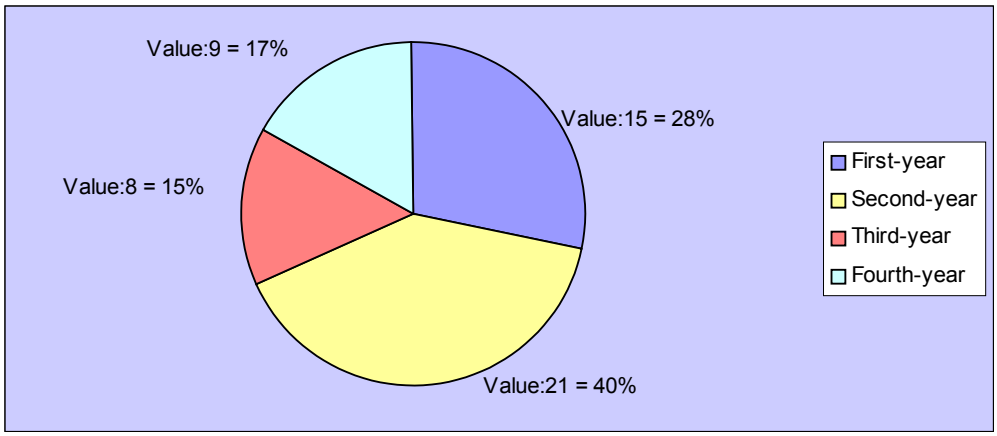
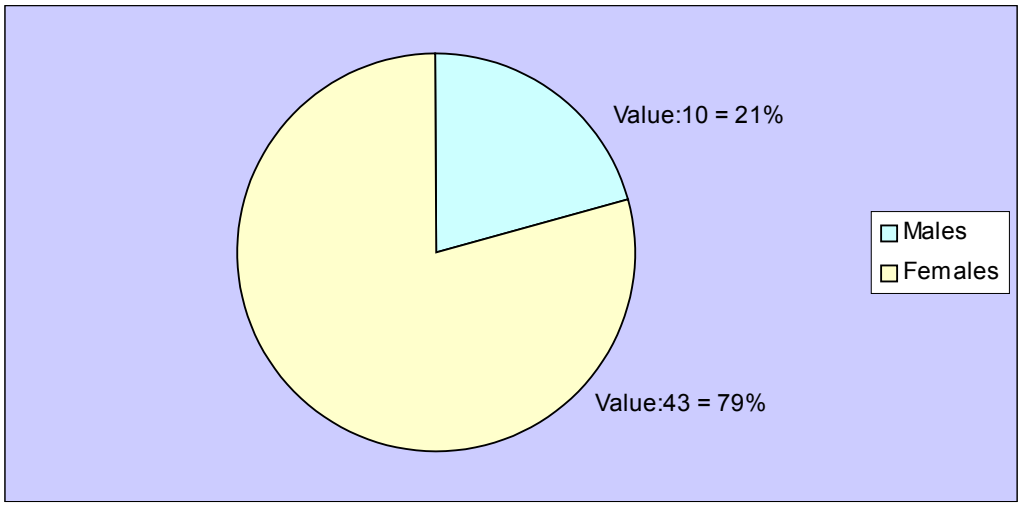


Figure 5. 2: Gender distribution of students' total population



Of the total population the gender representative was 79% females and 21% males. Figure 5.2 shows a pie graph representing the gender percentages of the total population of students from first to fourth year. Figure 5.3 shows a bar graph representing the mean age of the total population of students from first to fourth year.

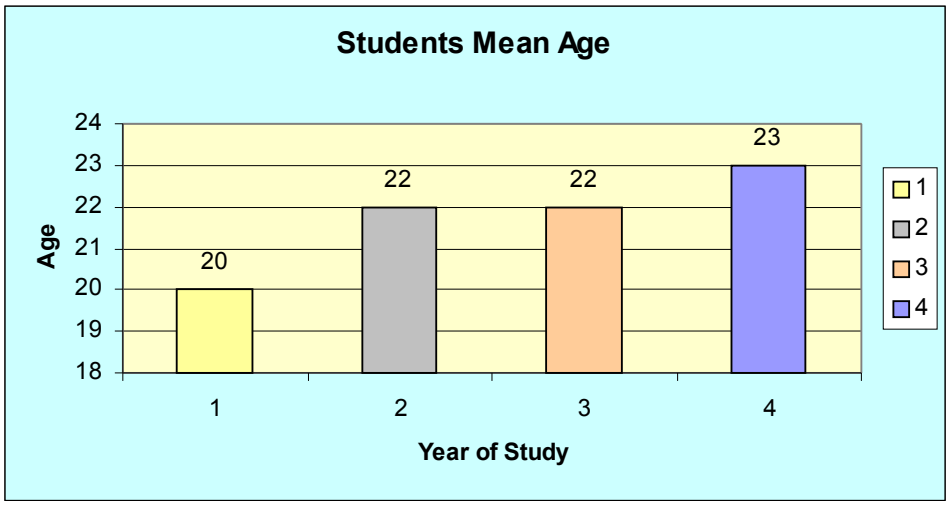


Figure 5. 3: Students' mean age during first to fourth years of study 2007 (n=53)

The PBL facilitators (n=6) who consented to participate in the study were each responsible for groups of students from first to fourth year and worked with these students for the entire year. The researcher provided these facilitators with verbal information on the purpose of the research study and informed them that their assessment scores of each student would be used in the study.

5.3.2 The Research Setting

Each problem-based learning tutorial for the research was conducted in a classroom setting with a facilitator and a group of 9 – 12 nursing students. The students completed self-assessments in the classroom after tutorials. After facilitator assessment of each student, a one-on-one meeting between the facilitator and the student took place in either the classroom post-tutorial or in the facilitator's office.

5.3.3 Approach to Data Collection

The students' performance in problem-based learning tutorials was assessed annually on the Tutorial Performance Evaluation Instrument. This assessment took place before the commencement of the final examinations. The students from each year were provided with a copy of the Tutorial Performance Evaluation Instrument (TPEI) and were asked to carry out a self-assessment to rate their performance in the problem-based learning tutorials. At the same time, the facilitators carried out facilitator assessments of all the students – first to fourth year – in their tutorial groups. One-on-one meetings were then held in order to discuss the differences between the facilitator and student ratings. A consensus was reached on a realistic rating per item. The ratings were calculated into a score and presented as a percentage. With the exception of the first-year students, 10% of this percentage was carried forward to the year-end mark.

The approach to the data collection was based on the procedure as described above, the only difference being that the evaluation instrument used was not the original Tutorial Performance Evaluation Instrument but the validated Tutorial Performance Rating Instrument that was developed and validated in Phase 1 of the study.

The data collection included the scores from both the student and the facilitator assessments as one of the objectives set out in chapter one was to test the inter-rater reliability of the instrument. A third set of data collected comprised the scores from the assessment following the consensus between the facilitators and the students.

5.3.4 Data Collection Procedure

Three (3) data sets were collected as part of the data for Phase 2 of the study. The first data set consisted of a self-assessment of tutorial performance of all the undergraduate Bachelor of Nursing students using the validated Tutorial Performance Rating Instrument (Annexure I) and the rating descriptors (Annexure J).

Each student was instructed to carry out a self-assessment of what he/she perceived his/her performance to be in problem-based learning tutorials. The skills to be assessed and those featured on the Tutorial Performance Rating Instrument as main items were as follows:

- problem-solving skills
- contributions
- communication skills
- critical thinking skills
- learning skills
- personal growth
- leadership

Within each group of main items were the related sub items. The students were asked to allocate a rating of 0-3 against each sub-item.

0 - Poor ability

1 - Inadequate ability

2 - Improved ability

3 - Good ability

A detailed description of the ratings was presented on the reverse side of the Tutorial Performance Rating Instrument (Annexure I). The purpose was to enable the students to be clear about rating decisions. The students (n=53) were given seven (7) days in which to complete the assessments.

Prior to the assessments being carried out, the researcher familiarized the first-year students with self-assessment procedures. It was decided to provide them with this information and to deal with any concerns or queries in this regard as the pilot study had yielded marked discrepancies between the student and the facilitator ratings.

The second data set consisted of a facilitator assessment of tutorial performance of all the undergraduate Bachelor of Nursing students using the validated Tutorial Performance Rating Instrument together with the rating descriptors (Annexure I). The facilitators (n= 6) who had worked with particular groups of students since the beginning of the year were given seven (7) days in which to complete the assessment.

Following the completion of the self- and facilitator assessments, an interview was held between the facilitator and each student within a group. The facilitator and student results were compared. Differences in ratings on particular items were discussed until consensus was reached and the final rating entered onto a blank Tutorial Performance Rating Instrument.

The third data set comprised the above ratings on the Tutorial Performance Rating Instrument decided upon between student and facilitator after consensus agreement was reached. The researcher was not present at these meetings. These one-on-one meetings are

valuable as they can also provide an opportunity for both the student and facilitator to discuss areas of concern. For each student there were three sets of ratings, the student's self-assessment rating, the facilitator's assessment rating and finally the rating that was consensually agreed upon between student and facilitator. Table 5.1 provides the total number of assessments in each year of study.

Table 5. 1: Total Number of data sets in year of study (n=53)

Data Sets Year of Study	1st	2nd	3rd	4th
Self-assessment	15	21	8	9
Facilitator assessment	15	21	8	9
Consensus agreement assessment	15	21	8	9

The three sets of ratings (n=159) were entered into the computer on the computer-based programme, the Tutorial Performance Evaluator. As was earlier stated, each main item and each sub item together with the four points on the ordinal scale has its unique weighting presented in a percentage. The computer-based Tutorial Performance Evaluator computed and calculated the percentages of each sub-item and main-item group, the ordinal scale that led to a score on each of the main-item groups and a total score represented as a percentage for the entire assessment.

Two copies of the computed assessment from the self- and the facilitator assessment were printed and kept by the researcher for further analysis, in particular to test the inter-rater reliability of the Tutorial Performance Rating Instrument. One copy remained with the researcher and the second copy was returned to the relevant facilitator who then evaluated and discussed the result with the student concerned. The item hierarchy allowed the facilitator to prioritise in the planning of academic support for a particular student.

Figure 5.4 illustrates how the three (3) data sets were used for data analysis.

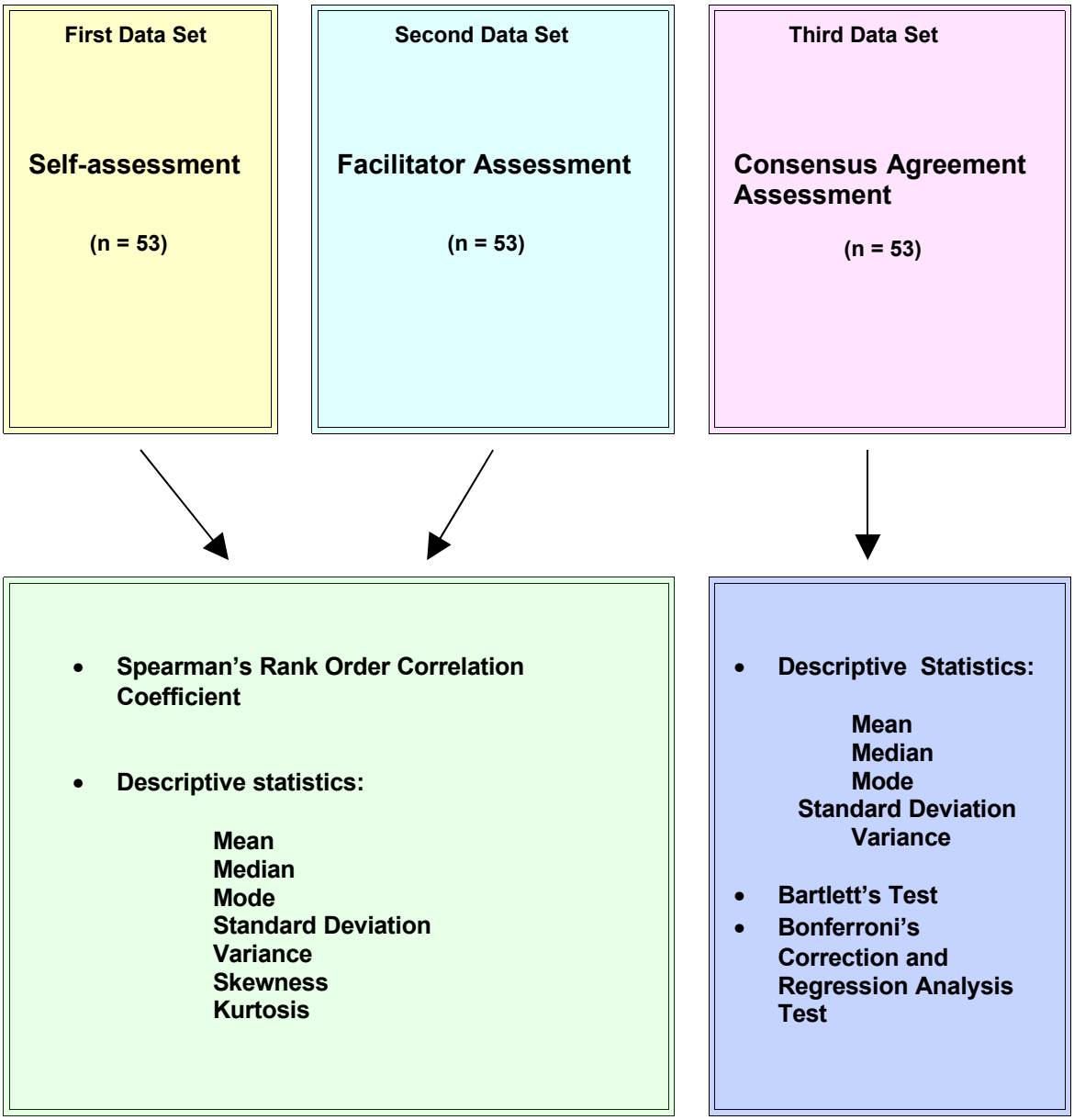


Figure 5. 4: Data sets in relation to data analysis

5.4 APPROACH TO DATA ANALYSIS

The data were captured using a database spreadsheet, in relation to the study objectives, statistical analysis followed. A statistician from the Epidemiology Data Centre (EDC) was consulted. Numerical data were used to describe the study sample and allow for comparisons to be made. The three (3) data sets were analysed using descriptive statistics utilizing the mean, mode, median and standard deviation together with the measure of central tendency.

Data were further analysed by inferential statistics using a STATA 9 computer statistical package to test the differences and similarities in student scores. Analysis of variance (ANOVA) was used to test the variance in student scores through each year of study and to determine whether the results were statistically significant or not.

Other statistical tests used were the Spearman rank-order correlation coefficient, a non-parametric analysis technique adapted from the Pearson correlation test. The Spearman test examines relationships between ranked student scores and facilitator scores. Bartlett's test was used to test for equal variances as well as Bonferroni's correction and regression analysis test. According to Burns and Grove (2001:581), the Bonferroni correction test controls the escalation of significance and is also used if various tests are performed on different aspects of the same data.

The results from the above tests are presented in chapter six.

5.5 VALIDITY AND RELIABILITY

5.5.1 Validity

The Tutorial Performance Rating Instrument developed in Phase 1 of the study was used as the data collection instrument. During this phase, the content validity of the instrument was determined. Content experts participated in and judged the content of items included in the Tutorial Performance Rating Instrument. The content validity of an instrument is considered to be 'good' if the experts' endorsement of the content is 0.85 The Tutorial Performance Rating Instrument carries the experts' endorsement of 1.00 (vide page 84).

The experts' judgements and opinions were honoured in determining the construct validity in the weighting of all the main items (constructs) and sub items on the Tutorial Performance Rating Instrument. Student assessments were, therefore, carried out on a validated instrument.

5.5.2 Reliability

The inter-rater reliability was tested and the results are presented in chapter six. A pilot study was conducted before the main data were collected to test the inter-rater reliability of both students and facilitators and to refine the evaluation instrument. A poor correlation was noted between the first-year students' self-assessment and the facilitator-assessments (vide page 66). The first-year students were orientated on how to carry out a reliable self-assessment.

The researcher was guided by the research objectives during the course of the study to avoid bias and to enhance rigour of the study. Furthermore, the researcher was the only person who collected the data.

5.6 CONCLUSION

This chapter described the research methodology of Phase 2 of this study where the individual performance of undergraduate nursing students in problem-based learning tutorials was assessed. Data were obtained from three assessments: self-assessment, facilitator-assessment and assessment following consensus agreement. The data were collected on the Tutorial Performance Rating Instrument, an instrument developed and validated in Phase 1 of the study. Data were entered into the computer on the computer-based instrument referred to as the Tutorial Performance Evaluator where the data on each assessment were electronically calculated. The approach to data analysis was presented.

The next chapter presents the data analysis and results specific to Phase 2 of the study.

CHAPTER SIX

DATA ANALYSIS AND RESULTS: PHASE 2

6.1 INTRODUCTION

Descriptive and inferential statistics were used to carry out analysis on preset data in Phase 2 of the study. This included summary statistics on the measures of central tendency: the mode, the median and the mean scores of the data. The relationships among the variables (the scores on the student self-assessment and those on the facilitator assessment of each student) were identified and described using a correlation analysis. Cross-sectional analyses were carried out on the student data from first to fourth year of study. Statistical procedures used were appropriate for the available data that were collected together with meeting the objectives of Phase 2 of the study. These were as follows:

- Evaluate the performance of the undergraduate nursing students during PBL tutorials, using self-assessment and facilitator-assessment
- Compare student scores in each year of study
- Determine the inter-rater relationship between student and facilitator tutorial performance scores

Whilst the above objectives are broad, the discussion and statistical analyses of the results of the students' evaluations are set out in more detail. Furthermore, the discussion encompasses a cross-section of students' evaluations from first to fourth year in each of the

seven main constructs and sub items featured on the validated Tutorial Performance Rating Instrument.

This chapter describes the data analysis and includes a textual and graphic presentation of the results of Phase 2 of the study.

6.2 DATA ANALYSIS

Three sets of computed scores constituted the raw data:

- Computed scores on the student self-assessments
- Computed scores on the facilitator assessments of each student
- Final computed score following consensus between facilitator and student

The analysis was two-fold in purpose:

1. To determine the inter-class correlation of scores on each of the seven main items and sub items featured on the Tutorial Performance Evaluator.

The Spearman Rho was used together with the following inferential statistics during data analysis:

- The analysis of variance (ANOVA) is defined as the analysis of the difference (variation) in the outcomes of an experiment to assess the contribution of each variable to the difference. The ANOVA decomposes the variability in the response variable amongst the different factors. It is, therefore, important to determine which factors have a significant effect on the response or how much of the variability in the

response variable is attributable to each factor before the analysis is done. The result is expressed as a ratio referred to as the F-ratio (http:/www.statgraphics.com/analysis_of_variance.htm).

- Bartlett's test was used to test if samples (student scores) have equal variances. This test indicates whether there is homogeneity of variances (equal variances across samples). This test is usually done after performing analysis of variance to verify an assumption, referred to as the null hypothesis (Ho), that variances are equal across groups or samples. The test is sensitive to departures from normality. If the null hypothesis is to be accepted, the F-ratio must be close to or = to 1. The p-value should be greater than 0.05.

- The Bonferroni correction test was used to carry out statistical adjustments in multiple comparisons. It allows for many comparison statements to be made, while still maintaining an overall confidence coefficient. Bonferroni's correction test performs multiple pair-wise comparisons between groups of samples. It is valid for both equal and unequal sample sizes. The use of this test helps to avoid making type 1 error (rejecting the null hypothesis inappropriately) by keeping the total chance of erroneously reporting a difference below some ALPHA value. This is achieved by dividing the test set significance level by the number of tests to be run (Simon, 2005a).

2. To determine the correlation between each student's self-assessment and the facilitator's assessment scores.

The raw data constituting the above scores were ranked and exported to the STATA 9.0 programme (Annexure N). Since the data sets were small the Spearman rank order correlation coefficient test was carried out. This is a non-parametric technique for ordinal data and is used to examine relationships among the variables in the study. The Spearman Rho (Greek R) was calculated based on the scores of each of the variables (facilitator scores/ student scores) that were ranked separately. A correlation analysis provided information on the nature of the linear relationship between the variables, representing a positive or negative relationship together with the strength of the positive or negative linear relationship.

A positive linear relationship implies that as one score changes the second score will change in the same direction, for example, all scores are low or all scores are high. A negative linear relationship implies that as one score changes the next score changes in the opposite direction, for example, one score may be high but the next low.

Measures of central tendency (the most concise position of location on data) were used in the form of the Mean (the sum of scores divided by the number of scores), the Mode (the numerical value that occurs most frequently) and the Median (the score at the exact centre of the group – the 50^{th} percentile). Statistics were used to explore deviations in the data such as the Standard Deviation (the square root of the variance that provides the 'average' difference or deviation score). The Variance (another measure commonly used) shows that the larger the variance, the larger the dispersion of scores. In establishing the shapes of distribution, the Skewness (asymmetry) and Kurtosis (the degree of peakedness of the curve) are measured.

6.3 THE STUDY RESULTS

A total of 53 students (n=53) returned their self-assessment scores. This represents a 100% student response rate. A total of six facilitators (n=6) returned their facilitator assessment scores on the students who had responded.

The results of the data analysis are presented according to the objectives as set out in Phase 2 of the study. The first objective requiring the evaluation to take place on a validated instrument was met. The statistics in this chapter are in relation to the second objective: the comparison of student scores in each year of study and the third objective: determining the inter-rater relationship between student and facilitator tutorial performance scores.

6.3.1 Inter-class Comparison of Students' Tutorial Performance Scores

One-on-one meetings were held between facilitators and students. The purpose of the meetings was to discuss the assessment ratings of both the facilitator assessments and the student self-assessments that had been carried out on the validated Tutorial Performance Rating Instrument. The rating on each sub item on the evaluation instrument was discussed. Consensus was reached and an agreed-upon rating was given to each of the sub items. These ratings were then entered into the computer on the Tutorial Performance Evaluator against all the corresponding sub items. The ratings were computed to obtain a percentage for each sub item and the main-item constructs (n = 7), together with a total percentage for the assessments that became the significant scores used in the students' summative evaluations. The total percentages obtained by the students in each year of study are presented in the following graphs: Fig. 6.1 to Fig. 6.6.

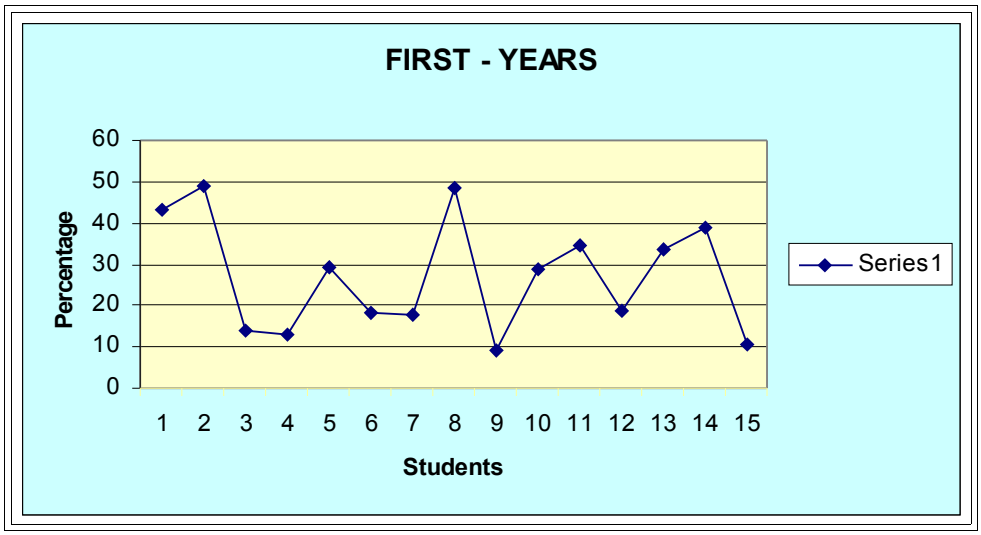


Figure 6. 1: First -year students' tutorial performance scores (n = 15).

All the first-year scores fall below 50%

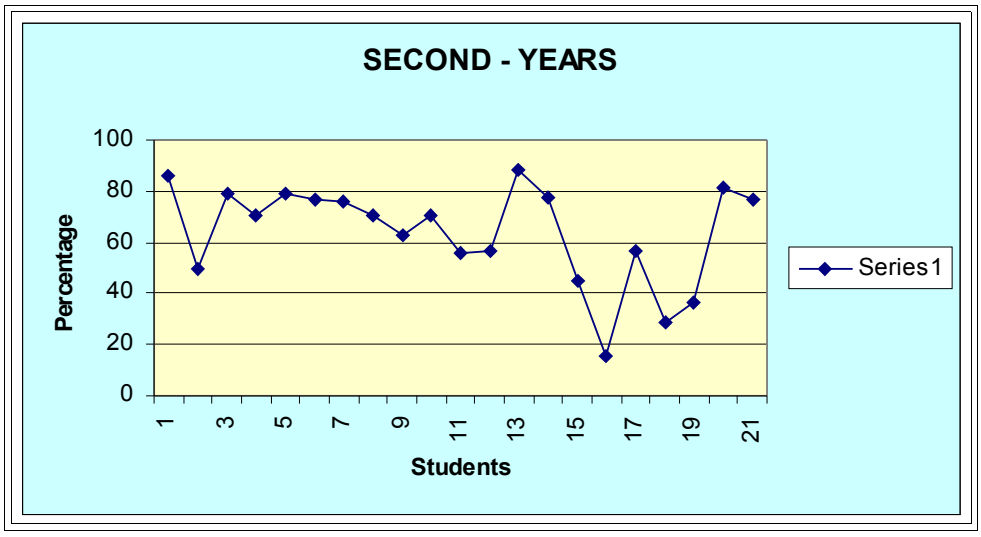


Figure 6. 2: Second-year students' tutorial performance scores (n = 21).

The above graph shows that 19% of the second-year scores fell below 50%

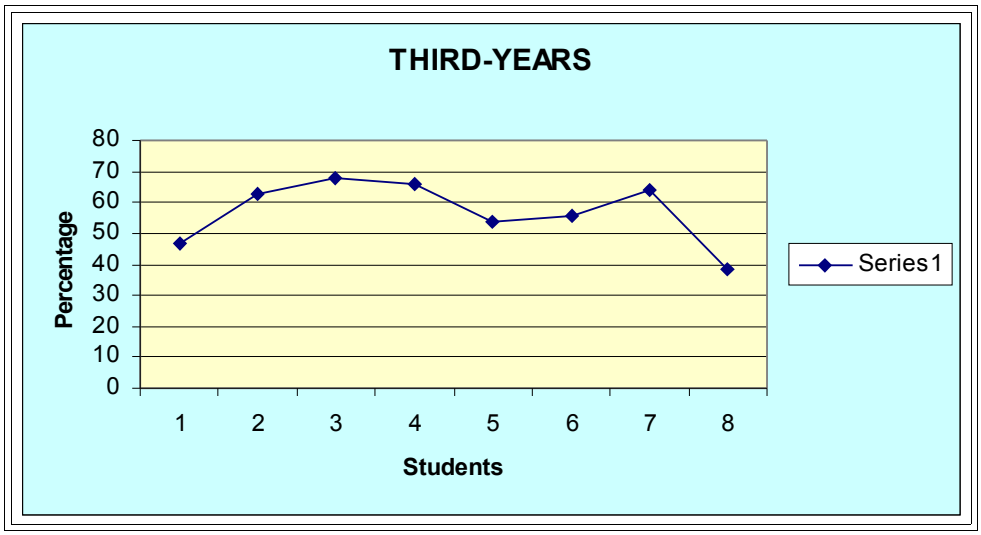


Figure 6. 3: Third-year students' tutorial performance scores (n = 8).

In this year, 87% of the scores placed above the 50% mark

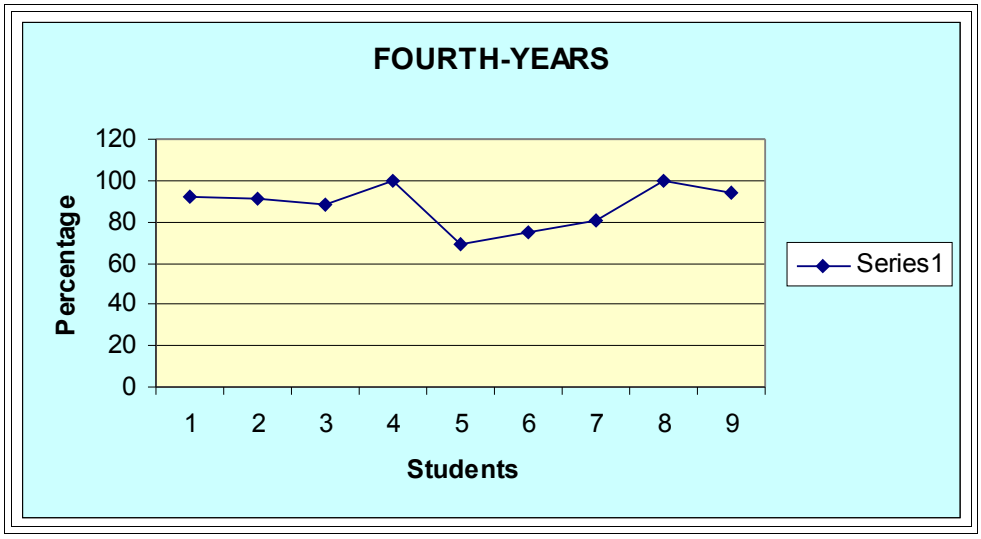


Figure 6. 4: Fourth-year students' tutorial performance scores (n = 9).

All the scores are above the 70% mark.

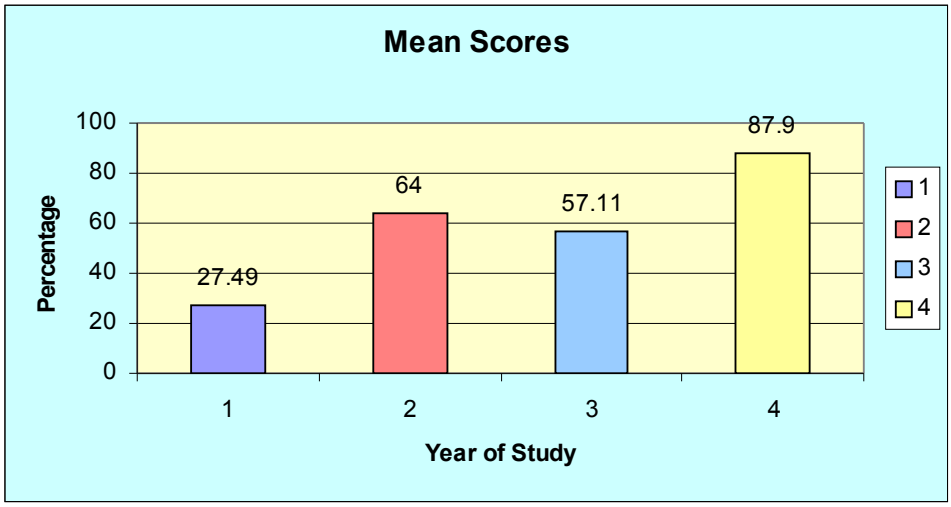


Figure 6. 5: Mean tutorial performance scores from first to fourth year (n = 53).

Figure 6.5 presents the mean score of each group of students from first to fourth year following consensus agreement between student and facilitator. The mean score of the first-year students shows a significant improvement of 36.5% when compared with that of the second-year students. There is a slight drop of 6.8% in the performance of third-year students when compared with that of the second-year students. The mean score of the fourth-year students shows a great improvement of 30.79% when compared with that of the third-year students.

The tutorial performance of the students is analysed in more depth in the next section. The inter-class correlation of scores was examined on each of the seven main-item constructs on the TPE with which the students were assessed: problem-solving skills, contributions, communication skills, critical thinking skills, learning skills, personal growth and leadership skills.

Tables and graphs represent results on the main items and the sub items computed on the Tutorial Performance Evaluator. These results span across each year of study from first to fourth year. The ANOVA test was applied to compare the different groups from first to fourth year of study versus the score attained. The purpose of the ANOVA test was to test for significant differences between the mean values of groups from first to fourth year. The Bartlett test was used to test if the samples (groups from first to fourth year) have equal variances. The Bonferroni correction test was done to carry out statistical adjustments.

6.3.1.1 Problem-solving Skills

Problem-solving skills featured top of the hierarchy and are represented by 17.38% of the total score. Within this construct there are five sub items that help to measure the students' problem-solving abilities.

The sub items are as follows:

1. Identifies possible solutions to the problem
2. Helps select a strategy to solve the problem
3. Manages to identify the problem
4. Implements a solution to the problem
5. Discusses the best solution to the problem

Table 6.1 provides a summary of the scores between the first- to fourth-year students in problem-solving skills.

Table 6.2 shows an analysis of variance in problem-solving skills.

Table 6.3 shows the comparison of problem-solving skills by year of study (Bonferroni test).

Table 6. 1: Summary of scores between first-year to fourth-year students in problem-solving skills (n=53)

Year	Mean	Std. Dev.	Frequency
1	26.544	15.356763	15
2	57.476192	22.599884	21
3	59.390001	10.66945	8
4	83.564444	19.104682	9
Total	**53.440755**	**26.630332**	**53**

The most significant observation is the steady improvement of the mean score from first- to fourth-year students. The low score achieved in first-year decreased the mean score. With the exception of the third-year students, the standard deviation is wide. This is possibly owing to the small sample and one or two outlying low marks.

Table 6. 2: Analysis of variance –- problem-solving skills

Source	SS	df	MS	F	Prob>F
Between groups	19643.5892	3	6547.86308	18.62	0.0000
Within groups	17233.4886	49	351.70385		
Total	**36877.0779**	**52**	**709.174575**		

Bartlett's test for equal variances: $chi^2(3) = 5.5073$ Prob > chi^2 =0.138

The Prob>F represents the p-value that is 0.0000. The p-value is < 0.05; therefore the results are statistically significant. One is able to refute the Ho. There is a difference in the problem-solving skills between the first-year to fourth-year students and its difference is significant at p-value of 0.0000.

Table 6. 3: Comparison of problem-solving skills by year of study (Bonferroni Test)

Row Mean- Col. Mean	1	2	3
2	30.9322 **0.000**		
3	32.846 **0.001**	1.91381 **1.000**	
4	57.0204 **0.000**	26.0883 **0.006**	24.1744 **0.044**

(p - value in bold.)

A pair-wise comparison between the groups of students from first to fourth year is shown in the above table. There is an improvement between first- and second-year students, shown by the statistically significant p-value of 0.000. Between the second- and third-year students no improvement is shown by the p-value of 1.000 that is not statistically significant. A significant difference is evident in the scores between third- and fourth-year students since the p-value of 0.044 is less than 0.05.

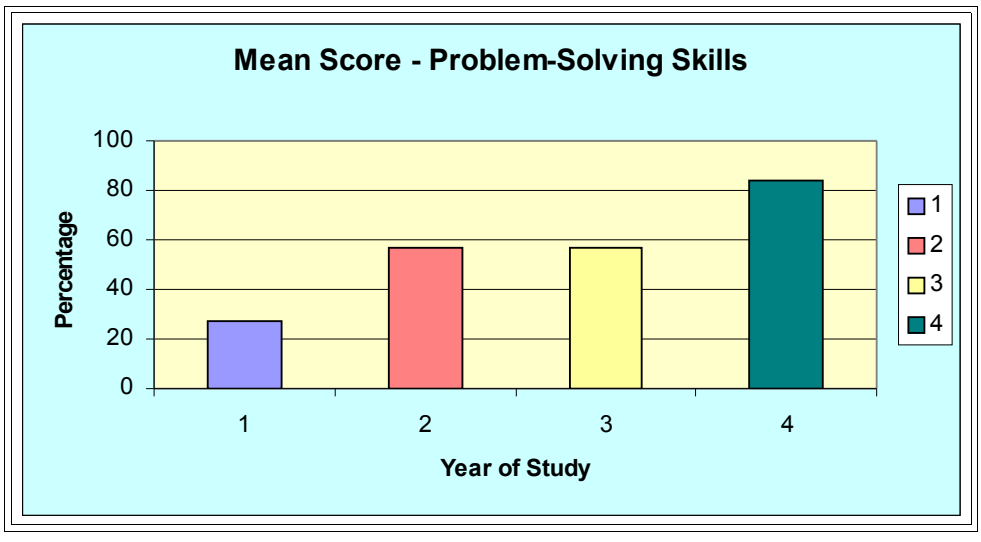


Figure 6. 6: Mean score first year to fourth year – problem-solving skills (n=53)

Figure 6.6 illustrates the mean score achieved by the students from first- to fourth-year in problem-solving skills. This graph clearly shows the improvement from first-year students with a mean score of 26.5% to 57.4% achieved by the second-years. Between the second-year students and third-year students there is a slight improvement of 2%. Fourth-year students achieve a mean score of 83.5% showing 57% improvement over the first-year students' mean score of 26.5%.

The next section will show a breakdown of each sub-item within the main-item of problem-solving skills. The breakdown is presented in a table representing the sub-items and is made up of the percentage of students who obtained a rating of 0, 1, 2 or 3 on the Likert scale from first to fourth year.

Table 6. 4 Percentage of students obtaining a 0-3 rating in problem-solving skills (n=53)

Sub item 1		**0**	**1**	**2**	**3**
	1st year		**49%**	**51%**	
Identifies possible solutions to the problem	**2nd year**	**23%**	**57%**	**20%**	
	3rd year	**12%**	**88%**		
	4th year			**33%**	**67%**
Sub item 2					
	1st year		**54%**	**46%**	
Helps select a strategy to solve the problem	**2nd year**	**5%**	**33%**	**52%**	**10%**
	3rd year	**12%**	**88%**		
	4th year		**11%**	**22%**	**67%**
Sub item 3					
	1st year		**40%**	**60%**	
Manages to identify the problem	**2nd year**	**5%**	**23%**	**52%**	**20%**
	3rd year	**12%**	**88%**		
	4th year			**22%**	**78%**
Sub item 4					
	1st year	**7%**	**53%**	**40%**	
Implements a solution to the problem	**2nd year**	**5%**	**33%**	**52%**	**10%**
	3rd year	**37%**	**63%**		
	4th year			**22%**	**78%**
Sub item 5					
	1st year	**7%**	**33%**	**60%**	
Discusses the best solution to the problem	**2nd year**	**5%**	**33%**	**52%**	**10%**
	3rd year	**50%**	**50%**		
	4th year			**22%**	**78%**

In their first year, 7% of the students showed an insufficient ability when discussing and implementing a solution to a problem. Students were rated a one (1) in all five (5) sub items as indicated in the above table, thus revealing a limited ability in their problem-solving skills. An improvement, however, is shown with 60% of the students being able to identify a problem and discuss the best solution and 40% being able to implement a solution to the problem. Further improvements were evidenced with 51% being able to identify a solution to the problem while 46% were able to select a strategy to solve the problem. None of the students rated a three (3), thereby displaying a good ability in problem-solving skills.

In second year there were students who received a rating of three (3) and, therefore, achieved the desired learning outcome that is expected of a fourth-year student. On each of the sub items students were rated zero (0), thereby displaying an insufficient ability in problem-

solving skills. On sub item 2, sub item 4, and sub item 5, 33% of the students were rated a one (1) revealing a limited ability with a further 23% showing a limited ability to identify a problem and 57% showing a limited ability to identify solutions to the problem. An improvement is shown with 52% of the students being rated two (2) on sub items 2-5 and a further 20% an improvement in identifying possible solutions to the problem.

In third year, there were students who were rated zero (0) on each of the sub items as indicated on the table, thus displaying an insufficient ability in problem-solving skills. Furthermore, 88% of the students were rated one (1) in sub items 1-3, revealing a limited ability to use their problem-solving skills. In implementing a solution to the problem, 63% showed a limited ability and 50% a limited ability in discussing the best solution to the problem.

There was a marked improvement in the fourth-year students and 74% of the students received a rating of three (3), thereby achieving the desired learning outcome that is expected of a fourth-year student. In sub item 2 through to sub item 5, 22% of the students were rated two (2) showing an improvement in their problem-solving abilities while 33% of the students displayed improved skills in identifying possible solutions to the problem. Certain students (11%) were rated one (1), manifesting a limited ability in being able to select a strategy for solving the problem.

6.3.1.2 Contributions

Students' contributions and integration of ethics, legislation and health services principles feature second on the hierarchy and are represented by 16.65% of the sum total of 100%.

Within this construct there are five sub items set out in a hierarchy relative to the given percent of each sub item.

The sub items are as follows:

1. Takes into account other disciplines when appropriate
2. Is comprehensive depending on subject learnt
3. Integrates ethics into discussion
4. Integrates legislation into discussion when appropriate
5. Integrates health service principles

Table 6.5 presents a summary of the scores of the first- to fourth-year students in contributions.

Table 6.6 shows an analysis of variance in contributions.

Table 6.7 shows the comparison of contributions by year of study (Bonferroni test).

Table 6. 5: Summary of the scores of first-year to fourth-year students in contributions (n =53)

Year	Mean	Std. Dev.	Frequency
1	15.344	10.38734	15
2	55.800477	19.276208	21
3	43.717501	13.216886	8
4	85.48	13.976387	9
Total	**47.566604**	**28.345752**	**53**

An important observation is the low mean score achieved by the first-year students. There is a decrease in the score of third-year students. Fourth-year students achieve a mean score of 85.48%. The low total mean score of 47.5% is the outcome of a poor performance in the first-year score of 15.3%. With the exception of the first-year students, the standard deviation is wide. This is possibly owing to one or two outlying low marks.

Table 6. 6: Analysis of variance – contributions

Source	SS	df	MS	F	Prob>F
Between groups	30053.5278	3	10017.8426	41.86	0.0000
Within groups	11727.5169	49	239.337081		
Total	**41781.0447**	**52**	**803.48163**		

Bartlett's test for equal variances: chi ^{2} (3) = 5.9421 Prob > chi ^{2} = 0.114

The Prob>F represents the p-value that is 0.0000. The p-value is < 0.05; therefore the results are statistically significant. One is able to refute the Ho. There is a difference in the scores between the first- to fourth-year students.

Table 6. 7: Comparison of student contributions by year of study

(Bonferroni Test)

Row Mean- Col. Mean	1	2	3
2	40.4565 **0.000**		

3	28.3735 **0.001**	-12.083 **0.396**	
4	70.136 **0.000**	29.6795 **0.000**	41.7625 **0.000**

p - value in bold

A pair-wise comparison between the groups of students from first- to fourth-year is shown in the above table. An improvement between first-year and second-year students is evident. The p-value of 0.000 is statistically significant. The difference in scores between the second- and third-year year students is not statistically significant. There is no significant difference between the ability of students to make contributions to the PBL tutorials, evidenced by the p-value of 0.396. The value is > than 0.05. An improvement is evident between third- and fourth-year students. The p-value of 0.000 is statistically significant.

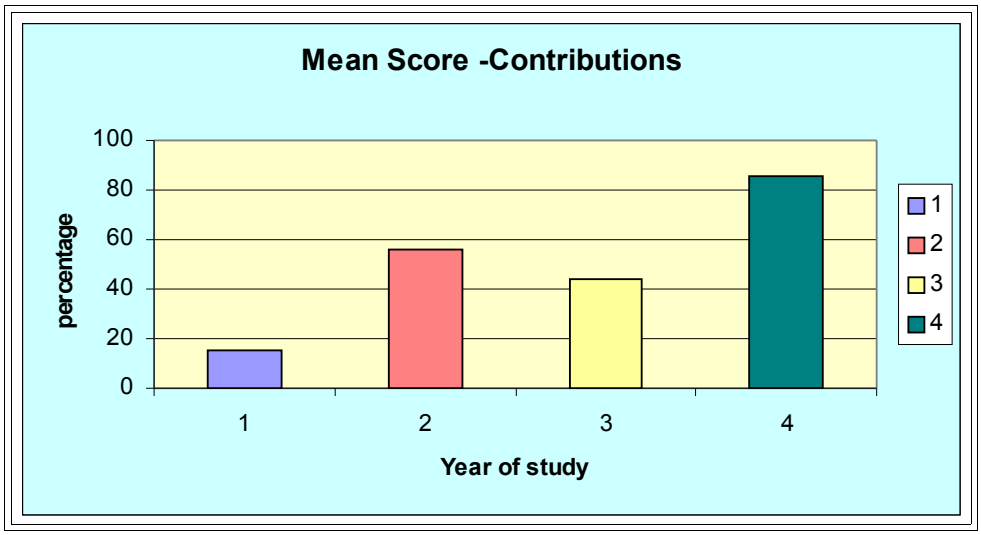


Figure 6. 7: Mean score of first to fourth year – contributions (n=53)

Figure 6.7 clearly illustrates the mean scores, represented in the graph, achieved by the students from first- to fourth-year in contributions. First-year students performed poorly with a mean score of 15.3%. There is a drop in the performance of the third-year students with a score of 43.7% as apposed to 53.8% in the second-year students. The fourth year students performed well with a mean score of 85.4%.

The next section will show a breakdown on each sub item within the main item of **c**ontributions. The breakdown is presented in a table representing the sub items and made up of the percentage of students who obtained a rating of either 0, 1, 2 or 3 on the ordinal scale from first year to fourth year.

Table 6. 8 Percentage of students obtaining a 0-3 rating in contributions (n=53)

Sub item 1		**0**	**1**	**2**	**3**
	1st year		**80%**	**20%**	
Takes into account other disciplines when appropriate	**2nd year**	**5%**	**24%**	**38%**	**33%**
	3rd year		**25%**	**75%**	
	4th year				**100%**
Sub item 2					
	1st year	**7%**	**26%**	**67%**	
Is comprehensive depending on subject learnt	**2nd year**	**5%**	**28%**	**43%**	**24%**
	3rd year		**38%**	**62%**	
	4th year				**100%**
Sub item 3					
	1st year	**7%**	**67%**	**26%**	
Integrates ethics into discussion	**2nd year**			**81%**	**19%**
	3rd year	**13%**	**74%**	**13%**	
	4th year			**11%**	**89%**
Sub item 4					
	1st year	**14%**	**60%**	**26%**	
Integrates legislation into discussion when appropriate	**2nd year**		**10%**	**86%**	**4%**
	3rd year	**13%**	**74%**	**13%**	
	4th year			**10%**	**90%**

Sub item 5 Integrates health service principles					
	1st year		**67%**	**33%**	
	2nd year			**72%**	**28%**
	3rd year	**10%**	**77%**	**13%**	
	4th year			**22%**	**78%**

In their first year, 7% of the students showed an inability to be comprehensive and integrate ethics into the discussion; 14% were unable to integrate legislation into the discussion. Students were rated a one (1) in all five (5) sub items as indicated in the above table, thus revealing a limited ability to make contributions in the tutorial sessions. However, an improvement is shown with 26% of the students being able to integrate ethics and legislature into the discussion and 20% being able to take into account other disciplines when appropriate. Furthermore, improvements were evident by 67% showing the ability to be comprehensive depending on the subject learnt and 33% being able to integrate health principles. None of the students received a rating of three (3).

In their second year, certain students were rated three (3) on sub items 1 to 5 as seen in the above table; therefore achieving the desired learning outcome that is expected of a fourth-year student. Only 5% of the students were rated zero (0), thus displaying a poor ability in being comprehensive depending on the subject learnt. On sub item 1 (24%), sub item 2 (28%), and sub item 4 (10%), students were rated a one (1) showing a limited ability in making contributions. The majority of the students received a rating of two (2) as shown in the above table, displayed an improvement in their ability to make contributions. Some students were rated a three (3) on all the sub items, therefore, achieving the desired learning outcome that is expected of a fourth-year student.

In their third year, 13% of the students were rated zero (0) and revealed an inability to integrate ethics and legislature into the discussion with 10% not being able to integrate health service principles. Furthermore, 74% showed a limited ability, by receiving a rating of one (1), for integrating ethics and legislature into the discussion with 77% revealing a limited ability for integrating health service principles. An improvement was demonstrated with 13% being able to integrate ethics, legislature and health service principles into the discussion. A further 62% showed the ability to be comprehensive whilst 75% were able to take into account other disciplines.

A marked improvement was evident in the fourth-year students as seen on the above table. In sub item 1 and sub item 2, 100% of the students were rated three (3) showing a good ability in the skill. There was an improvement in the students' ability to make contributions in the tutorial sessions, demonstrated in sub item 3 as only 11% of the students received a rating of two (2). Sub item 4 revealed 10% of the students receiving a rating of 2 and in sub item 5, 22% of the students received a rating of 2.

6.3.1.3 Communication

Communication is represented by 14.58% of the overall 100%. Within this construct there are two sub items set out in a hierarchy relative to that item's given percentage.

The sub items are as follows:

1. Demonstrates verbal skills appropriate to the situation
2. Demonstrates non-verbal skills appropriate to the situation

Table 6.9 presents a summary of the scores between the first- to fourth-year students in communication skills.

Table 6.10 shows an analysis of variance in communication skills.

Table 6.11 shows the comparison of student communication skills by year of study (Bonferroni test).

Table 6. 9: Summary of the scores between first- to fourth-year students in communication skills (n = 53)

Year	Mean	Std. Dev.	Frequency
1	35.713333	26.515071	15
2	81.382381	25.784604	21
3	64.483749	13.90781	8
4	87.464444	15.257143	9
Total	**66.939245**	**30.760294**	**53**

The most significant observation is the steady improvement of the mean score of 35.7% in first-year students to 87.4% in fourth-year students. With the exception of the third- and fourth-year students the standard deviation is wide. This is possibly owing to a number of outlying low marks.

Table 6. 10: Analysis of Variance – communication skills

Source	SS	df	MS	F	Prob>F
Between groups	22846.3406	3	7615.44688	14.16	0.0000
Within groups	26355.8355	49	537.874194		
Total	**49202.1761**	**52**	**946.195695**		

Bartlett's test for equal variances: chi ^{2} (3) = 5.6403 Prob > chi ^{2} = 0.130.

The **Prob>F** represents the p-value that is 0.0000. The p-value is < 0.05; therefore the results are statistically significant. One is able to refute the Ho. There is a difference in the communication skills between the first- to fourth-year students.

Table 6. 11: Comparison of student communication skills by year of study (Bonferroni Test)

Row Mean- Col. Mean	1	2	3
2	45.669 **0.000**		
3	28.7704 **0.040**	-16.8986 **0.514**	
4	51.7511 **0.000**	6.08206 **1.000**	22.9807 **0.218**

P - value in bold

A pair-wise comparison between the groups from first- to fourth-year students is shown in the above table. There is an improvement in communication skills between first- and second-year students. The p-value of 0.000 is statistically significant since the p-value is < than 0.05. Between the second- and third-year year students, there is no significance in the p-value of 0.514 indicating no difference in their communication skills. No significance is evident between third- and fourth-year students' scores since the p-value of 0.218 is > than 0.05. This could result from an outlying low score.

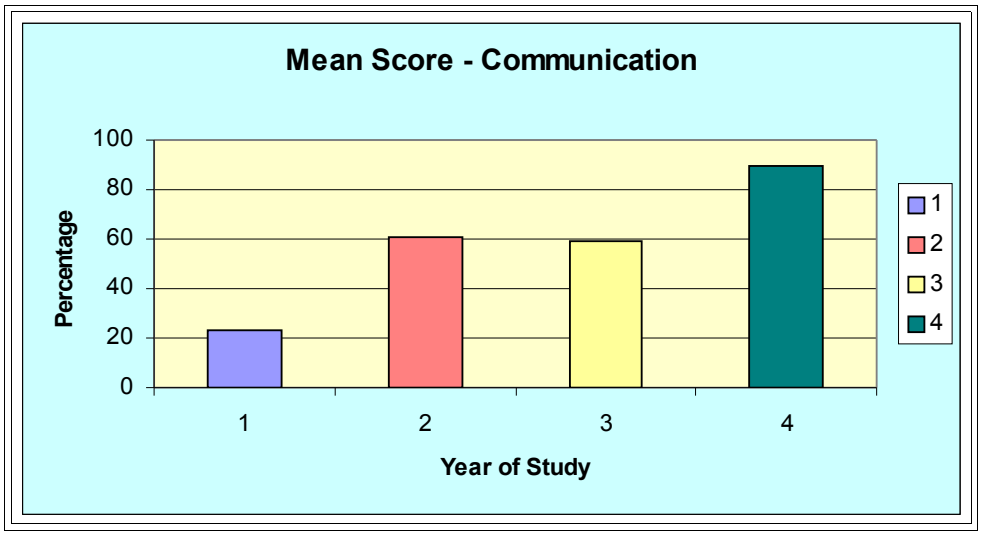


Figure 6. 8: Mean score first-year to fourth-year – communication skills (n=53)

Figure 6.8 illustrates the mean scores represented in the graph achieved by the students from first to fourth year in communication skills. First-year students performed poorly with a mean score of 35.7%. There is a drop in the performance of the third-year students with a score of 64.4% as apposed to 81.3% in the second-year students. The fourth year students performed well with a mean score of 87.4%.

The next section will show a breakdown of each sub item within the main item of communication skills. The breakdown is shown in a table representing the sub items. Each table is made up of the percentage of students who obtained a rating of either 0, 1, 2 or 3 on the ordinal scale from first year to fourth year.

Table 6. 12: Percentage of students obtaining a 0-3 rating in communication skills (n=53)

		0	1	2	3
Sub item 1 Demonstrates verbal skills appropriate to the situation.	1st year		53%	40%	7%
	2nd year		23%	23%	54%
	3rd year			87%	13%
	4th year			20%	80%
Sub item 2 Demonstrates non-verbal skills appropriate to situation.					
	1st year		53%	40%	
	2nd year		14%	19%	67%
	3rd year		25%	75%	
	4th year				100%

The majority of the first-year students showed minimal verbal and non-verbal communication skills evidenced by the 53% who were rated a one (1). Only 7% of students were rated a three (3) in verbal communication skills. The remaining 40% showed an improvement in their communication skills.

In their second year, 54% of the students were rated a three (3) in verbal communication and 67% were rated a three (3) in non-verbal communication. A group of 23% demonstrated improved skills in verbal communication and a further 23% demonstrated minimal verbal

communication skills. In non-verbal communication skills 19% showed an improvement and a further 14% minimal skills.

In their third year, 13% of the students rated three (3) in verbal communication and, therefore, met the requirements expected of a fourth year student. The majority of the students showed an improvement in their communication skills – 87% in verbal communication and 75% in non-verbal communication. A group of 25% demonstrated minimal skills in non-verbal communication.

There was a marked improvement in the fourth-year students. The majority achieved the desired learning outcome expected of a fourth-year student, achieving 100% in non-verbal communication and 80% in verbal communication. An improvement in verbal communication skills was evident in 20% of the students.

6.3.1.4 Critical Thinking Skills

The construct, critical thinking skills, is represented by 13.44% of the overall 100%. Within this construct there are four (4) sub items set out in a hierarchy relative to that item's given percentage.

The sub items are as follows:

1. Identifies a problem, question or issue.
2. Uses evidence to support an argument or position.
3. Suggests and proposes alternatives.
4. Verbally analyses the problem, question or issue.

Table 6.13 presents a summary of the scores between the first-year to fourth-year students in critical thinking skills.

Table 6.14 shows an analysis of variance in critical thinking skills.

Table 6.15 indicates the comparison of critical thinking skills by year of study (Bonferroni test).

Table 6. 13: Summary of the scores between first-year to fourth-year students in critical thinking skills (n = 53)

Year	Mean	Std. Dev.	Frequency
1	23.571333	12.707683	15
2	60.680477	24.720749	21
3	58.906251	17.485525	8
4	89.66	13.45382	9
Total	**54.79151**	**29.244772**	**53**

The most significant observation is the steady improvement of the mean score from first- to second-year students and again from third- to fourth-year students. A slight drop in score was evident between second- to third-year students. The standard deviation is wide amongst second-year students. This is possibly owing to a number of outlying low scores.

Table 6. 14: Analysis of variance – critical thinking skills

Source	SS	df	MS	F	Prob>F
Between groups	26401.9999	3	8800.66665	23.86	0.0000
Within groups	18071.349	49	368.803042		
Total	**44473.349**	**52**	**855.256712**		

Bartlett's test for equal variances: chi ^{2} (3) = 8.1345 Prob > chi ^{2} = 0.043

The Prob>F represents the p-value that is 0.0000. The p-value is < 0.05; therefore, the results are statistically significant. One is able to refute the Ho. A difference in the critical thinking skills between the first-year to fourth-year students is evident.

Table 6. 15: Comparison of students' critical thinking skills by year of study

(Bonferroni Test)

Row Mean- Col. Mean	1	2	3
2	37.0091 **0.000**		
3	35.3349 **0.001**	-1.67423 **1.000**	
4	66.0887 **0.000**	29.0795 **0.002**	30.7537 **0.011**

p-value in bold

A pair-wise comparison between the first- to fourth-year student groups is shown in the above table. There is an improvement between first-year and second-year students. The p-value of 0.000 is statistically significant since the p-value is < than 0.05. Between the second- and third-year year students there is no significance in the p-value of 1.000 indicating that there is no improvement in the critical thinking skills. Between the third- and fourth-year students, the p-value =0.011 and is < than 0.05; therefore showing statistical significance. An improvement is visible in their scores.

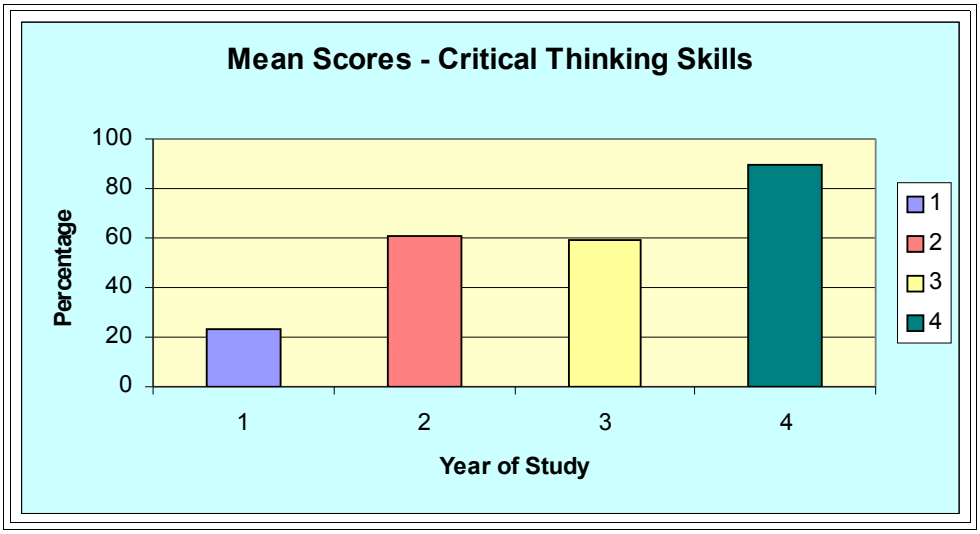


Figure 6. 9: Mean scores first year to fourth year –- critical thinking skills (n=53)

Figure 6.9 illustrates the mean score achieved by the students from first to fourth year in critical thinking skills. There is a substantial improvement in the mean scores from first year 23.5% to second year 60.6%. In third year the mean score drops slightly to 58.9%. The fourth-year mean score improves to 89.6%.

The next section will show a breakdown on each sub item within the construct: critical thinking kills. The breakdown is demonstrated in a table representing the sub items. Each table is made up of the percentage of students who obtained a rating of either 0, 1, 2 or 3 on the ordinal scale from first to fourth year.

Table 6. 16: Percentage of students obtaining a 0-3 rating in critical thinking skills (n=53)

Sub item 1		**0**	**1**	**2**	**3**
	1st year		**53%**	**47%**	
Identifies a problem, question or issue.	**2nd year**		**24%**	**57%**	**19%**
	3rd year		**13%**	**50%**	**37%**
	4th year			**22%**	**78%**
Sub item 2					
	1st year	**13%**	**67%**	**20%**	
Uses evidence to support an argument or position.	**2nd year**		**24%**	**67%**	**9%**
	3rd year		**25%**	**25%**	**50%**
	4th year				**100%**
Sub item 3					
	1st year	**20%**	**73%**	**7%**	
Suggests and proposes alternatives.	**2nd year**		**32%**	**54%**	**14%**
	3rd year		**37%**	**24%**	**37%**
	4th year				**100%**
Sub item 4					
	1st year		**53%**	**47%**	
Verbally analyses the problem, question or issue.	**2nd year**		**24%**	**62%**	**14%**
	3rd year		**37%**	**24%**	**37%**
	4th year			**22%**	**78%**

In first year, 47% of the students showed an improvement in identifying and analysing a problem, question or issue while 53% revealed a limited ability. In using evidence to support an argument, 13% lacked critical thinking skills with a further 67% showing a limited ability and 20% revealing an improvement. In suggesting and proposing alternatives, 20% lacked critical thinking skills, 73% registered a limited ability with a further 7% demonstrating an improvement.

In second year, certain students were rated three (3) on all the sub items as seen in the above table; therefore achieving the desired learning outcome expected of a fourth-year student. On sub item 1 (24%), sub item 2 (24%), sub item 3 (32%) and sub item 4 (24%), students were rated a one (1) showing a limited ability in critical thinking skills. From 54% to 67% of the students revealed an improvement in their critical thinking skills.

In third year, 37% of the students evinced a limited ability to verbally analyse the problem or suggest alternatives to solving the problem. A further 25% showed a limited ability to use evidence in supporting an argument and 13% had limited abilities in identifying a problem, question or issue. From 24% to 50% of the students were rated two (2) in all the sub items, demonstrating an improvement in their critical thinking skills. Certain students were rated three (3) on all the sub items as seen in the above table; therefore achieving the desired learning outcome expected of fourth-year students.

The fourth-year students revealed a marked improvement. The majority achieved the desired learning outcome expected of a fourth-year student, attaining 100% in sub items 2 and 3. There was an improvement in 22% of the students relating to their ability to identify and analyse a problem, question or issue.

6.3.1.5 Learning Skills

Learning skills is represented by 13.21% of the overall 100%. Within this construct there are three (3) sub items set out in a hierarchy relative to that item's given percentage.

The sub items are as follows:

1. Should be able to use more than one resource.
2. Demonstrates ability to understand concepts and theories.
3. Is able to interpret a learning objective.

Table 6.17 presents a summary of the scores between the first- to fourth-year students in learning skills.

Table 6.18 shows an analysis of variance in learning skills.

Table 6.19 indicates the comparison of learning skills by year of study (Bonferroni test).

Table 6. 17: Summary of the scores between first-year to fourth-year students in learning skills (n = 53)

Year	Mean	Std. Dev.	Frequency
1	26.114667	13.973888	15
2	67.432856	20.404553	21
3	59.6075	13.014573	8
4	91.981111	11.270307	9
Total	**58.726415**	**27.999424**	**53**

The most significant observation is the steady improvement of the mean score from first- to second-year students and again from third- to fourth-year students. A slight drop in score between second- to third-year students is evident. The standard deviation is wide amongst second-year students. This is possibly owing to a number of outlying low scores.

Table 6. 18: Analysis of variance – learning skills

Source	SS	df	MS	F	Prob>F
Between groups	27503.8202	3	9167.94008	33.87	0.0000
Within groups	13262.5016	49	270.663298		
Total	**40766.3218**	**52**	**783.967728**		

Bartlett's test for equal variances: chi ^{2} (3) = 5.0832 Prob >chi ^{2} =0.166

The Prob>F represents the p-value that is 0.0000. The p-value is < 0.05; therefore the results are statistically significant. One is able to refute the Ho. There is a difference in the scores between the first- to fourth-year students

Table 6. 19: Comparison of learning skills by year of study

Row Mean- Col. Mean	1	2	3
2	41.3182 **0.000**		
3	33.4928 **0.000**	-7.82536 **1.000**	
4	65.8664 **0.000**	24.5483 **0.003**	32.3736 **0.001**

P - value in bold

A pair-wise comparison between the groups from first- to fourth-year students is shown in the above table. An improvement in the learning skills between first- and second-year students is evident. The difference between first- and second-year students is statistically significant since the p-value is < than 0.05. Between the second- and third-year year students there is no significance in the p-value of 1.000 indicating that there is no improvement in the learning skills. Between the third- and fourth-year students the p-value =0.001 and is <than 0.05; therefore showing statistical significance.

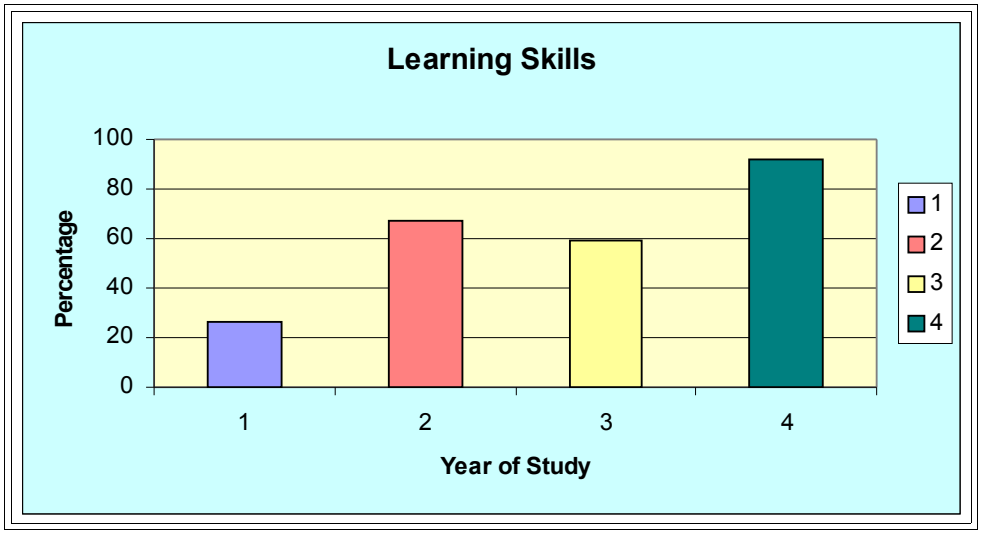


Figure 6.10: Mean score first year to fourth year – learning skills (n=53)

Figure 6.10 illustrates the mean score achieved by the students from first to fourth year in learning skills. There is a substantial improvement in the mean scores from first year 26.1% to second-year 67.4%. In third year, the mean score drops to 59.6%. The fourth year mean score improves to 91.9%.

The next section will show a breakdown on each sub item within the construct: learning skills. The breakdown is shown in a table representing the sub items. Each table is made up of the percentage of students who obtained a rating of 0, 1, 2 or 3 on the Likert scale from first to fourth year.

Table 6. 20 Percentage of students obtaining a 0-3 rating in learning skills (n=53)

		0	1	2	3
Sub item 1 Should be able to use more than one resource.	1st year	14%	12%	60%	14%
	2nd year	5%	19%	38%	38%
	3rd year		12%	75%	13%
	4th year			11%	89%
Sub item 2 Demonstrates ability to understand concepts and theories.					
	1st year		40%	60%	
	2nd year	5%	19%	66%	10%
	3rd year		38%	62%	
	4th year			10%	90%
Sub item 3 Is able to interpret a learning objective.					
	1st year	14%	46%	40%	
	2nd year		24%	62%	14%
	3rd year		25%	75%	
	4th year			11%	89%

In first year, 14% of students showed an inability to use resources and to interpret objectives. A further 12% revealed a limited ability to use more than one resource while a further 60% showed an improvement. Among the students, 14% rated three (3) in sub item 1 and, therefore, met the requirements expected of a fourth-year student. Furthermore, 40% of the students demonstrated a limited ability to understand concepts and theories while 60% showed an improvement. The inability to interpret a learning objective was manifested by 46% of the students with 40% showing an improvement.

In second year, certain students were rated three (3) on all the sub items as seen in the above table; therefore achieving the desired learning outcome expected of a fourth-year student. In the ability to interpret concepts and theories and to use more than one resource, 5% were rated zero (0). On sub item 1 (19%), sub item 2 (19%) and sub item 3 (24%) students were rated a one (1) showing limited learning skills ability. From 38% to 62% of the students revealed an improvement in their learning skills as demonstrated in the above table.

In third year, while 12% of the students showed an inability to use resources, 75% demonstrated an improvement and 13% were rated a three (3). A further 38% revealed a

limited ability to understand concepts and theories while 62% showed an improvement. Of the students, 25% were unable to interpret a learning objective while 75% registered an improvement in their learning skills.

There was a marked improvement in the fourth-year students with 89% rated a three (3), thus showing an ability to use resources and interpret a learning objective, with 11% demonstrating an improvement. A further 90% were rated a three (3), thus showing an ability to understand concepts and theories while 10% of the students manifested an improvement.

6.3.1.6 Personal Growth

Personal growth is represented by 13.16% of the overall 100%. Within this construct there are eight (8) sub items set out in a hierarchy relative to that item's given percentage.

The following are the sub items:

1. Displays active listening.
2. Presents constructive interventions and feedback.
3. Shows ability to brainstorm.
4. Acknowledges contributions from group members.
5. Offers encouragement and support to group members.
6. Able to summarize discussion.
7. Willing to work with group members.
8. Assists and manages ground rules for the group.

Table 6.21 presents a summary of the scores between the first- to fourth-year students in personal growth.

Table 6.22 shows an analysis of variance in personal growth.

Table 6.23 indicates the comparison of personal growth by year of study (Bonferroni test).

Table 6. 21: Summary of the scores between first-year to fourth-year students in personal growth (n = 53)

Year	Mean	Std. Dev.	Frequency
1	35.092	14.894285	15
2	67.06762	20.192535	21
3	56.558751	14.635079	8
4	93.421111	5.3639947	9
Total	**60.906793**	**25.362374**	**53**

The most significant observation is the improvement of the mean score from first- to second-year students and again from third- to fourth-year students. An 11% drop in score by third-year students is evident. The standard deviation is wide amongst first-year, second-year and third-year students. This is possibly owing to a number of outlying low marks.

Table 6. 22: Analysis of variance – personal growth

Source	SS	df	MS	F	Prob>F
Between groups	20458.9964	3	6819.66545	25.72	0.0000
Within groups	12990.004	49	265.102123		
Total	33449.0004	52	643.250007		

Bartlett's test for equal variances: chi ^{2} (3) = 12.6251 Prob >chi ^{2} =0.006

The Prob>F represents the p-value that is 0.0000. The p-value is < 0.05; therefore the results are statistically significant. One is able to refute the Ho. A difference in the scores between the first- to fourth-year students is evident.

Table 6. 23: Comparison of personal growth by year of study

Row Mean- Col. Mean	1	2	3
2	31.9756 **0.000**		
3	21.4668 **0.025**	-10.5089 **0.760**	
4	58.3291 **0.000**	26.3535 **0.001**	36.8624 **0.000**

P-value in bold

A pair-wise comparison between the groups from first- to fourth-year students is shown in the above table. An improved personal growth between first-year and second-year students is evident. The difference is statistically significant since the p-value is < than 0.05. Between the second- and third-year year students there is no significance in the p-value of 0.760 indicating no improvement in personal growth. Between the third- and fourth-year students the p-value =0.000 and is <than 0.05; therefore showing statistical significance and evidence of personal growth.

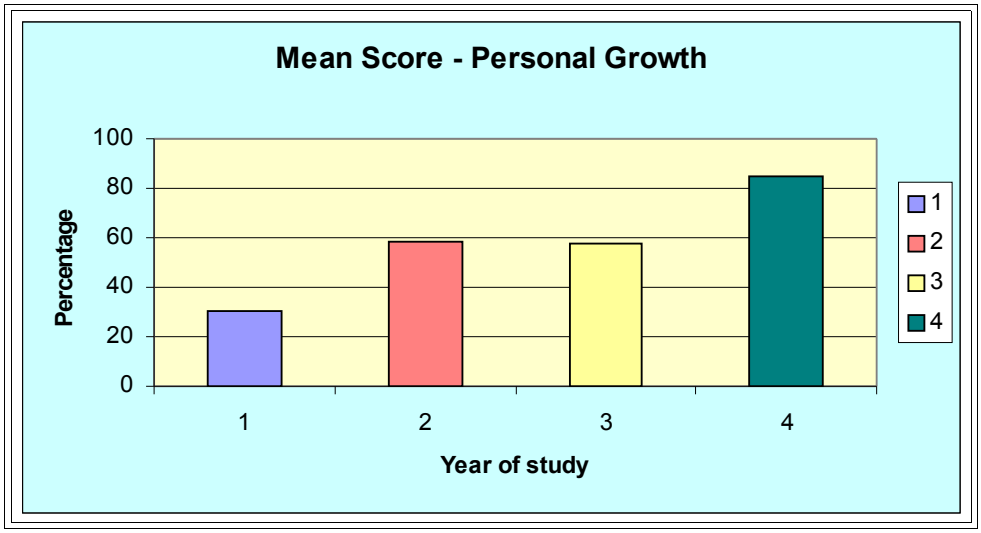


Figure 6. 11: Mean score first year to fourth year – personal growth (n=53)

Figure 6.11 illustrates the mean score achieved by the students from first to fourth year in personal growth. A substantial improvement in the mean scores from first year 35.0% to second year 67.0% is apparent. In third year the mean score drops to 56.5%. The fourth-year mean score improves to 93.4%.

The next section will show a breakdown on each sub item within the construct, personal growth. The breakdown is shown in a table representing the sub items. The table is made up of the percentage of students who obtained a rating of either 0, 1, 2 or 3 on the Likert scale from first to fourth year.

Table 6. 24 Percentage of students obtaining a 0-3 rating in personal growth (n=53)

Sub item 1		**0**	**1**	**2**	**3**
Displays active listening.	**1st year**		**40%**	**60%**	
	2nd year		**10%**	**28%**	**62%**
	3rd year		**12%**	**75%**	**13%**
	4th year			**10%**	**90%**
Sub item 2					
Presents constructive interventions and feedback.	**1st year**	**14%**	**53%**	**33%**	
	2nd year		**19%**	**53%**	**28%**
	3rd year		**25%**	**75%**	
	4th year				**100%**
Sub item 3					
Shows ability to brainstorm.	**1st year**		**40%**	**60%**	
	2nd year		**24%**	**43%**	**33%**
	3rd year		**38%**	**12%**	**50%**
	4th year				**100%**

Sub item 4 Acknowledges contributions from group members.					
	1st year	**7%**	**14%**	**65%**	**14%**
	2nd year		**14%**	**76%**	**10%**
	3rd year		**38%**	**62%**	
Sub item 5 Offers encouragement and support to group members.					
	1st year		**53%**	**47%**	
	2nd year		**24%**	**67%**	**9%**
	3rd year		**38%**	**50%**	**12%**
	4th year				**100%**
Sub item 6 Able to summarize discussion.					
	1st year		**26%**	**74%**	
	2nd year		**19%**	**53%**	**14%**
	3rd year		**38%**	**62%**	
	4th year				**100%**
Sub item 7 Willing to work with group members.					
	1st year		**26%**	**74%**	
	2nd year		**19%**	**53%**	**28%**
	3rd year		**16%**	**23%**	**15%**
	4th year			**10%**	**90%**
Sub item 8 Assists and manages ground rules for the group.					
	1st year		**35%**	**65%**	
	2nd year		**19%**	**62%**	**19%**
	3rd year		**23%**	**77%**	
	4th year				**100%**

In first year, 14% of the students showed an inability with 53% revealing a limited ability and 33% an improvement in presenting constructive feedback and interventions. A small number (7%) were unable to acknowledge contributions from group members, with 14% showing a limited ability, 65% an improvement and 14% rating a three (3). Furthermore, 40% of the students demonstrated a limited ability to display active listening with 60% evincing an improvement. Limited ability to offer encouragement and support to the group members was evident in 53% of the students with 47% showing an improvement. A further 26% displayed a limited ability to summarize a discussion and work with group members whilst 74% improved. In assisting and managing ground rules, 35% revealed a limited ability to work within a team and 65% an improvement.

In second year, certain students were rated three (3) on all the sub items as seen in the above table; therefore achieving the desired learning outcome expected of a fourth-year student. On sub item 2, sub item 6, sub item 7, and sub item 8, 19% of the students were rated a one (1)

revealing a limited ability to function within a team whilst 10% displayed limited active-listening ability. A further 24% showed a limited ability to brainstorm or to offer encouragement to group members with 14% displaying a limited ability to acknowledge contributions from group members. From 28% to 76% of the students showed an improvement in their personal growth as indicated in the above table.

In third year from 12% to 38% of the students showed limited personal growth in all of the sub items with 12% to 75% improving. In sub items 2, 4, 6, 8, students were rated a three (3). A marked improvement was seen in the fourth-year students with 100% rated a three (3) on sub items 2, 3, 5, 6, 8, thus being able to work effectively in groups. In the remaining items, 11% registered an improvement. A further 90% were rated a three (3), thus showing an ability to understand concepts and theories with 10% of the students revealing an improvement.

A marked improvement was evident in the fourth-year students. The majority met the requirement expected of fourth-year students.

6.3.1.7 Leadership Skills

Leadership skills are represented by 11.58% of the overall 100%. Within this construct there are seven (7) sub items set out in a hierarchy relative to that item's given percentage.

The following are the sub items:

1. Offers facts, suggestions and opinions to group members.
2. Identifies learning issues.
3. Initiates the undertaking of tasks.
4. Shows a caring attitude.

5. Drives the process forward.
6. Takes decisions.
7. Shows assertiveness.

Table 6.25 presents a summary of the scores between the first- to fourth-year students in leadership skills.

Table 6.26 shows an analysis of variance in leadership skills.

Table 6.27 indicates the comparison of leadership skills by year of study (Bonferroni test).

Table 6. 25: Summary of the scores between first-year to fourth-year students in leadership skills (n = 53)

Year	Mean	Std. Dev.	Frequency
1	30.330667	10.765587	15
2	58.65923	24.56615	21
3	57.403749	13.775025	8
4	84.493334	17.505596	9
Total	**54.839245**	**27.246269**	**53**

The most significant observation is the steady improvement of the mean score from first- to second-year students and again from third- to fourth-year students. The score of third- year students drops slightly. The standard deviation is wide amongst second-year students. This is possibly owing to a number of outlying low marks.

Table 6. 26: Analysis of variance – leadership skills

Source	SS	df	MS	F	Prob>F
Between groups	17283.4394	3	5761.14647	13.24	0.0000
Within groups	21319.239	49	435.08651		
Total	**38602.6784**	**52**	**742.3592**		

Bartlett's test for equal variances: chi ^{2} (3) = 3.4354 Prob >chi ^{2} =0.329

The Prob>F represents the p-value that is 0.0000. The p-value is < 0.05; therefore the results are statistically significant. One is able to refute the Ho. A difference in the scores between the first and fourth-year students is apparent.

Table 6. 27: Comparison of leadership skills by year of study

Row Mean- Col. Mean	1	2	3
2	28.3289 0.001		
3	27.0731 0.028	-1.25577 1.000	
4	54.1627 0.000	25.8338 0.019	27.0896 0.041

A pair-wise comparison between the groups from first- to fourth-year students is shown in the above table. There is an improvement between first- and second-year students. The difference is statistically significant since the p-value is < than 0.05. Between the second- and third-year year students there is no significance in the p-value of 1.000 indicating that there is no improvement in personal growth. Between the third- and fourth-year students the p-value =0.041 and is <than 0.05; therefore showing statistical significance. Their leadership skills have improved.

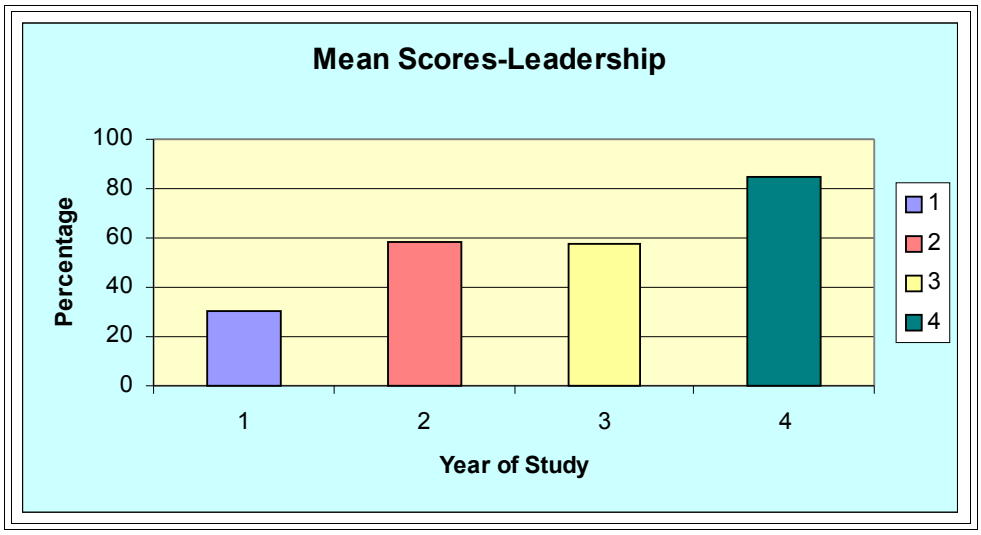


Figure 6. 12: Mean score first- to fourth-year students – leadership skills (n=53)

Figure 6.12 illustrates the mean score achieved by first- to fourth-year students in leadership skills. A substantial improvement in the mean scores from first year 30.3% to second year 58.6% is visible. In third year the mean score drops to 57.4%. The fourth-year mean score improves to 84.4% in leadership skills.

The next section shows a breakdown on each sub item within the construct leadership. The breakdown is displayed in a table representing the sub items and made up of the percentage of students that obtained a rating of 0, 1, 2 or 3 on the Likert scale from first to fourth year.

Table 6. 28 Percentage of students obtaining a 0-3 rating in leadership skills (n=53)

Sub item 1 Offers facts, suggestions, opinions to group members.		**0**	**1**	**2**	**3**
	1st year	**7%**	**53%**	**40%**	
	2nd year	**10%**	**28%**	**52%**	**10%**
	3rd year		**25%**	**50%**	**25%**
	4th year			**56%**	**44%**
Sub item 2 Identifies learning issues.					
	1st year	**14%**	**40%**	**46%**	
	2nd year	**4%**	**14%**	**78%**	**4%**
	3rd year		**25%**	**62%**	**13%**
	4th year			**56%**	**44%**
Sub item 3 Initiates the undertaking of tasks.					
	1st year	**7%**	**67%**	**26%**	
	2nd year	**10%**	**28%**	**58%**	**4%**
	3rd year		**37%**	**50%**	**13%**
	4th year			**67%**	**33%**
Sub item 4 Shows a caring attitude.					
	1st year	**14%**	**20%**	**66%**	
	2nd year	**4%**	**19%**	**63%**	**14%**
	3rd year		**50%**	**50%**	
	4th year			**67%**	**33%**
Sub item 5 Drives the process forward.					
	1st year	**8%**	**46%**	**46%**	
	2nd year	**19%**	**19%**	**52%**	**10%**
	3rd year		**37%**	**63%**	
	4th year			**56%**	**44%**
Sub item 6 Takes decisions.					
	1st year	**14%**	**26%**	**60%**	
	2nd year	**19%**	**38%**	**33%**	**10%**
	3rd year		**50%**	**50%**	
	4th year			**56%**	**44%**
Sub item 7 Shows assertiveness.					
	1st year	**14%**	**33%**	**53%**	
	2nd year	**4%**	**38%**	**44%**	**14%**
	3rd year		**50%**	**50%**	
	4th year			**67%**	**33%**

In first year, an average of 11% of the students showed poor leadership skills by obtaining a rating of 0 in all of the sub items whilst an average of 41% of the students displayed limited leadership skills. An average of 48% of the students demonstrated an improvement in their leadership skills. Amongst the second-year students an average of 10% showed poor leadership skills. This is 1% better than the first-year score. However, an average of 10% of the students received a rating of three (3), thus displaying good leadership skills. None of the third-year students showed poor leadership skills and an average of 7% of the students received a rating of three (3), thus revealing good leadership skills. Amongst the fourth-year students, an average of 39% displayed good leadership skills with 61% improving their leadership skills.

6.3.2 Reliability between Facilitator and Student

The variables described are clearly defined as the facilitator score, student score and the final score that was obtained following consensus between student and facilitator. The facilitator and student scores constituted the data from which the correlation coefficients between facilitator and student were carried out. The data are presented in tables representing the facilitator assessment data and the student self-assessment data for each year of study. A further table describes the Spearman Rank Order correlation between facilitator and student scores for each year of study. Graphs present the computed score obtained by the students on the performance evaluation, following consensus between student and facilitator for each year of study.

Table 6.29 and Table 6.30 show a comparison of statistics between the facilitator assessments and the first-year students' self-assessments.

Table 6. 29: Results of first-year/facilitator assessments (n = 15)

FACILITATOR A				
Percentiles	Percentage	Smallest	Observations	15
1%	2.53	2.53	Sum of Wgt	15
5%	2.53	4.73	Mean	22.672
10%	4.73	5.98	Std. Dev.	16.65788
25%	8.24	8.24	Variance	277.485
50%	16.38		Skewness	.4588686
		Largest	Kurtosis	1.76307
75%	39.47	39.47		
90%	49.84	42.73		
95%	49.89	49.84		
99%	49.89	49.89		

Table 6. 30: Results of first-year student self-assessments (n = 15)

STUDENTS				
Percentiles	Percentage	Smallest	Observations	15
1%	33.56	33.56	Sum of Wgt	15
5%	33.56	34.55	Mean	49.35429
10%	34.55	35.41	Std. Dev.	10.98784
25%	43.94	43.94	Variance	120.7327
50%	48.725		Skewness	.2047903
		Largest	Kurtosis	2.221767
75%	56.56	56.56		
90%	66.46	56.78		
95%	68.95	66.46		
99%	68.95	68.95		

The 50th percentile represents a score at the centre of the rank-ordered scores, also referred to as the median. It is a precise measure of central tendency. The difference between the 50th percentile on the facilitator statistics (16.3%) and the students' statistics (48.7%) is large. The lowest score in the facilitator statistics is 2.53% while the lowest score in the student statistics is 33.56%. In the facilitator statistics the highest score is 49.89% while the highest student-statistics score is 68.95%. This is a clear indication of the tendency of students, who are inexperienced in carrying out self-assessments, to overrate themselves.

The Standard Deviation (SD) provides a measurement that shows the average deviation of scores from the mean score. There is a greater SD in facilitator scores (16.6%) as apposed to the students' SD (10.9%).

The mean value of the sum of all the scores divided by the number of scores is 22.6% in the facilitator statistics and 49.3% in the student statistics, again representing the higher scores within the student statistics. Both the facilitator and student mean scores illustrate the poor performance amongst the first-year students.

Results of Spearman's Rho = 0.3964 and is positive, representing a 39% correlation between facilitator and student scores in the first year. This is not a statistically significant Rho since the p-value of 0.1435 is greater than 0.05. The difference between the facilitator and student scores is not significant

Table 6.31 and Table 6.32 show a comparison of statistics between the facilitator assessments and the second-year student self-assessments.

Table 6. 31: Results of second-year facilitator assessments (n = 21)

FACILITATORS B and C				
Percentiles	Percentage	Smallest	Observations	21
1%	6.15	6.15	Sum of Wgt	21
5%	30.56	30.56	Mean	62.25905
10%	36.27	36.27	Std. Dev.	21.62017
25%	46.44	41.04	Variance	467.4317
50%	69.46		Skewness	-.8885169
		Largest	Kurtosis	3.20856
75%	78.44	83.62		
90%	83.68	83.68		
95%	84.26	84.26		
99%	91.10	91.10		

Table 6. 32: Results of second-year student self-assessments (n = 21)

STUDENTS				
Percentiles	Percentage	Smallest	Observations	21
1%	29.13	29.13	Sum of Wgt	21
5%	50.14	50.14	Mean	69.17571
10%	52.28	52.28	Std. Dev.	13.50976
25%	67.82	54.40	Variance	182.5137
50%	72.16		Skewness	-1.331455
		Largest	Kurtosis	4.837398
75%	75.48	81.04		
90%	82.44	82.44		
95%	84.71	84.71		
99%	87.42	87.42		

In the second-year statistics there is a 2.7% difference at the 50th percentile between the facilitator statistics (69.46%) and the student statistics (72.16%). The lowest score on the facilitator statistics is 6.15% and the lowest score in the student statistics is 29.13%. In the facilitator statistics, the highest score is 91.10% while the highest score in the student statistics is 87.42%. These results show a different trend. The student with the lowest score on the facilitator statistics has overrated him or herself by 23% while the student with the top score on the facilitator assessment has underrated him or herself by 4%. The students at the 50th percentile and above have shown a discrepancy of a small percentage above or below the facilitator percentage.

On the 5th percentile there is a difference of 2.7% in favour of the student. On the 75th percentile a difference of 2.9% in favour of the facilitator was seen. The 90th percentile shows a 1.82% difference in favour of the facilitator and the 95th percentile shows a .45% difference in favour of the student. These results make it clear that students obtaining the higher scores rate themselves similar to the facilitator ratings.

The mean facilitator score is 62.25% and student score 69.17%. Those students below the 50th percentile overrated themselves by 20% – 23% and this created the 6.92% difference in favour of the students in the mean score.

There is a greater SD in the facilitator score (21.6%) as apposed to the student SD (13.5%). This indicates that there is a greater number of lower scores on the facilitator assessment of second-year students.

The above tables illustrate the improvement in the performance of the second-year students. There is a closer correlation between the facilitator assessment scores and the student self-assessment scores particularly in the students with the higher percentages.

In the second-year Spearman Rank Order Correlation Coefficient test there are 21 pairs of observations. Each pair represents the facilitator assessment score and the student self-assessment score. Spearman's Rho = 0.5247 and is positive, representing a 52% correlation between facilitator and student scores. This is a statistically significant Rho since the p-value of 0.0146 is less than 0.05. Therefore, there is a significant correlation between the facilitator and second-year student scores.

Table 6.33 and Table 6.34 show a comparison of statistics between the facilitator assessments and the third-year student self-assessments.

Table 6. 33: Results of third-year facilitator assessments (n = 8)

FACILITATOR - D				
Percentiles	Percentage	Smallest	Observations	8
1%	40.44	40.44	Sum of Wgt	8
5%	40.44	44.46	Mean	58.42
10%	40.44	52.78	Std. Dev.	11.40065
25%	48.62	58.23	Variance	129.9749
50%	62.565		Skewness	-.5413843
		Largest	Kurtosis	1.711417
75%	67.615	66.90		
90%	69.32	67.61		
95%	69.32	67.62		
99%	69.32	69.32		

Table 6. 34: Results of third-year student self-assessments (n = 8)

STUDENTS				
Percentiles	Percentage	Smallest	Observations	8
1%	52.45	52.45	Sum of Wgt	8
5%	52.45	56.98	Mean	61.90625
10%	52.45	59.32	Std. Dev.	5.455718
25%	58.15	62.24	Variance	29.76486
50%	62.885		Skewness	-.4297621
		Largest	Kurtosis	2.203477
75%	65.915	63.53		
90%	68.90	64.47		
95%	68.90	67.36		
99%	68.90	68.90		

A difference of 0.32% between the 50th percentile on the facilitator statistics 62.56% and the student statistics 62.88% is evident. The lowest score on the facilitator statistics is 40.44% while the lowest student score is 52.45%. In the student statistics, the highest score is 68.90% and the highest facilitator score is 69.32%. The student with the lowest score on the facilitator statistics has overrated him or herself by 12% while the student with the top score underrated him or herself by 0.4%. All the students above the 50th percentile underrated themselves between .42% – 1.7% while the students below the 50th percentile overrated themselves by between 9.53% – 12.01%. There is an improvement in the ability of the third-

year students to carry out a self-assessment as the scores between the facilitator and student assessments show less of a discrepancy than those of the second-year students.

The mean value is 58.42% in the facilitator statistics and 61.90% in the student statistics, again representing a slightly higher score within the student statistics owing to the students below the 50th percentile who have overrated themselves.

There is a greater SD in the facilitator score (11.40%) as apposed to that in the student score (5.4%). This indicates a larger number of lower scores on the facilitator assessment of third-year students. The student SD indicates more consistency with the scores. There are no outlying low or high scores.

The above tables illustrate the improvement in the performance of the third-year students in their assessment ability. A closer correlation between the facilitator assessment scores and the third-year student self-assessment scores is apparent.

There are eight pairs of observations representing the facilitator-assessment scores and the student self-assessment scores in the third-year Spearman Rank Order Correlation Coefficient test. Spearman's Rho = -0.1667 shows a weak negative relationship. This is not a statistically significant Rho since the p-value of 0.6932 is greater than 0.05. One can, therefore, conclude that there is a weak correlation between the facilitator assessment scores and the student assessment scores.

Table 6.35 and Table 6.36 show a comparison of statistics between the facilitator assessments and the fourth-year student self-assessments.

Table 6. 35: Results of fourth-year facilitator assessment (n = 9)

FACILITATOR -E				
Percentiles	Percentage	Smallest	Observations	9
1%	70.88	70.88	Sum of Wgt	9
5%	70.88	75.30	Mean	87.98889
10%	70.88	78.65	Std. Dev.	10.69627
25%	78.65	88.06	Variance	114.4101
50%	91		Skewness	-.4180397
		Largest	Kurtosis	1.767192
75%	95.78	92.53		
90%	100	95.48		
95%	100	100		
99%	100	100		

Table 6. 36: Results of fourth-year student self-assessment (n = 9)

STUDENTS				
Percentiles	Percentage	Smallest	Observations	9
1%	67.06	67.06	Sum of Wgt	9
5%	67.06	74.07	Mean	87.36
10%	67.06	80.47	Std. Dev.	11.38669
25%	80.47	87.55	Variance	129.6567
50%	90.30		Skewness	-.586933
		Largest	Kurtosis	2.150253
75%	93.45	93.34		
90%	100	93.45		
95%	100	100		
99%	100	100		

There is a 0.7% difference between the 50th percentile on the facilitator statistics (91%) and the student statistics (90.30%). The lowest score on the facilitator statistics is 70.88% and in the student statistics the lowest score is 67.06%. The highest score in the student and facilitator statistics is 100%. The student with the lowest score on the facilitator statistics has underrated him or herself by 3.8% whilst the top score was the same for both facilitator and student. A comparison of the above scores clearly shows the ability of the students to carry out a reliable self-assessment although, with the exception of the students with the highest marks, the remainder underrated themselves.

The mean score is 87.98% in the facilitator statistics and 87.36% in the student statistics. The difference is 0.62%.

There is a small SD in the facilitator score (10.69%) as apposed to the SD in the student scores (11.38%). This indicates that there are no outlying low scores and most of the scores are high.

The above tables illustrate the improvement in the tutorial performance of the fourth-year students and the improvement in their assessment ability. A significant correlation is evident between the facilitator assessment scores and the student self-assessment scores.

Nine pairs of observations represent the facilitator assessment scores and the student assessment scores. Spearman's Rho = 0.9406 indicates a strong positive correlation between facilitator and student scores. This is a statistically significant Rho since the p- value of 0.0001 is less than 0.05. One can conclude that there is a correlation between the facilitator and fourth-year student scores.

Figure 6.13 represents a correlation between the mean scores on the facilitator assessment and the student self-assessment. This graph illustrates the improvement in self-assessment skills from first to fourth year of study.

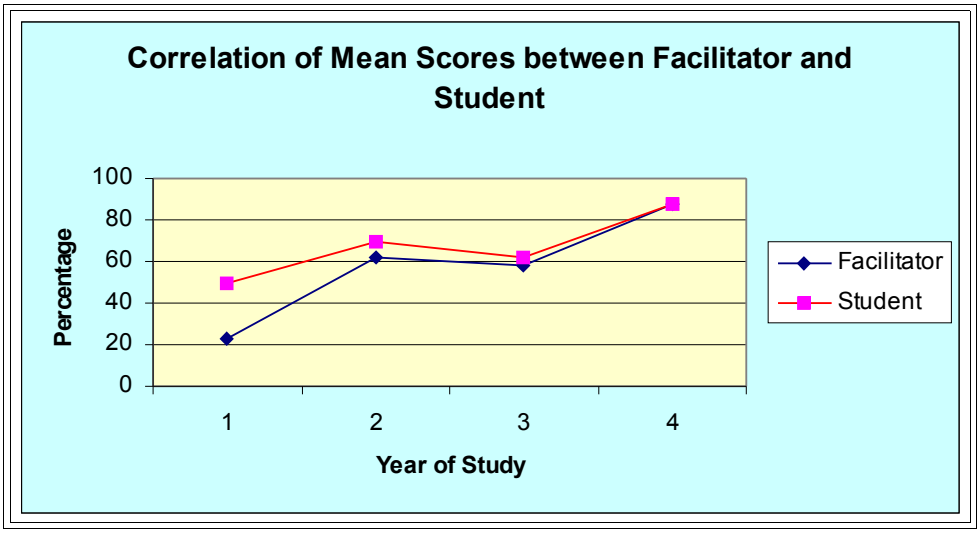


Figure 6. 13 Correlation of mean scores between facilitator (n=6) and students (n=53)

The inter-rater reliability of the Tutorial Performance Rating Instrument developed in Phase 1 of the study could only be tested after the student self-assessment and facilitator assessment had taken place.

This graph presented in Figure 6.13 serves to illustrate the improvement in self-assessment skills when compared with facilitator skills from first to fourth year. There is a poor

correlation of scores between first-year students and facilitator with a mean score of approximately 30% difference. One assumes that this is owing to the inexperience of the students in using the instrument and their inability to carry out a self-assessment rather than the poor reliability of the instrument. This is evidenced by the closer correlation between the scores of students and facilitator in second and third year. The fourth-year students and the facilitators show a good correlation of scores.

Table 6.37 illustrates the correlation in the mean scores in the facilitator assessment compared with the mean score in the student self-assessment. Again this shows the comparison between the facilitator assessment mean score and the fourth-year student mean score.

Table 6. 37: Comparison of facilitator and student mean scores first year to fourth year ((n=53)

	Facilitator Assessment	Student Self-assessment
First year	22.67%	49.35%
Second year	62.25%	69.17%
Third year	68.42%	61.90%
Fourth year	87.98%	87.36%

6.4 CONCLUSION

This chapter presented the results in Phase 2 of the study. The results were derived from descriptive and inferential statistical tests that were applied to identify, analyse and

synthesize the data. The results were presented in tables and graphs to allow for clarity of interpretation. The results of student inter-class relationships from first to fourth year of study were provided. The reliability between the facilitator and student assessment scores on the Tutorial Performance Rating Instrument (Annexure I) was shown.

The next chapter presents the discussion of the results in both Phase 1 and Phase 2 of the study and also discusses the main findings, recommendations and finally the conclusion.

CHAPTER SEVEN

DISCUSSION OF RESULTS, MAIN FINDINGS RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

7.1 INTRODUCTION

In the final chapter, a summary of this study and a discussion of the results of Phase 1 and Phase 2 are presented. This is followed by a presentation of the main findings in both phases conducted in the study. Recommendations for management, nursing education and further research are presented. The chapter closes with the conclusion of the study.

7.2 SUMMARY OF THE STUDY

Set in two phases, the purpose of this study was to determine the performance of undergraduate nursing students during PBL tutorials based on a validated tutorial performance evaluation instrument.

With an overarching quantitative approach, a descriptive, comparative design was used. Phase 1 involved the development and validation of an evaluation instrument that was used to assess students in PBL tutorials. The outcome was the development of the computer-based instrument. In Phase 2 the performance of a cross-section of undergraduate nursing students in PBL tutorials was determined using the validated Tutorial Performance Rating Instrument

and the computer-based instrument. In this phase, a descriptive comparative design was used. Three data sets in respect of student performance were analysed:
facilitator assessment on student performance, student self-assessment and the assessment of the students following consensus agreement.

7.3 DISCUSSION OF RESULTS: PHASE 1

The results on the judgments made by the expert group are presented with a discussion on each of the seven main-item constructs and the sub-items within each construct featured on the Round One Questionnaire (Annexure G) and Round Two Questionnaire (Annexure H).

7.3.1 Personal Growth

A suggestion was made that the main-item construct referred to as 'group growth' be changed to 'personal growth' with new sub-items that would still relate to the group process but would be more personal to the students' development. A suggested sub-item being: *Able to assume different roles in the group.* The nature of nursing is such that nurses constantly interact with patients, colleagues and members of the community. The above statement being supported by Rideout (2000:4) on quoting Valainis (2000) in describing the twenty-first century nurse as professionals who have to manage care by providing patients and their families with a continuity of service and often work within groups.

Outlining the characteristics of human groups in relation to the nursing profession can be carried out in PBL tutorials. There are many task roles that members of a group can adopt; some specific to the PBL tutorials such as: information giver, clarifier, explorer, summarizer, record-keeper and supporter. The role of standard setter would apply to a person who assists in setting ground rules for the group. The person who shows skills in conflict handling fills

the role of harmoniser. The remainder of the suggested new sub-items are as follows: *presents constructive interventions and feedbacks; displays active listening; has a consultative attitude; is able to summarize a discussion*. The tutorial is also an opportunity for the facilitator to identify any negative roles displayed by a group member such as the role of aggressor.

Following the Round Two survey the expert group agreed that eight (8) relevant sub-items should remain within the main-item construct of personal growth most of which are related to the task roles adopted by members of the group. Following the weighting and statistical analysis of the main-item constructs and its sub-items, personal growth scored 13.16% of the total score of 100% for the entire evaluation instrument On the hierarchy of percentages, personal growth was placed at number six (6) out of the seven (7) main-item constructs featured on the evaluation instrument referred to as the Tutorial Performance Rating Instrument.

Many of the sub-items featured are indicative of group work as well as the personal development of the student. Willis et al. (2002:495) states that group work is supported as a method of learning and the most motivational learning is derived from groups that work cooperatively. Nieminen et al. (2006:68) proposes that there is a strong relationship between group functioning and study success. It is therefore necessary to assess the students' skills in the group process to determine whether the students have the necessary skills needed for effective group functioning.

Willis et al. (2002:495) further state that group assessment is important for the students to gain credit for the processes of learning. With positive reinforcement the students will be

motivated to improve their group skills. In a study conducted by Thorpe and Loo (2003:88) to examine the values profile of nursing undergraduate students, personal development was rated as the most important value as it reflects the basic need and lifelong goals of the individual simply to develop as a person. These researchers suggest that there is a gap between most people's personal knowledge skills and attitudes and those required of professional practitioners.

7.3.2 Creative Thinking

A further suggestion from the expert group following the Round One survey was to include a new main-item construct referred to as 'creative thinking' with the sub-items: *shows ability in creative writing; shows ability in brainstorming; has skills in drawing.* Following the Round Two survey this construct was rejected and the sub-item *shows ability in brainstorming* was retained and placed within the construct of personal growth.

7.3.3 Leadership

The expert group suggested that the main-item construct headed 'leadership' be retained. It is generally stated that in most organizations people are called upon to exhibit leadership qualities. Whilst it is assumed that not everyone has the potential to become a leader, it is important to instil within the student the understanding of leadership and to develop leadership qualities to the best of the student's abilities. Following the Round One survey, eight (8) new sub-items were included under 'leadership'.

Following the Round Two survey, the list was reduced to four (4) relevant items as follows: *shows a caring attitude; shows assertiveness; initiates the undertaking of tasks; drives the process forward*. Altogether there were seven (7) sub-items under leadership, the four (4)

new sub-items and three (3) sub-items that remained from the original Tutorial Performance Evaluation Instrument (Annexure A). The percentage allocated to the main-item construct of leadership was 11.58%. As this was the lowest percentage allocated to one of the seven main-item constructs, leadership was placed at the bottom of the hierarchy of percentages on the Tutorial Performance Rating Instrument.

7.3.4 Learning Skills

The original construct of 'Learning and teaching skills' was changed to 'learning skills'. While each person has the ability to learn, the manner in which this learning takes place is important for the students to understand. Students in PBL tutorials are trained to enhance self-direction in their learning and to develop the ability to 'manage knowledge'. The sub- items included were, therefore, specific to the students' learning skills. It was decided that the aspects related to learning were numerous; for the purpose of this evaluation instrument certain items were prioritized.

Two (2) new sub-items were included after the Round One survey: *demonstrates the ability to read around a learning objective* and *demonstrates the ability to understand professional language*. Following the Round Two survey: *demonstrates the ability to understand concepts and theories* and *able to interpret a learning objective* remained together with an item from the original Tutorial Performance Evaluation Instrument (Annexure A) *should be able to use more than one resource.*

Following the weighting of this construct a score of 13.21% was allocated, placing learning skills as number five (5) out of the seven (7) constructs. Relative to learning skills, Fourie (2003:124) states that learning is approached through deep, surface or combination learning

and when motivated by fear students use a surface method to satisfy shallow levels of understanding. This leads to a lack of curiosity.

7.3.5 Contributions

The original construct 'content of inputs' was changed to 'contributions'. The latter measures that which the students contribute to the group tutorials in the form of integration of ethics, legislation and health-service principles. It measures the students' ability to take into account other disciplines when appropriate. The Round One survey produced five (5) new sub-items related to ethics, legislation and health service principles. Following the Round Two survey these five (5) items were rated as relevant and it was decided that they would feature on the evaluation instrument. Statistical analysis produced a percentage weighting of 16.65% for the construct of contributions and as it was the second highest percentage, it was placed second on the list.

7.3.6 Problem-Solving Skills

The Phase 2 construct 'problem-solving skills' scored 17.38% following statistical analysis on the weighting of the constructs. This percentage was the highest of the percentages allocated to the seven (7), main-item constructs and is therefore accepted as the top priority on the evaluation instrument. The most significant point found in the sub-items that have also been ranked from the highest percentage to the lowest percentage in a hierarchy is sub-item 3: *manages to identify the problem,* in the literature on problem-solving skills *manages to identify the problem* appears as the beginning of the process. The experts justify this position by stating that in the problem-based learning model, learning begins with the 'problem' that is given to the students. Therefore, sub-item 1 deals with, *identifies solutions to the problem* and sub-item 2 refers to *helps select a strategy to solve the problem.* It is usually after this

stage that the students begin to identify further problems that will need possible solutions and strategies for implementation.

Quinn (2005:19) quotes Gagne (1985) that in student learning the most effective problems are novel to the student and within the students' capabilities. Barrows and Tamblyn (1980) refer to Problem-based Learning as being different from problem-solving teaching strategies in that the problem is given prior to any form of input. In the traditional methods information is given and the students are required to identify the problem. The literature states that according to the McMaster University method the main purpose of problem solving groups is to encourage critical thinking by the learners.

7.3.7 Communications

In the Round One survey of the main-item construct 'communications' a suggestion was to include *demonstrates writing skills appropriate to the situation.* The Round Two survey rejected this sub-item and the two relevant items decided on were *to demonstrate verbal skills appropriate to the situation* and *to demonstrate non- verbal skills appropriate to the situation*. It may be difficult to give a student an accurate rating on non-verbal skills as opposed to verbal skills. The experts therefore weighted verbal skills much higher (63.81%) than non-verbal skills (36.19%). The construct was allocated a third highest position on the hierarchy with a score of 14.58%.

It was suggested that communication skills, for the purpose of the evaluation instrument not encompass a whole list of sub-items but concentrate mainly on verbal communication. One of the disadvantages facing second language students is their difficulty with verbal communication and a facilitator should therefore, concentrate on that aspect of communication. According to Knight (2004:5), students should be made aware of their

English proficiency and what the underlying cognitive needs are to attain success in their degree. Knight further states that once the students enjoy group work, social interaction results in improved English language skills. Ustun (2005:421) maintains that a goal of the PBL model is to provide nursing students with the communication skills they require to function in the helping process.

7.3.8 Critical Thinking Skills

'Critical thinking' was changed to 'critical thinking skills' and scored 13.44% out of the seven (7) constructs and was rated fourth (4) on the hierarchy. While it is important to identify strategies that foster critical thinking, it is difficult to measure this abstract skill. Following the Round One survey, 14 new sub-items were suggested for inclusion in the evaluation instrument. Many of these items were adopted from items featured on evaluation tools that are specific to evaluating critical thinking skills, for example, The Watson-Glaser Critical Thinking Appraisal amongst others.

Following the Round Two survey, only four sub-items were rated as relevant for the development of the new evaluation instrument. The critical thinking skills required by the students would serve to identify and analyse problems, seek alternatives and discuss a position or argument. The problems associated with measuring this skill as outlined in the comments made by Scheffer and Rubenfield (2006:197), although widely discussed and debated in nursing circles, show no sign of waning. Attempts to measure this construct have resulted in discouragement and frustration in teaching and in the belief that critical thinking skills cannot be taught. Nurses have been told to ‘think better’ but have never been given strategies to obtain that goal. Scheffer and Rubenfield (2006:198) suggest that critical

thinking needs to be put into the real world of nursing with the aim of achieving an improvement in health care.

7.3.9 Weighting of Items

The experts made a unanimous suggestion that the Likert scale be confined to a scale of four (4) points 0-3. The 0-3rating scale was weighted and is no longer equidistant, meaning that the percentage allocated for each point is different e.g. 0=0% 1=28%: 2=69%. 3=100%.

At the end of the Round Three survey, the total number of main-item constructs and sub-items were weighted in paired comparisons on visual analogue scales (n=800) together with the weighting of the Likert scale (n=8). The scales were accurately measured, the measurements entered into the computer on an excel spreadsheet and sent for statistical analysis. Regression analyses were applied to predict the variance in the value of each variable, in this case the VAS. According to Polit and Beck (2004:511), one of the important features of regression is that a more accurate prediction results from a high correlation of variables.

The essential qualities required of a measuring instrument were addressed. The content validity of the Tutorial Performance Rating Instrument was determined. Construct validity was determined based on the weightings of the main-item constructs and sub-items that were considered 'content relevant' by the expert panel. Following statistical analysis, a unique percentage was allocated to each item on the evaluation instrument leading to a preferential ranking of items. As the concept of construct validity changes, for the purpose of this study the construct validity was determined based on the integrity of the experts' judgments in

relation to the weighting of items that provided each item with a unique score thereby producing an instrument of quality.

7.3.10 Tutorial Performance Evaluator (TPE)

The usability of the Tutorial Performance Rating Instrument would become difficult if after each student assessment, each item had to be manually calculated by (weight of the ordinal scale)(weight of main-item)(weight of sub-item)/100%. It was, therefore, necessary to develop a computer-based programme on which to enter the student assessment ratings and allow for these calculations to be computed efficiently, accurately and quickly. The programme was tested repeatedly by comparing the scores on an assessment that was calculated manually with the scores of the same assessment calculated electronically. The outcome was favourable and the scores correlated for each test. The computer programme was considered to be accurate, effective and time-efficient. The transference of ratings from the Tutorial Performance Rating Instrument into the computer-based TPE took 20 seconds per assessment.

The programme was further developed to allow for the document to be printed by clicking on the button 'Print screen'. A reset facility was included in the programme. By clicking on the button 'Reset', the previous ratings are removed and a blank instrument becomes ready for the next rating calculation to take place. The programme does not allow for any information to be saved to a file. An added advantage is that each main-item construct and the related sub-items are calculated separately and a percentage is allocated to each main-item construct. This allows the facilitator and the student to assess the student's performance in each of the seven main-item constructs.

The programme was built on a wide screen computer. A 'Help' facility is included that guides the user to reduce the size of the programme if a smaller screen is used. In the development of this programme, the researcher attempted to keep the procedure as simple as possible as the main purpose of the programme is to calculate percentages and this has been achieved.

Following the Round Two survey the content validity on the newly developed Tutorial Performance Rating Instrument had been determined. Before the Round Three survey on the weighting of items commenced, the content was tested to determine its practicability and overall simplicity of use in a Pilot Study. The study results showed that the first-year students required training on how to carry out a self-evaluation using the instrument.

7.4 DISCUSSION OF RESULTS: PHASE 2

The discussion of results will include a comparison of student scores in each year of study from first-year to fourth-year. This discussion will relate to the seven (7), main-item constructs featured on the Tutorial Performance Rating Instrument. The discussion further includes the comparison of facilitator-assessment scores and student self-assessment scores.

7.4.1 First-Year Students

The first-year students on their Tutorial Performance evaluation obtained a mean score of 27.49%. The highest score achieved by a student in this group was 50% and the lowest score 9%. This is clearly a poor result and each of the seven (7) main-item constructs, will be looked at in greater depth. The mean score achieved in 'problem-solving skills' was 26.54% with 40% of the students showing a limited ability to identify a problem. This is significant because a PBL tutorial starts with a given 'problem' based on a real-life situation that

students are expected to solve. The students were unable to identify the concept of a 'problem' and were unable to work through the problem solving process and struggled in their ability to identify further problems. The remaining 60% of the group showed an improvement in their ability to identify a problem but still struggled with the problem-solving process. None of the first-year students achieved a rating of three (3) on the Tutorial Performance Rating Instrument representing their ability to identify possible solutions to the problem; 51% of the students' obtained a rating of two (2) showing an improvement in their ability to identify possible solutions to the problem and 49% of the students obtained a rating of one (1) showing a limitation in their ability to identify possible solutions to the problem.

The same group of students who scored poorly in the above skills manifested a limited ability to implement a solution, with 7% of the group not able to find a solution at all.

The mean score evidences the poor performance of first-year students in problem-solving skills. These students arrive into tertiary education with a particular mindset learned in primary and secondary school education, where rote learning and thinking prevails. The latter does not promote the development of the skills required to allow for effective and competent problem-solving techniques, this being evidenced by the ratings and scores obtained by the students. Within the PBL tutorial, an effective group process requires effective problem-solving skills together with student participation where questioning, discussion and argument take place.

According to Knight (2004:1), questioning becomes a goal in itself and should help with the development of the students' problem-solving skills. Questioning not only stimulates the thinking process but also requires discussion and argument. In this respect, students should be

encouraged to question the point of view of peers in the group. However, L2 students are reluctant to enter into discussion since they lack fluency in academic language and often struggle with base-line English. The development of problem-solving skills is determined by the students' ability to enter into discussion with their peers and facilitator and this seems to be compromised due to their difficulty with conversing in a second language.

Schmidt, Vermeulen and Van der Molen (2006:562) conducted a study to evaluate the long-term effects of problem-based medical training on the professional competencies of graduates. The graduates rated themselves as having better competencies in problem solving and added that the PBL approach to learning is able to develop more effective problem-solving skills in students.

Fichart, Becker, Viljoen, Botma and Bester (2003:59) describe the objectives of PBL as set out by Barrows as 'an acquisition of a basis of knowledge that is better retained, integrated from all the relevant disciplines, applicable in the clinical contexts and extended into the future through self-directed learning'. In a study that explored the integration of study material in the problem-based learning method, Fichart et al. (2003:60), concluded that PBL does contribute to an integrated curriculum. Their results showed that 97% of the students in their study group felt that PBL increased their ability to consider problems from other viewpoints. That said the mean score of 15.34% achieved by the first-year students in the construct headed 'contributions' clearly indicates a problem with contributing to PBL tutorial discussions. A high percentage of poor performance was apparent in each of the five (5) sub-items featured within this main-item construct. What is significant is that 7% of the students showed an inability to be comprehensive in their thinking depending on the subject learnt. This group was unable to integrate ethics into the discussion while 14% were unable to

integrate legislation into the discussion. Of the students, 80% manifested a limited ability to take into account other disciplines when appropriate and 67% showed a limited ability to integrate health-service principles. First-year students were not able to identify relevant information particularly relating to legislation or to health service principles in any of the sub-items.

It is, therefore, necessary to assist first-year students to develop their ability to consider various viewpoints and be able to approach the given problem in a holistic way. In the same way that first-year students require assistance in developing their problem-solving skills, they also need to be guided into understanding the ways of acquiring relevant information and sharing this information with the group. Furthermore, the importance of knowing the required legislation and health service principles must be stressed as most information is based on these aspects.

Obtaining relevant information requires motivation and a commitment to learning and again this refers to the relationship of group functioning and study success in PBL. According to Nieminen, Sauri and Lonka (2006:64), a student's commitment to learning is influenced by a well-functioning group. This is a view, reinforced by Das Carlo, Swadi, Mpofu (2003:63) who state that the success of a group is determined by the contributions made by the students and that group interaction, motivation and group productivity are associated positively. Willis et al. (2002:500) found a direct relationship between students' motivation and interactions about the productivity of the PBL group.

According to Ustun (2006:421), communication skills are an essential element of professionalism and one of the goals of the PBL model is to provide nursing students with the

communication skills needed in the helping process. Guttman (2004:264) believes that as the nurse-patient relationship is built on communication, the nurse's most important tool is effective language.

The mean score of 35.71% achieved by the first-year students clearly indicates a problem with communication skills. Amongst these students, 53% showed minimal verbal and non-verbal communication. While only 7% displayed good verbal communication skills, 40% did register an improvement in both verbal and non-verbal communication skills.

Although English is the second and frequently the third language of most students, most manage social speech but face a major challenge in mastering academic language. As one of the principles of the PBL method is small-group discussion according to Van Loggerenberg-Hattingh (2003:57), there is no doubt that the problem-based approach to learning enhances participation in discussion. Encouraging the students to enter into verbal communication with peers and the facilitator not only improves the spoken word but also gives the students the self-confidence to participate in group discussion and argument.

By their own admission, students find that discussion is often difficult. They translate a sentence from English to their mother tongue, attempt to understand the question being asked, find an answer and then try to find the English words to answer the question. Knight (2004:2) believes that English language proficiency affects the degree of performance of students in the Health Sciences. Knight (2004:6) further adds that successful language acquisition, takes place during the critical period of 16 -18 years of age. Once that critical period has passed, it becomes increasingly difficult to become skilled in any language.

Students should, therefore, practise English under all circumstances, particularly in their peer groups outside the lecture hall. This does not always happen as students often revert to their first language when conversing with their peers and facilitators.

Within the main-item construct of' problem-solving skills', the sub-item *manages to identify the problem* is featured and within the main-item construct of critical thinking skills the sub-item *identify the problem, question or issue* is featured. The latter is justified, since this skill is an abstract concept to measure and one of the ways to test this skill is by the students' response to identifying a problem, question or issue. The mean score achieved by the first-year students in critical thinking skills was 23.57%, a poor score and needs to be investigated further. In the construct of 'problem-solving skills' 40% of the students showed a limited ability to identify a problem. In the construct of 'critical thinking skills', 53% of the students revealed a limited ability to identify a problem, question or issue. An increase of 13% is probably related not only to the inability to identify a problem but also to being unable to identify a question or issue. The remaining 47% of the students showed an improvement in this skill. One can question whether critical thinking can be learnt and if so should this learning commence during the students' first year of study. According to Riddell (2007:121) certain accreditation bodies internationally require that critical thinking be included in the nursing curricula and whilst there is no valid measurement tool for measuring students' critical thinking abilities there is also a lack of research supporting the assumption that critical thinking can be learned.

A mean score of 26.11% achieved by the first-year students clearly shows that there is a problem with their learning skills. Amongst these students, 14% were unable to use more

than one resource and were unable to interpret a learning objective. A further 40% showed a limited ability to understand concepts and theories.

According to McParland, Noble and Livingston (2004:860), students in a PBL curriculum, when compared with those in a traditional curriculum, achieve higher clinical- and knowledge-based scores. Learning styles are affected positively as students evince the ability to use deeper and less surface learning. Self-directed and more versatile learning is also evident.

Visschers-Pleijers et al. (2006:130) state that group interactions that generally account for 80% of the total session time determine deep and collaborative learning as the students strive to develop a critical understanding of the material. It is clear that all interactions except for irrelevant and procedural interactions are conducive to learning. Students are also able to integrate new learning into what they already know. For all these reasons, PBL is seen as a powerful learning method.

In the construct of 'personal growth' a mean score of 35.09% was achieved; 14% of the group were unable to present constructive interventions and feedback during a discussion. A further 7% were not able to acknowledge contributions from group members.

The mean score achieved by the first-year students in leadership skills was 30.33%. Amongst the first-year students, 14% displayed poor leadership skills and 67% showed limited leadership qualities.

According to Peterson (2008:1), each student should be given the chance to show assertiveness within the group discussions in order to give him/her the opportunity to learn the value of his/her thoughts and actions. The leadership role, therefore, needs to be modified in the PBL method of teaching. By definition, the leader who leads in a traditional way is seen as a person with authority who will make the final decision, a person who will be relied upon by the team members and without whom, the team is not able to function. Peterson (2008:1) states that in PBL discussion, all the team members should have the opportunity to lead. Shared leadership leads to shared responsibilities and accountability. The leader should assume the role of facilitator, one who encourages and manages students, implements dialogue and is able to resolve conflict. Leadership skills allow students to manage their own learning situations more effectively.

7.4.2 Second-Year Students

The second-year students on their Tutorial Performance evaluation obtained a mean score of 64%. The highest score achieved by a student in this group was 84% and the lowest score 18%. In the construct 'problem-solving skills' the second-year students achieved a mean score of 57.47%, showing a substantial improvement in their results compared with those of the first-year group who obtained a score of 26.54%. Only 5% of the students were unable to identify a problem. In the majority of sub-items related to the problem-solving group, students achieved a rating of three (3) in their evaluation. In the sub-item: *identify solutions to a problem*, 23% of the students were unable to identify solutions to a problem while 57% demonstrated a limited ability to identify solutions to a problem and 20% showed an improvement in being able to identify solutions to a problem. This is a significant finding – although 80% showed no or only limited ability in identifying solutions to a problem, 20% of the group did reveal an improvement.

There was a marked improvement in the students' scores in the main-item construct 'contributions' this being represented by the mean score of 55.80%. Although a small percentage of students were still unable to integrate ethics, legislation and health service principles into a discussion there was a group of 33% that scored a three (3) in one of the sub-items representing a 'good' performance.

Although the students achieved a mean score of 81.38% in the construct 'communication, 23% of the students displayed minimal verbal communication skills with a further 23% of the group showing an improvement and 54% revealing good communication skills. As the literature has shown the success of the PBL tutorial is based on discussion that requires good communication skills. The significant point relating to these percentages is that 46% of the class do not possess good communication skills and this will affect the performance within the tutorial.

Within the 'critical thinking' construct students achieved a mean score of 60.68% with 24% revealing a limited ability in identifying a problem, question or issue. This is comparative with the 23% of students who displayed a limited ability in identifying a problem in the construct of 'problem-solving skills'. Of the students, 57% registered an improvement in their ability to identify a problem, question or issue as compared with 52% who showed an improvement in identifying a problem in the construct of 'problem-solving skills'. The remaining 19% of the students showed good critical thinking skills.

In a study conducted by Behrens (1996:35) students' critical thinking abilities were tested using the Watson-Glaser Critical Thinking Appraisal. The results demonstrated the positive relationship between chronological age and the students' critical thinking abilities. The scores

obtained by the first- to fourth-year students in critical thinking skills increased in relation to the mean age of each group of students. In the first-year group of students the mean age was 20 years and the mean score in critical thinking skills was 23.5%. In second and third year, the mean age for each group was 22 years and the mean score was 60% and 59% respectively, showing a difference of only 1%. The fourth year students' score was 89.6% and this group manifested the highest mean age of 23 years.

A mean score of 67.43% was obtained for the construct 'learning skills' with 5% displaying an inability to understand concepts and theories or use more than one resource; 19% registered a limited ability to understand concepts and theories or use more than one resource. The remaining percentage of the group showed signs of improvement and displayed good learning skills.

Within the construct of 'personal growth' the students achieved a mean score of 67.06%. A group of 24% of the students displayed a limited ability to function within a team; were unable to acknowledge contributions from group members; unable to offer encouragement and support to group members and were not willing to work with group members; 56% of students showed an improvement in all of the sub-items within the personal growth group while 20% demonstrated a good ability to function within a team. A significant finding was that 24% of the class showed a disinterest in working as a team and acknowledging contributions from group members. In the first-year group there were 7% of the students who did not acknowledge contributions from group members.

In ‘leadership skills’ a mean score of 58.65% was obtained with 19% displaying poor leadership skills and 38% limited leadership skills. The remainder of the group showed an improvement in this skill.

7.4.3 Third-Year Students

The mean score achieved by the third-year student in the tutorial performance evaluation was 57.11%. This is 6.89% less than the mean score obtained by the second-year students. This drop in performance could be attributed to the fact that in their third year of study new disciplines are introduced to the students such as: Psychiatric nursing and Midwifery. On looking at the overall performance 88% of the third-year students were able to identify solutions to a problem. While 12% showed an inability to help select problem-solving strategies, 10% of the group achieved a rating of three (3) on certain sub-items on the Tutorial Performance Rating Instrument.

Within the construct ‘contributions’ a drop of 12% in the mean score was noted when compared with the results of the second-year students in the same construct. This drop may be attributed to the new subjects that are introduced in the third year of study. A significant point is that all of the students were able to contribute relevant information in some way. Although none of the students achieved a rating of three (3) on sub-items on the tutorial performance evaluation up to 75% showed an improvement in their ability to contribute information and discussion within the tutorial.

A mean score of 64.48% was achieved by the group in ‘communication skills’ a drop from the second-year score of 81.38%. The new subjects that are introduced in third-year are

accompanied with new terminology that could result in the reluctance of students entering into any discussion.

In their 'critical thinking skills' the third-year students achieved a mean score of 58.90% a percentage of 1.78% less than that achieved by the students in their second-year of study. Van Loggerenberg-Hattingh (2003:53), states that a problem-based approach enhances student participation. Furthermore, the PBL tutorial allows for questioning, critical thinking and discussion on the given problems all of which should assist the students to develop these skills.

The third-year students achieved a mean score of 59.60% and one noticeable point was that all of the students were able to perform in all of the sub-items within the 'learning skills' construct.

A significant finding was within the construct of 'personal growth,' a mean score of 56.55% was achieved however, 12% of the group showed a limited ability to function within a team a similar situation to what occurred in second-year where 24% of the group and 7% of the first-year group showed an inability to function as a team.

Within the construct 'leadership skills' a mean score of 57.40% was achieved and 30% of the group registered limited leadership skills.

7.4.4 Fourth-Year Students

The fourth-year students achieved a mean score of 87.9% on their tutorial performance evaluation the highest score being 100% and the lowest score was 70%. In the construct of 'problem-solving skills' a mean score of 83.56% with 67% of the students obtaining a rating

of three (3) against sub-items within the construct. A marked improvement in problem-solving skills amongst student groups from first to fourth year (vide page 129) is apparent.

In the construct 'contributions' the group achieved a mean score of 85.48% with 78%-100% of the group obtaining a rating of three (3) in one or the other of the five sub-items within the construct showing the ability to integrate ethics, legislation and health service principles into the discussion. The group were able to take the other disciplines into account in their discussions. Fichardt, Becker, Viljoen, Botma and Bester (2003:60) support the view that PBL enhances the gathering of information from various sources and increases the ability of students to consider problem-solving from various viewpoints.

The students registered a marked improvement, scoring a mean of 87.46% in communication skills.

In their critical thinking skills a mean of 89.66% was achieved with 78% of the group obtaining a rating of three (3) on their evaluation.

According to Tiwari, Lai, So and Yuen (2006:547), students' development of critical thinking is facilitated or hindered by educational approaches. The effects, of PBL and the lecture approach on the students' critical thinking abilities were compared in a study conducted by the above researchers. The results showed that the significant difference in the development of critical thinking amongst the students from the PBL course occurred as a result of the encouragement of students' active participation in small-group discussions. In a PBL programme, students registered significantly higher critical thinking disposition scores on

completion of their training and this remained for two years afterwards although to a lesser degree.

Walsh and Seldomridge (2006:214) support the view that the didactic content format tends to limit discussion, the use of logic, problem solving and creativity amongst students. Computer technology and 'spoon feeding' also often extinguish students' critical thinking abilities.

The aims of the PBL programme include the development of problem-solving skills in an undergraduate student. Duchscher (2003:14) reinforces the belief that in nursing education, a primary goal is the development of critical thinking through emphasis on process, inquiry and reasoning. Without critical thinking skills it becomes difficult to carry out the problem-solving process effectively.

Walsh and Seldomridge (2006:214) question whether the role of critical thinking in the undergraduate nursing didactic programme has been strengthened or diminished in the classroom. The didactic content format tends to limit discussion, the use of logic, problem solving and creativity amongst the students. Computer technology and 'spoon feeding' also often extinguish students' critical thinking abilities.

In a study conducted by Behrens (1996:35) students' critical thinking abilities were tested using the Watson-Glaser Critical Thinking Appraisal. The results demonstrated the positive relationship between chronological age and the students' critical thinking abilities. The scores obtained by the first- to fourth-year students in critical thinking skills increased in relation to the mean age of each group of students. In the first-year group of students the mean age was 20 years and the mean score in critical thinking skills was 23.5%. In second and third year,

the mean age for each group was 22 years and the mean score was 60% and 59% respectively, showing a difference of only 1%. The fourth year students' score was 89.6% and this group manifested the highest mean age of 23 years.

Duchscher (2003:15) adds that students entering a nursing programme who had prior university education reported a significantly higher baseline critical thinking score than that of undergraduates without prior university education. At the end of the course there was no significant difference in the critical thinking scores of these two groups.

The fourth-year students' mean score of 91.98% in learning skills reveals a significant improvement over the scores of first- to third-year students. According to Siu, Spence, Laschinger and Vingilis (2005:461), the earlier research findings by Rideout (2002), when compared with the traditional training methods, prove that PBL is more effective in facilitating student motivation, learning satisfaction and confidence in their clinical functioning and the acquisition of knowledge. They become more self-directed in their work and are also able to use a variety of learning resources.

In the construct of 'personal growth' the students achieved a mean score of 93.42% and 100% of the students were able to function within a team.

Sui et al. (2005:461) further reiterate that the PBL method is more empowering than the conventional method of teaching by citing Kanter's (1993) theory of workplace empowerment with the contention that the individual's attitude and behaviour, are influenced by their environment. According to Kanter's 1993 theory, the small-group and self-directed learning approach enhances each student's position within the group, as each student

provides relevant input that determines the group's learning. PBL provides the student with greater opportunities for self-development and therefore higher levels in psychological empowerment. Self-development is determined by the ability to be reflective. The ability to be critically reflective in turn determines one's value system.

According to Thorpe and Loo (2003:83-89), the values of an individual are strong indicators of professional performance. Nurses are individuals and professionals who live and work in various social structures in institutions – frequently demanding work environments – that provide opportunities for employment and the ability to realize their dreams The individual's personal values have become more significant in the effort to cope with the realities of working in the 21st century. Nursing students should understand their own values and the values of the profession in order to realize the challenges and the rewards of a caring profession.

In 'leadership skills' the fourth year students achieved a mean score of 84.49% with 67% of the group manifesting an improvement in their leadership skills. The remaining 33% of students showed good leadership skills.

The relative weighting of each main-item construct places leadership skills at the bottom of the hierarchy as these were judged the least important of all the constructs. The literature however, shows that the value of leadership skills appears to have an importance in the PBL method of teaching and these skills may need to be developed amongst students.

7.4.5 Comparison between Facilitator and Student Scores

The overall performance of first-year students in PBL tutorials was poor. The facilitator's mean score of 22.67% (vide page 163) was very low in comparison with that of the self-assessment carried out by the students – 49.35% (vide page 163).

According to the above results – the students mean score is 26.68% higher than the facilitator's score and clearly shows that the students' overestimate their abilities. The lowest score in the student self-assessment was 31.03% higher than the facilitator's lowest score for that student and the highest score was 19.06% higher than the facilitator's score for that student. According to the statistical analysis, there is a weak correlation between the facilitator assessment scores and the student self-assessment scores.

In the second year of study the mean score in the facilitator assessment of student performance was 62.25% in a range of lowest score to highest score 6.15% to 91.10% (vide page 165), this being a wide range of 84.95%. The students mean score in the self-assessment was 69.17% in a range from 29.13% to 87.42% (vide page 165) again a wide range of 58.29%. There is a 7.02% difference in the facilitator and student mean scores in favour of the students. This clearly reveals a stronger assessment correlation between the student and the facilitator when one compares the mean scores.

In third year, the mean score shown by the facilitator assessment was 58.42% in a range of 40.44% to 69.32% (vide page 168). The student self-assessment mean score was 61.90% in a range of 52.45% to 68.90% (vide page 168). In both the facilitator and student assessment scores the range has decreased. The difference of 3.48% indicates a much stronger correlation between the scores. The mean scores dropped from the second-year students' performance by 3.83% in the facilitator assessment and by 7.27% in the student self-assessment. This drop in

score should not be considered relevant since this was a cross-section of the sample and not a longitudinal study. In their third year of study the fact that students are introduced to new subjects with new related terminology could impact on their lower scores.

In their fourth year of study, the mean score on the facilitator assessment was 87.98% in a range from 70.88% to 100% (vide page 171) while the student self-assessment showed a mean score of 87.36% in a range from 67.06% to 100% (vide page 171) – a difference of 0.62%.

A steady improvement in the correlation of mean scores between the facilitator assessment and the student self-assessment from first to fourth year is evident.

To sum up:

First year – a difference of 26.68% in favour of student self-assessment

Second year – a difference of 7.02% in favour of student self-assessment

Third year – a difference of 3.48% in favour of student self-assessment

Fourth year – a difference of 0.62% in favour of facilitator assessment

The above figures clearly show that by the time the students reach their final year of study they are more capable of carrying out a self-assessment, the latter being an important outcome of PBL.

According to Tousignant and Des Marchais (2002:19), third-year students in a conventional four-year programme demonstrated poor self-assessment accuracy when compared with their performance in a problem-based learning programme. They state that despite the importance

of the PBL students' self-assessment ability, empirically there is not much known about this ability. While studies have investigated students' self-assessment abilities compared with external criteria like peer and tutor evaluation in the PBL context, the results have been poor, showing inaccuracy in the students' self-assessment ability.

Rudy, Fejfar, Griffith and Wilson (2001:445) state that self-assessment is a private activity. There is a possibility that students are overcritical of themselves because of social norms relating to an over-inflated opinion of oneself, the culture of evaluation in professional education or trying to achieve unrealistic personal goals.

7.5 MAIN FINDINGS

The most significant finding was the poor results achieved by the first-year students on their tutorial performance. They performed poorly in all of the seven (7), main-item constructs. They showed a poor ability to integrate ethics, legislation and health service principles into a discussion and were unable to take other disciplines into account when appropriate. Their critical thinking skills and problem-solving skills ranged between a mean score of 23% to 26% and they struggled with the problem solving process. Their communication skills produced a mean score of 35.7%, indicating the problem the students face in English language discourse. Personal growth produced a mean score of 35% and 7% of the group showed reluctance in working as a team.

The above results indicate that the first-year students clearly struggle with all aspects of the PBL tutorial. Furthermore the students lacked experience and ability in conducting a self-assessment and overrated themselves when compared with the facilitator- assessment.

The second-year students displayed an improved ability in carrying out a self-assessment with a 7% difference in favour of the students when compared with the facilitator assessment. The students who overrated themselves were those who scored poorly in the facilitator-assessment and this was a similar trend that presented amongst the first-year students. A marked improvement in the overall percentage of the tutorial performance evaluation was evident. In total, 81% of the students achieved a score above 50%. The biggest improvement was in communication skills where a mean score of 81.3% was achieved. More discussion took place within the group showing an improved level of confidence in the students' ability to communicate in the English language.

There was a drop of 7% in the mean score between the third- and second-year students that can be attributed to the new subjects such as Midwifery (Women's Health) and Psychiatric Nursing – that commence in third year and present a further challenge in the form of a 'new language'. While a drop in the mean score was evident, there was an improvement in the percentage of students who achieved a score above 50% and when compared with second-year students' percentage indicated a 6% improvement. The mean score in communication skills dropped by 17%. Again this can be attributed to fewer discussions taking place resulting from the lack of confidence in relation the new subjects. The ability to contribute within the group in terms of legislation, ethics and health service principles scored 43.7% that can once again be related to the different legislation and health service principles of the new subjects.

The mean score of the fourth-year students in each main-item construct was greater than 83%. There is a vast improvement in skills from first- to fourth-year students and this result can be attributed to the PBL approach to learning.

Nurse education is aimed at developing the student to meet the nursing health needs of society. It is, therefore, important to design nursing education in such a way that it achieves these aims. The problem-based approach to teaching and learning has many benefits for nursing education and the nursing student:

- New information is learning-focused rather than teaching-focused
- The development of skills to facilitate self-directed learning rather than the rote learning of knowledge is encouraged
- Learning becomes the students' and not the teachers' responsibility
- Group discussions encourage cooperation with peers. The student is socialized into functioning effectively within a group, such as the multidisciplinary team, the client and the client's family amongst others
- Working within a group also enables students to develop their leadership skills, communication, problem-solving and decision-making skills
- The problem-based learning approach can assist in building students' confidence; motivate them enough to keep abreast of the latest trends in health care; function effectively within a multidisciplinary health team
- One of the main goals of nursing education is aimed at developing the student nurse into becoming an ethical, responsible, caring individual who will carry out health care to members of society from before birth till beyond death, in a safe and professional manner

This positive outcome of the PBL approach to learning has to be weighed against the negative impact on the faculty involving the cost of implementing and maintaining such a programme. The financial impact on changing a curriculum, training and supporting personnel as well as motivating tutors to adopt the new curriculum needs to be taken into

account. Norman and Schmidt (2007:1) agree that the positive outcomes of problem-based learning far outweigh its negative impact.

7.6 STUDY LIMITATIONS

The study was conducted in a single centre, thus the study findings cannot be generalized beyond the study population to students in other universities who use the PBL method of teaching. The total population of students was used (n=56). This is a small cross-sectional sample and could be a potential weakness in the study.

In evaluating the performances of these students in the PBL tutorials one has to take into account that there are many variables amongst the different groups of students and one can, therefore, not observe trends in terms of individual performance. Furthermore, the emerging paradigms of validity are being replaced with a unitary concept "construct validity".

7.7 RECOMMENDATIONS

Several recommendations for future research can be drawn from the present study. These recommendations are based on the main findings of the study.

7.7.1 Nursing Education

Consideration should be given in providing more assistance to the first-year students and first-year facilitator. Small group tutorials are essential in providing the students with as much academic support as may be required and a less threatening environment to encourage discussions. Alternatively introducing a foundation year of study for the 'at risk' students to prepare them to achieve better results in their first-year of study. During this foundation year, emphasis could be placed on the group process and on language fluency.

The Tutorial Performance Rating Instrument and the computer-based Tutorial Performance Evaluator are recommended for use by other universities to test their effectiveness and value.

7.7.2 Research

- A longitudinal study of students from first to fourth year would give a greater indication on the tutorial performance of each student from his/her first to fourth year of study
- Further research is needed on the carrying out of students' readiness for self-assessment
- Research is needed on the effectiveness of the group process on the development of problem-solving skills, learning skills, communication skills, critical thinking skills and leadership skills

7.8 CONCLUSION

In the South African context, students are already academically and linguistically compromised when they enter their first year of study. The PBL method of teaching has all the advantages to overcome the obstacles these students encounter. The need for tutorial-based assessment maintains the philosophy of PBL particularly in the ability to develop self-directed learning. Furthermore, it assists the students and the facilitators to identify the areas where academic support is needed. Professional competence requires many skills. Evaluation of these skills provides useful feedback that the students can use to develop future learning habits, self-awareness and self-reflection. It also provides feedback to faculty on the effectiveness of the programme itself.

In this study, a validated instrument that serves as a rating instrument to assess the performance of undergraduate students in PBL tutorials was developed. A weighted computer-based instrument able to calculate the ratings from the above-mentioned rating instrument was developed. The students' performance in PBL tutorials was evaluated. The planned objectives for this study were met. The findings from this study show the advantage of the PBL approach to learning particularly amongst the South African undergraduate nursing student body. It illustrates the hardship particularly among the first-year students from an academic and a linguistic point of view and shows the improvement among the students when they are evaluated in their fourth year of study.

This study should offer faculty information in assisting with the development of the curriculum and planning the strategies required for nursing education.

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ORIGINAL TUTORIAL PERFORMANCE EVALUATION INSTRUMENT **ANNEXURE A**

Student Number …… **Percentage……**

	0	1	2	3	4	5	6	7
A GROUP GROWTH								
• Offers facts, suggestions, opinions								
• Willing to work with group members								
• Offers encouragement and support to group members								
• Takes risks in expressing ideas								
• Acknowledges contributions from group members								
• Willing to share resources								
B LEADERSHIP								
• Gives direction								
• Suggests options/decisions								
• Volunteers to undertake tasks								
• Identifies learning issues								
• Identifies resources								
C LEARNING AND TEACHING SKILLS								
• Demonstrates use of multiple resources								
• Demonstrates ability to integrate resources used								
• Contextualizes learning								
• Demonstrates the ability to assist others to learn								
D CONTENT								
• Is accurate								
• Is up to date								
• Is sequential								
• Is comprehensive/interdisciplinary								
• Integrates legislation, ethics, social and physical science								
• Evaluates and selects								
E PROBLEM-SOLVING SKILLS								
• Defines/delineates problem								

• Selects appropriate framework/strategies to solve problem using discipline								
• Selects or designs appropriate frameworks and strategies to solve problems								
• Implements solutions or options								
• Evaluates the problem-solving process								
F INTERACTION/COMMUNICATION								
• Identifies own strengths and weaknesses								
• Assumes different roles in the group								
• Demonstrates verbal skills appropriate to the situation (reflection, clarification, paraphrasing , focusing)								
• Demonstrates non-verbal skills appropriate to situation (facial expression, posture, listening, silence, gestures)								
• Demonstrates attitudes appropriate to situation (empathy, tolerance, respect)								
• Demonstrates integrity to own values / morals managing								
G CRITICAL THINKING								
• Identifies and challenges assumptions								
• Demonstrates contextual awareness and thinking								
• Explores and imagines alternatives								
• Demonstrates analyses (active inquiry) and action								
TOTAL								

ANNEXURE B

Faculty of Health Sciences
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

7 York Road PARKTOWN Johannesburg 2193 Telegrams WITSMED Telex 4-24655.SA
FAX 643-4318 TELEPHONE 717-2075/2076
E-MAIL healthpg@health.wits.ac.za

MRS M LACK
P O BOX 3062
SPRINGS
1560

APPLICATION NUMBER 9308016W
STATUS (DEG 35) (MM031) PZZ

2006-06-08

Dear Mrs Lack

Approval of protocol entitled Instrument validation and problem-based learning tutorial performance of undergraduate nursing students

I should like to advise you that the protocol and title that you have submitted for the degree of Master Of Science In Nursing (Full-Time) have been approved by the Postgraduate Committee at its recent meeting. Please remember that any amendment to this title has to be endorsed by your Head of Department and formally approved by the Postgraduate Committee.

Prof JC Bruce has/have been appointed as your supervisor/s. Please maintain regular contact with your supervisor who must be kept advised of your progress.

Please note that approval by the Postgraduate Committee is always given subject to permission from the relevant Ethics Committee, and a copy of your clearance certificate should be lodged with the Faculty Office as soon as possible, if this has not already been done.

Yours sincerely

S Benn (Mrs)
Faculty Registrar
Faculty of Health Sciences

Telephone 717-2075/2076

Copies - Head of Department_____Supervisor/s

ANNEXURE C

University
of the Witwatersrand,
Johannesburg

Nursing Education

Medical School, 7 York Road, Parktown, Johannesburg 2193 · Telegrams 'Witsmed' · Telephone: +27 11 488-4272 · Fax: +27 11 488-4195
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Mrs. L. Lack
Department of Nursing Education
Faculty of Health Sciences

3 June 2005

Dear Mrs. Lack

RE: MSc (Nursing) degree

The Postgraduate Office has approved your candidature of the MSc (Nursing) degree (by dissertation).

You are required to attend the research course scheduled for 20-24 June 2005 in the Department of Nursing Education, after which a certificate of completion must be submitted to the Postgraduate Office.

I wish you all the best as you pursue your MSc (Nursing) degree.

Yours sincerely

Professor J Bruce
Head: Department of Nursing Education

ANNEXURE D

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

RECEIVED 2006 -04- 0 4

FILE: .....

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Lack

CLEARANCE CERTIFICATE	PROTOCOL NUMBER M060116
PROJECT	Instrument Validation and Problems Based Learning Tutorial Performance of Undergraduate Nursing Staff
INVESTIGATORS	Mrs M Lack
DEPARTMENT	Nursing Education
DATE CONSIDERED	06.01.27
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 06.03.28 CHAIRPERSON .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof J Bruce

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

ANNEXURE E

STUDY TITLE: PERFORMANCE OF UNDERGRADUATE NURSING STUDENTS IN PROBLEM-BASED LEARNING TUTORIALS

RESEARCHER: MELANIE LACK MSc. NURSING STUDENT

Dear Colleague

I am a part-time lecturer in the Department of Nursing Education at the University of the Witwatersrand. My main responsibility is to facilitate problem-based learning tutorials in the second-year B.Nurs degree.

I am a Master's student currently registered at the University of the Witwatersrand, Department of Nursing Education. I am conducting a research study, to be done in two phases.

Phase 1 of the study will test the validity of the existing and original 38-item Tutorial Performance Evaluation Instrument currently in use. I require a group of experts, whom I will select purposively to assist me in conducting **Phase 2** of this study.

I would like to invite you to participate in this study, to assist me by becoming a member of the 'expert group'. I will ask you to test the content validity of the 38-item Tutorial Performance Evaluation Instrument. This will be done utilizing the Delphi Technique. Data will be gathered on questionnaires, which I will develop before each round of the Delphi survey. The first questionnaire will contain the 38 items found on the original evaluation instrument. You will be asked to rate the relevance of the 38 items on a scale of 1-4. You will be asked to include new items you consider should be featured on an evaluation instrument. Subsequent questionnaires will follow in further rounds of the Delphi survey. This will continue until content validity of the items has been determined. The construct validity will then be tested.

Should you consent to participate in this study, I will provide you with a more detailed description of what is required, together with an explanation of how to use the questionnaires developed for this purpose. The approximate time you will spend on the data collection will also be discussed.

Participation in this study is voluntary. You have the right to refuse to participate or withdraw at any stage, with no consequence to you or your university. There are no risks involved to you or to your university. You will remain anonymous as will your university. Codes will be assigned to your identity. All raw data will be kept in a locked cupboard to maintain confidentiality.

Thank you

MELANIE LACK, RN.

Cell: 083.233.4137

email: mellack@mweb.co.za

ANNEXURE F

INFORMATION LETTER

RESEARCH TITLE: PERFORMANCE OF UNDERGRADUATE NURSING STUDENTS IN PROBLEM-BASED LEARNING TUTORIALS

RESEARCHER: MELANIE LACK

Dear Student

I am a part-time lecturer in the Department of Nursing Education at the University of the Witwatersrand and an MSc (Nursing) student registered at the University of the Witwatersrand. I am conducting a research study, which will determine the performance of students in problem-based learning tutorials using a validated evaluation instrument.

I request your permission to access the marks you obtain for your tutorial performance evaluations in your current year of study. Only your marks will be used. Your name, student number or year of study will not be used. You will remain anonymous. You have the right to refuse with no consequence to yourself. There will be no benefit to you at present by allowing me to access your marks, but your contribution towards my study will enable me to arrive at an informative conclusion which will benefit nursing students in the future.

I will handle the raw data and keep it in a locked cupboard. Once the data analysis is complete, the raw data will be destroyed.

Should you consent to allow me access to your marks, kindly sign the consent form on the following page. This indicates that you have understood the contents of this information letter and that you consent to allow me to access and use your tutorial performance marks for the purpose of this study.

Yours sincerely

MELANIE LACK R/N

RESEARCH TITLE: PERFORMANCE OF UNDERGRADUATE NURSING STUDENTS IN PROBLEM-BASED LEARNING TUTORIALS

RESEARCHER: MELANIE LACK

CONSENT FORM

I…….. (print name)

do hereby give my consent for my tutorial performance evaluation marks to be accessed and used by the researcher for the purpose of the above study. I have read the information letter and understand its contents.

Signed ……Date ……

Witness signature ……

ANNEXURE G

ROUND ONE QUESTIONNAIRE

Please note that all main items and sub items featured on this questionnaire are replicated from the original 38-item Tutorial Performance Evaluation Instrument.

Instructions to 'experts'

1. This instrument is made up of 7 main items (upper case). Under each group of main items, there are sub items (lower case).

2. Using your judgement, rate each main item and sub item in one of the columns marked 1, 2, 3 or 4. A description of what each number represents is set out on the next page.

3. Should an item receive a rating of three (3), kindly give your opinion on how the item should be revised. This you will do under 'Comments'.

4. If you feel that an item has been omitted and should be included, kindly list this item under 'Comments'.

5. Completed questionnaire will be collected by me on …….

Thank you for your participation

MELANIE LACK

ROUND ONE QUESTIONNAIRE

Mi = main item (Upper case)

si = sub item (Lower case)

1 = Not relevant

2 = Unable to assess relevance without item revision or item is in need of such revision that it will no longer be relevant

3 = Relevant but needs minor alteration

4 = Very relevant

(The above nominal scale is the work of Mary R. Lynn 1986)

	1	2	3	4
Mi 1. GROUP GROWTH				
si 1. Offers facts, suggestions, opinions to group members				
si 2. Willing to work with group members				
si 3. Offers encouragement and support to group members				
si 4. Acknowledges contributions from group members				
si 5. Willing to share resources				
COMMENTS:				

	1	2	3	4
Mi 3. LEADERSHIP				
si 1. Gives direction				
si 2. Suggests options				
si 3. Takes decisions				
si 4. Identifies learning issues				
si 5. Identifies resources				
COMMENTS:				

	1	2	3	4
Mi 3. LEARNING AND TEACHING SKILLS				
si 1. Demonstrates use of multiple resources				
si 2. Demonstrates ability to integrate resources used				
si 3. Contextualizes learning				
si 4. Demonstrates the ability to assist others to learn				
COMMENTS:				

	1	2	3	4
Mi 4. CONTENT				
si 1. Is accurate				
si 2. Is up to date				
si 3. Is sequential				
si 4. Is comprehensive/interdisciplinary				
si 5. Integrates legislation, ethics, social and physical science				
si 6. Evaluates and selects				
COMMENTS:				

	1	2	3	4
Mi 5. PROBLEM-SOLVING SKILLS				
si 1. Defines/delineates problem				
si 2. Selects appropriate framework/strategies to solve problem using				

discipline				
si 3. Selects or designs appropriate frameworks/strategies to solve problems				
si 4. Implements solutions or options				
si 5. Evaluates the problem-solving process				
COMMENTS:				

	1	2	3	4
Mi 6. INTERACTION/COMMUNICATION				
si 1. Identifies own strengths and weaknesses				
si 2. Assumes different roles in the group				
si 3. Demonstrates verbal skills appropriate to the situation (reflection, clarification, paraphrasing, focusing)				
si 4. Demonstrates non-verbal skills appropriate to the situation (facial expression, posture, listening, silence, gestures)				
si 5. Demonstrates attitudes appropriate to situation (empathy, tolerance, respect.)				
si 6. Demonstrates integrity to own values/morals managing				
COMMENTS:				

	1	2	3	4
Mi 7. CRITICAL THINKING				
si 1. Identifies and challenges assumptions				
si 2. Demonstrates contextual awareness and thinking				
si 3. Explores and imagines alternatives				
si 4. Demonstrates analysis (active inquiry) and action				
COMMENTS:				

ANNEXURE H

INFORMATION LETTER

STUDY TITLE: PERFORMANCE OF UNDERGRADUATE NURSING STUDENTS IN PROBLEM-BASED LEARNING TUTORIALS

RESEARCHER: MELANIE LACK
MSc Student.

Dear Colleague

Thank you for your participation in **Round One** of Instrument Validation in the above study.

The Round One questionnaire has been rated by the experts using a subjective judgement. A rating of 1, 2, 3 or 4 was given to all the main items and the sub items on the questionnaire. All items receiving a rating of 1 or 2 were excluded. The items receiving a rating of 3 were modified according to the comments made by the experts. The items that received a rating of 4 have remained on the questionnaire as these items were seen as 'very relevant'. Certain items have been added to the checklist.

Enclosed please find the Round One questionnaire and instructions. This questionnaire has been sorted into a workable document. Items have been excluded, new items have been included and certain items have been modified according to the opinions of the experts. The new items that have been included and those items that were modified are featured in blue print. For further modification and refinement I again request you to allocate a rating to each item in blue print. The items in black print were rated a four (4) during Round One. They have remained on the **Round Two** questionnaire in order to view the questionnaire in its entirety.

I once again thank you for your participation in this study.

MELANIE LACK. RN

Cell. 083.233.4137
e-mail- mellack@mweb.co.za

ROUND TWO QUESTIONNAIRE

Mi = Main item (Upper case)
si = sub item (Lower case)

1 = Not relevant

2 = Unable to assess relevance without item revision or item is in need of such revision that it will no longer be relevant

3 = Relevant but needs minor alteration

4 = Very relevant

(The above nominal scale is the work of Mary R. Lynn 1986)

	1	2	3	4
Mi 1. PERSONAL GROWTH				
si 1 Willing to work with group members				
si 2 Offers encouragement and support to group members				
si 3 Acknowledges contributions from group members				
si 4 Able to assume different roles in the group				
si 5 Presents constructive interventions and feedback				
si 6 Assists in the setting of ground rules for the group				
si 7 Displays active listening				
si 8 Has a consultative attitude				
si 9 Shows skills in conflict-handling				
Comments				
Mi 2. CREATIVE THINKING				
si 1 Shows ability in creative writing				
si 2 Shows ability in brainstorming				
si 3 Has skills in drawing.				
Comments				
Mi 3 LEADERSHIP				
si 1 Shows a caring attitude				
si 2 Shows assertiveness				
si 3 Offers facts, suggestions, opinions to group members				
si 4 Demonstrates facilitation skills				
si 5 Takes decisions				
si 6 Initiates the undertaking of tasks				
si 7 Identifies learning issues				
si 8 Moves process forward				
si 9 Assumes different roles in group				
si 10 Assists in resolving conflict				
si 11 Able to summarize discussion				
Comments				
	1	**2**	**3**	**4**
Mi 4 LEARNING AND TEACHING SILLS				
si 1 Should be able to use more than one resource				

si 2	Demonstrates ability to read around a learning objective				
si 3	Demonstrates ability to understand professional language				
Comments					
Mi 5	**CONTENT OF INPUTS (CONTRIBUTIONS)**				
si 1	Is comprehensive depending on subject learnt				
si 2	Literature not older than five years				
si 3	Takes into account other disciplines				
si 4	Integrates legislation into discussion				
si 5	Integrates ethics into discussion				
si 6	Integrates health service principles				
Comments					
Mi 6	**COMMUNICATION**				
si 1	Demonstrates verbal skills appropriate to the situation				
si 2	Demonstrates non-verbal skills appropriate to the situation				
si 3	Demonstrates writing skills appropriate to the situation				
Comments					
Mi 7	**PROBLEM-SOLVING SKILLS**				
si 1	Manages to identify the problem				
si 2	Selects a strategy to solve the problem				
si 3	Identifies possible solutions to the problem				
si 4	Rates the possible solutions to the problem				
si 5	Decides on the best solution to the problem				
si 6	Implements a solution to the problem				
Comments					
Mi 8	**CRITICAL THINKING**				
si 1	Identifies purpose or goal				
si.2	Identifies a problem, question or issue				
si 3	Verbally analyses the problem, question or issue				
si 4	Able to use a frame of reference				
si 5	Uses evidence to support an argument or position				
si 6	Evidence is clear				
si 7	Evidence is accurate				
si 8	Evidence is adequate				
si 9	Conceptual dimensions are clear				
si 10	Reasoning based on clear assumptions				
si 11	An understanding of implications and consequences				
si 12	Proper inference-making				
si 13	Suggests and proposes alternatives				
si 14	Able to explain the conclusion				
Comments					

ANNEXURE I

UNIVERSITY OF THE WITWATERSRAND
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF NURSING EDUCATION

Student name…….Student No……

Facilitator Name……Year of Study……..Date……

A. PROBLEM SOLVING SKILLS	**0**	**1**	**2**	**3**
1. Identifies possible solutions to the problem				
2. Helps select strategy to solve the problem				
3. Manages to identify the problem				
4. Implements a solution to the problem				
5. Discusses the best solution to the problem				
B. CONTRIBUTIONS	**0**	**1**	**2**	**3**
1. Takes into account other disciplines when appropriate				
2. Is comprehensive depending on subject learnt				
3. Integrates ethics into discussion				
4. Integrates legislation into discussion when appropriate				
5. Integrates health service principles				
C. COMMUNICATION	**0**	**1**	**2**	**3**
1. Demonstrates verbal skills appropriate to the situation				
2. Demonstrates non-verbal skills appropriate to situation				
D. CRITICAL THINKING SKILLS	**0**	**1**	**2**	**3**
1. Identifies a problem, question or issue				
2. Uses evidence to support an argument or position				
3. Suggests and proposes alternatives				
4. Verbally analyses the problem, question or issue				
E. LEARNING SKILLS	**0**	**1**	**2**	**3**
1. Should be able to use more than one resource				
2. Demonstrates ability to understand concepts and theories				
3. Is able to interpret a learning objective				
F. PERSONAL GROWTH	**0**	**1**	**2**	**3**
1. Displays active listening				
2. Presents constructive interventions and feedback				
3. Shows ability to brainstorm				
4. Acknowledges contributions from group members				
5. Offers encouragement and support to group members				
6. Able to summarize discussion				
7. Willing to work with group members				
8. Assists and manages ground rules for the group				
G. LEADERSHIP	**0**	**1**	**2**	**3**
1. Offers facts, suggestions, opinions to group members				
2. Identifies learning issues				
3. Initiates the undertaking of tasks				
4. Shows a caring attitude				
5. Drives the process forward				
6. Takes decisions				
7. Shows assertiveness				

ANNEXURE J

TUTORIAL PERFORMANCE RATING INSTRUMENT DESCRIPTORS

(Bruce 1994)

-

	0	1	2	3
PROBLEM-SOLVING	- Insufficient ability to problem-solve	- Limited ability to problem-solve	- Improved problem-solving abilities	- Good problem-solving skills
CONTRIBUTIONS	- Confused understanding of legislation and ethics	- Superficial understanding of legislation and ethics	-Improved understanding of legislation and ethics	-Clear and systematic understanding of legislation and ethics
COMMUNICATION SKILLS	- Poor communication skills	- Minimal communication skills	- Improved communication skills	- Good communication skills
CRITICAL THINKING SKILLS	- Lack of critical thinking abilities	- Limited critical thinking abilities	- Improved critical thinking abilities	- Uses good critical thinking skills
LEARNING SKILLS	- Poor use of resources and literature -Confused usage of concepts, theories and issues	- Inadequate use of resources and literature - Superficial understanding of concepts, theories and issues	- Improved use of resources and literature. - Fair understanding of concepts, theories and issues	- Good use of resources and literature. -Clear and systematic argument supported by evidence. Firm grasp of concepts, theories and issues
PERSONAL GROWTH	Unable to function in a team	- Inadequate ability to function within a team	-Attempts to function well within the team	- Functions well within a team
LEADERSHIP SKILLS	- Poor leadership qualities	- Shows limited leadership qualities	- Shows some leadership qualities	Displays most leadership qualities

ANNEXURE K

INFORMATION LETTER

STUDY TITLE: PERFORMANCE OF UNDERGRADUATE NURSING STUDENTS IN PROBLEM-BASED LEARNING TUTORIALS

RESEARCHER: MELANIE LACK
MSc Student

Dear Colleague

Thank you for your participation in **Round One** and **Round Two** of the Delphi Technique. Following your judgement, a new evaluation instrument has been developed, referred to as the Tutorial Performance Rating Instrument.

The analysis of Round Two incorporated rigorous practices. The Content Validity Index (CVI) was applied to both the items and the new instrument. Both the items and the instrument scored a 1.00. Content validity has been determined

In **Round Three** construct validity will be tested. This will be done using the Subjective Judgement Model. Enclosed find paired comparisons of items displayed on visual analogue scales (VAS). A comparative pair-wise weighting will be subjectively determined by the experts on each VAS. (See - Instructions to the Experts). The measurement on each VAS will eventually convert to ratio scales and percentages. Measuring the relative importance of an item at any given level can then be carried out.

Secondly, give a weighting to the 4-point Likert Scale which will be used as the competency rating on the newly developed evaluation instrument.

Data collection from the experts will be completed at the end of this round.

Once this study has been completed you will be given the completed evaluation instrument.

I once again thank you for your participation in this study.

Yours sincerely

MELANIE LACK. RN

Cell. 083.233.4137
E-mail- mellack@absamail.co.za

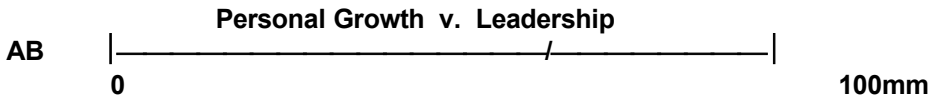
Instructions to the experts

1. The visual analogue scale (VAS) will ultimately provide ratio-level data and percentages.

2. The VAS is 100mm in length between the right-angle anchors on either side of the line.

3. Please place a mark at some point on the line between the two anchors. This mark will indicate your subjective judgement to estimate the relative importance of one item versus a second item in a paired comparison.

Example



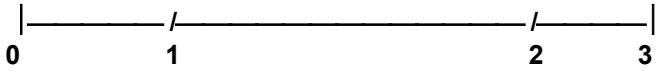
- The AB refers to the comparison of Construct A – Personal Growth versus Construct B – Leadership (The Main items and sub items featured on the Tutorial Performance Rating Instrument are included in the pack for easy reference to codes assigned to the Main items and sub items).

- The distance between 0 to the mark placed by the expert is the weighted measurement of Personal Growth when compared with Leadership.

- The accurate measurement in mm between 0- expert's mark (done by researcher) will be sent to the statistician for conversion to ratio scales.

4. On the four (4) point 0-3 Competency Scale, place a mark for point one (1) and a mark for point two (2). Read the descriptors for each point and decide where the marks should be placed.

Example



DATA WILL BE COLLECTED ON THE 4 AUGUST O6

VISUAL ANALOGUE SCALES

Main-Items / Constructs

Personal Growth v. Leadership

AB |————————————————————————————————————|

Personal Growth v. Learning Skills

AC |————————————————————————————————————|

Personal Growth v. Contributions

AD |————————————————————————————————————|

Personal Growth v. Communication

AE |————————————————————————————————————|

Personal Growth v. Problem-solving Skills

AF |————————————————————————————————————|

Personal Growth v. Critical Thinking Abilities

AG |————————————————————————————————————|

Leadership v. Learning Skills

BC |————————————————————————————————————|

Leadership v. Content of Inputs

BD |————————————————————————————————————|

Leadership v. Communication

BE |————————————————————————————————————|

Leadership v. Problem-solving Skills

BF |————————————————————————————————————|

Leadership v. Critical Thinking Abilities

BG |————————————————————————————————————|

Learning Skills v. Contributions

CD |————————————————————————————————————|

Learning Skills v. Communication

CE |————————————————————————————————————|

Learning Skills v. Problem-solving Skills

CF |————————————————————————————————————|

Learning Skills v. Critical Thinking Abilities

CG |————————————————————————————————————|

Contributions v. Communication

DE |————————————————————————————————————|

Contributions v. Problem-solving Skills

DF |————————————————————————————————————|

Contributions v. Critical Thinking Abilities

DG |————————————————————————————————————|

Communication v. Problem-solving Skills

EF |————————————————————————————————————|

Communication v. Critical Thinking Abilities

EG |————————————————————————————————————|

Problem-solving Skills v. Critical Thinking Abilities

FG |————————————————————————————————————|

Sub-items : Construct A (Personal Growth)

Willing to work with group members v. Offers encouragement and support to group members

A 1-2 |———————————————————————————————|

Willing to work with group members v. Acknowledges contributions from group members

A 1-3 |———————————————————————————————|

Willing to work with group members v. Presents constructive interventions and feedback

A 1-4 |———————————————————————————————|

Willing to work with group members v. Assists and manages ground rules for the group

A 1-5 |———————————————————————————————|

Willing to work with group members v. Displays active listening

A 1-6 |———————————————————————————————|

Willing to work with group members v. Shows ability to brainstorm

A 1-7 |———————————————————————————————|

Willing to work with group members v. Able to summarize discussion

A 1-8 |———————————————————————————————|

Offers encouragement and support to group members v. Acknowledges contributions from group members

A 2-3 |———————————————————————————————|

Offers encouragement and support to group members v. Presents constructive interventions and feedback

A 2-4 |———————————————————————————————|

Offers encouragement and support to group members v. Assists and manages ground rules for the group

A 2-5 |———————————————————————————————|

Offers encouragement and support to group members v. Displays active listening

A 2-6 |———————————————————————————————|

Offers encouragement and support to group members v. Shows ability to brainstorm

A 2-7 |———————————————————————————————|

Offers encouragement and support to group members v. Able to summarize discussion
A 2-8 |——————————————————————————|

Acknowledges contributions from group members v. Presents constructive interventions and feedback
A 3-4 |——————————————————————————|

Acknowledges contributions from group members v. Assists and manages ground rules for the group
A 3-5 |——————————————————————————|

Acknowledges contributions from group members v. Displays active listening
A 3-6 |——————————————————————————|

Acknowledges contributions from group members v. Shows ability to brainstorm
A 3-7 |——————————————————————————|

Acknowledges contributions from group members v. Able to summarize discussion
A 3-8 |——————————————————————————|

Presents constructive interventions and feedback v. Assists and manages ground rules for the group
A 4-5 |——————————————————————————|

Presents constructive interventions and feedback v. Displays active listening
A 4-6 |——————————————————————————|

Presents constructive interventions and feedback v. Shows ability to brainstorm
A 4-7 |——————————————————————————|

Presents constructive interventions and feedback v. Able to summarize discussion
A 4-8 |——————————————————————————|

Assists and manages ground rules for the group v. Displays active listening
A 5-6 |——————————————————————————|

Assists and manages ground rules for the group v. Shows ability to brainstorm
A 5-7 |——————————————————————————|

Assists and manages ground rules for the group v. Able to summarize discussion
A 5-8 |——————————————————————————|

Displays active listening v. Shows ability to brainstorm
A 6-7 |——————————————————————————|

Displays active listening v. Able to summarize discussion
A 6-8 |——————————————————————————|

Shows ability to brainstorm v. Able to summarize discussion
A 7-8 |——————————————————————————|

Sub-items : Construct B (Leadership)

Shows a caring attitude v. Shows assertiveness
B 1-2 |——————————————————————————|

Shows a caring attitude v. Offers facts, suggestions, opinions to group
B 1-3 |——————————————————————————|

Shows a caring attitude v. Takes decisions
B 1-4 |——————————————————————————|

Shows a caring attitude v. Initiates the undertaking of tasks
B 1-5 |——————————————————————————|

Shows a caring attitude v. Identifies learning issues
B 1-6 |——————————————————————————|

Shows a caring attitude v. Drives the process forward
B 1-7 |——————————————————————————|

Shows assertiveness v. Offers facts, suggestions, opinions to group
B 2-3 |——————————————————————————|

Shows assertiveness v. Takes decisions

B 2-4 |———————————————————————————————|

.

Shows assertiveness v. Initiates the undertaking of tasks
B 2-5 |———————————————————————————————|

Shows assertiveness v. Identifies learning issues
B 2-6 |———————————————————————————————|

Shows assertiveness v. Drives the process forward
B 2-7 |———————————————————————————————|

Offers facts, suggestions, opinions to group v. Takes decisions
B 3-4 |———————————————————————————————|

Offers facts, suggestions, opinions to group v. Initiates the undertaking of tasks
B 3-5 |———————————————————————————————|

Offers facts, suggestions, opinions to group v. Identifies learning issues B
3-6 |———————————————————————————————|

Offers facts, suggestions, opinions to group v. Drives the process forward
B 3-7 |———————————————————————————————|

Takes decisions v. Initiates the undertaking of tasks
B 4-5 |———————————————————————————————|

Takes decisions v. Identifies learning issues
B 4-6 |———————————————————————————————|

Takes decisions v. Drives the process forward
B 4-7 |———————————————————————————————|

Initiates the undertaking of tasks v. Identifies learning issues
B 5-6 |———————————————————————————————|

Initiates the undertaking of tasks v. Drives the process forward
B 5-7 |——————————————————————————|

Identifies learning issues v. Drives the process forward
B 6-7 |——————————————————————————|

Sub-items : Construct C (Learning Skills)

Should be able to use more than one resource v. Is able to interpret a learning objective
C 1-2 |——————————————————————————|

Should be able to use more than one resource v. Demonstrates ability to understand concepts and theories
C 1-3 |——————————————————————————|

Is able to interpret a learning objective v. Demonstrates ability to understand concepts and theories
C 2-3 |——————————————————————————|

Sub-items : Construct D (Contributions)

Is comprehensive depending on subject learnt v. Takes into account other disciplines when appropriate
D 1-2 |——————————————————————————|

Is comprehensive depending on subject learnt v. Integrates legislation into discussion when appropriate
D 1-3 |——————————————————————————|

Is comprehensive depending on subject learnt v. Integrates ethics into discussion
D 1-4 |——————————————————————————|

Is comprehensive depending on subject learnt v. Integrates health service principles
D 1-5 |——————————————————————————|

Takes into account other disciplines when appropriate v. Integrates legislation into discussion when appropriate
D 2-3 |——————————————————————————|

Takes into account other disciplines when appropriate v. Integrates ethics into discussion
D 2-4 |——————————————————————————|

Takes into account other disciplines when appropriate v. Integrates health service principles
D 2-5 |——————————————————————————|

Integrates legislation into discussion when appropriate v. Integrates ethics into discussion
D 3-4 |——————————————————————————|

Integrates legislation into discussion when appropriate v. Integrates health service principles
D 3-5 |——————————————————————————|

Integrates ethics into discussion v. Integrates health service principles
D 4-5 |——————————————————————————|

Sub items: Construct E (Communication)

Demonstrate verbal skills appropriate to situation v. Demonstrates non verbal skills appropriate to situation
E 1-2 |——————————————————————————|

Sub items : Construct F (Problem-solving Skills)

Manages to identify the problem v. Helps select a strategy to solve the problem
F 1-2 |——————————————————————————|

Manages to identify the problem v. Identifies possible solutions to the problem
F 1-3 |——————————————————————————|

Manages to identify the problem v. Discusses the best solution to the problem
F 1-4 |——————————————————————————|

Manages to identify the problem v. Implements a solution to the problem
F 1-5 |——————————————————————————|

Helps select a strategy to solve the problem v. Identifies possible solution to the problem
F 2-3 |———————————————————————————|

Helps select a strategy to solve the problem v. Discusses the best solution to the problem
F 2-4 |———————————————————————————|

Helps select a strategy to solve the problem v. Implements a solution to the problem
F 2-5 |———————————————————————————|

Identifies possible solution to the problem v. Discusses the best solution to the problem
F 3-4 |———————————————————————————|

Identifies possible solution to the problem v. Implements a solution to the problem
F 3-5 |———————————————————————————|

Discusses the best solution to the problem v. Implements a solution to the problem
F 4-5 |———————————————————————————|

Sub items : Construct G (Critical Thinking Abilities).

Identifies a problem, question or issue v. Verbally analyses the problem, question or issue
G 1-2 |———————————————————————————|

Identifies a problem, question or issue v. Uses evidence to support an argument or position
G 1-3 |———————————————————————————|

Identifies a problem question or issue v. Suggests and proposes alternatives
G 1-4 |———————————————————————————|

Verbally analyses the problem, question or issue v. Uses evidence to support an argument or position
G 2-3 |———————————————————————————|

Verbally analyses the problem, question or issue v. Suggests and proposes alternatives
G 2-4 |———————————————————————————|

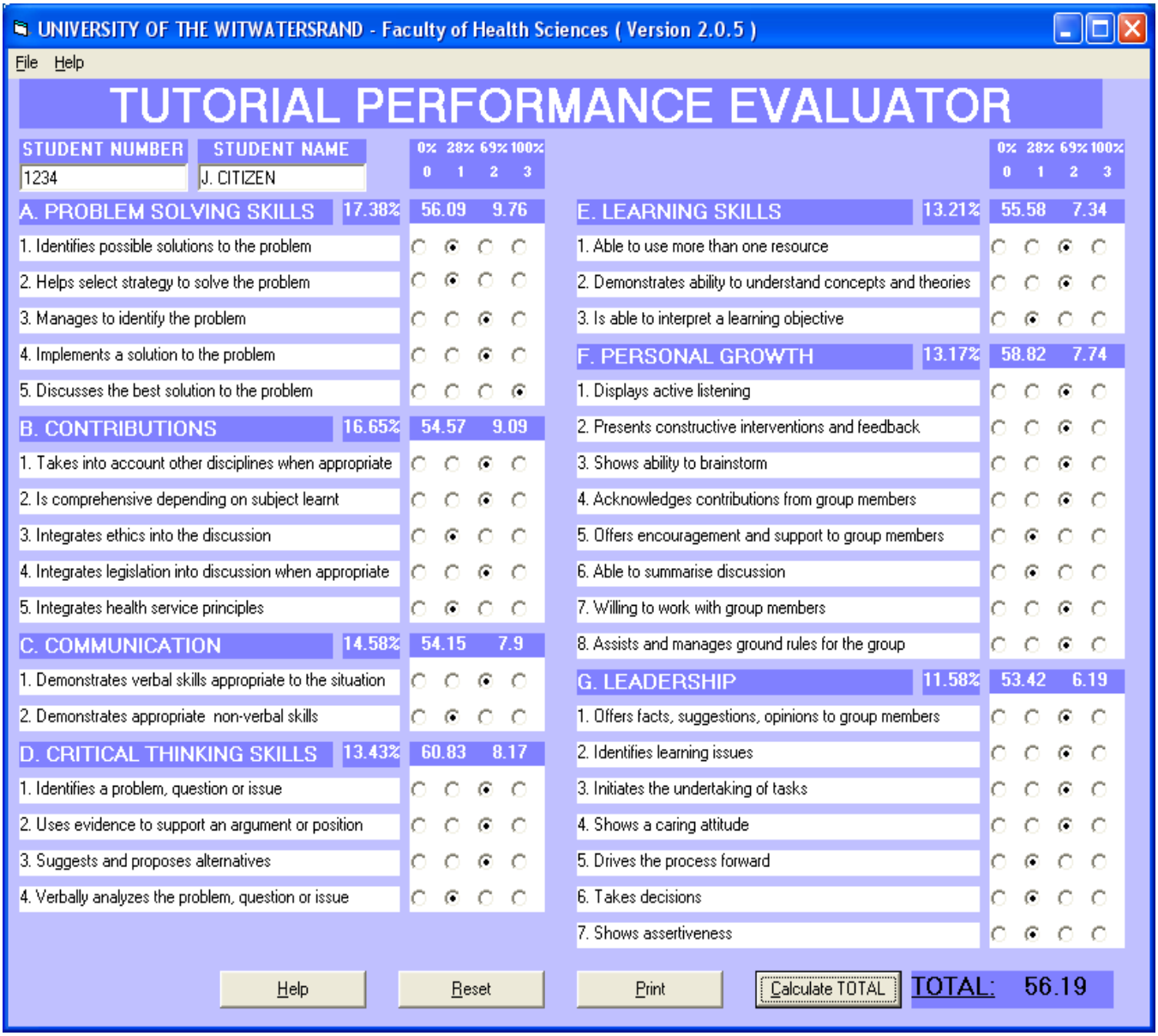
Uses evidence to support an argument or position v. Suggests and proposes alternatives
G 3-4 |————————————————————————————————————|

Weights of Main- items and sub-items **ANNEXURE L**

Coef.	Coef.	Exp.(Coef.)	Std Weight %
Con_a	**-0.0206**	**0.9797**	**13.16**
Ques_a1	-0.0250	0.9753	11.69
Ques_a2	0.0612	1.0632	12.74
Ques_a3	0.0858	1.0896	13.06
Ques_a4	0.1196	1.1270	13.51
Ques_a5	-0.1839	0.8320	9.97
Ques_a6	0.1237	1.1317	13.57
Ques_a7	0.1163	1.1234	13.47
Ques_a8	0.0000	1.0000	11.99
		8.3423	100.00
Con_b	**-0.1486**	**0.8619**	**11.58**
Ques_b1	0.0094	1.0094	14.27
Ques_b2	-0.1887	0.8280	11.71
Ques_b3	0.1388	1.1488	16.24
Ques_b4	-0.1619	0.8506	12.03
Ques_b5	0.0953	1.1000	15.55
Ques_b6	0.1273	1.1358	16.06
Ques_b7	0.0000	1.0000	14.14
		7.0726	100.00
Con_c	**-0.0168**	**0.9833**	**13.21**
Ques_c1	0.0180	1.0182	33.95
Ques_c2	-0.0197	0.9805	32.70
Ques_c3	0.0000	1.0000	33.35
		2.9987	100.00
Con_d	**0.2141**	**1.2387**	**16.65**
Ques_d1	0.3465	1.4142	21.13
Ques_d2	0.4874	1.6280	24.32
Ques_d3	0.2619	1.2994	19.41
Ques_d4	0.3019	1.3524	20.20
Ques_d5	0.0000	1.0000	14.94
		6.6940	100.00
Con_e	**0.0815**	**1.0849**	**14.58**
Ques_e1	0.5671	1.7632	63.81
Ques_e2	0.0000	1.0000	36.19
		2.7632	100.00
Con_f	**0.2570**	**1.2931**	**17.38**
Ques_f1	0.1278	1.1363	20.66
Ques_f2	0.1678	1.1827	21.50
Ques_f3	0.2239	1.2509	22.74
Ques_f4	-0.0716	0.9309	16.92
Ques_f5	0.0000	1.0000	18.18
		5.5008	100.00

Con_g	0.0000	1.0000	13.44
Ques_g1	0.1201	1.1276	28.38
Ques_g2	-0.2358	0.7899	19.88
Ques_g3	0.0536	1.0551	26.56
Ques_g4	0.0000	1.0000	25.18
		3.9726	100.00

ANNEXURE M



```
-------------------------------------------------------------------------------
-------------------
       log:  C:\Documents and Settings\Eustasius Musenge\My
Documents\msc_nursing.log
  log type:  text
 opened on:  10 Dec 2007, 19:15:01

. by skills year, sort: summ  score

-------------------------------------------------------------------------------
---------------------------------
-> skills = A, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        15      26.544    15.35676      12.14
68.98

-------------------------------------------------------------------------------
---------------------------------
-> skills = A, year = 2

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        21    57.47619    22.59988       6.36
94.75

-------------------------------------------------------------------------------
---------------------------------
-> skills = A, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         8       59.39    10.66945      45.78
68.98

-------------------------------------------------------------------------------
---------------------------------
-> skills = A, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         9    83.56444    19.10468      44.76
100
```

```
-------------------------------------------------------------------------
---------------------------------
-> skills = B, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        15      15.344    10.38734       5.91
36.63

-------------------------------------------------------------------------
---------------------------------
-> skills = B, year = 2

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        21    55.80048    19.27621          0
79.88

-------------------------------------------------------------------------
---------------------------------

-> skills = B, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         8     43.7175    13.21689      27.97
69.41

-------------------------------------------------------------------------
---------------------------------
-> skills = B, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         9       85.48    13.97639      68.97
100

-------------------------------------------------------------------------
---------------------------------
-> skills = C, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        15    35.71333    26.51507          0
88.78

-------------------------------------------------------------------------
---------------------------------
-> skills = C, year = 2
```

```
    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        21    81.38238     25.7846      27.99
100

-------------------------------------------------------------------------
---------------------------------
-> skills = C, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         8    64.48375    13.90781      42.83
88.78

-------------------------------------------------------------------------
---------------------------------
-> skills = C, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         9    87.46444    15.25714      68.99
100

-------------------------------------------------------------------------
---------------------------------
-> skills = D, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        15    23.57133    12.70768          0
39.62

-------------------------------------------------------------------------
---------------------------------

-> skills = D, year = 2

Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------
+--------------------------------------------------------
       score |        21    60.58048    24.72075          0
100
-------------------------------------------------------------------------
---------------------------------
-> skills = D, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         8    58.90625    17.48552      27.98
77.22
```

```
-------------------------------------------------------------------------
---------------------------------
-> skills = D, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         9       89.66    13.45382      68.98
100

-------------------------------------------------------------------------
---------------------------------
-> skills = E, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        15    26.11467    13.97389          0
55.58

-------------------------------------------------------------------------
---------------------------------
-> skills = E, year = 2

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |        21    67.43286    20.40455      27.98
100

-------------------------------------------------------------------------
---------------------------------
-> skills = E, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         8     59.6075    13.01457       41.9
79.52

-------------------------------------------------------------------------
---------------------------------
-> skills = E, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         9    91.98111    11.27031      68.99
100

-------------------------------------------------------------------------
---------------------------------
-> skills = F, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
```

```
-------------
+---------------------------------------------------------
       score |        15      35.092    14.89429      17.62
64.05

-------------------------------------------------------------------------
---------------------------------
-> skills = F, year = 2

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+---------------------------------------------------------
       score |        21    67.06762    20.19254      25.13
100

-------------------------------------------------------------------------
---------------------------------
-> skills = F, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+---------------------------------------------------------
       score |         8    56.55875    14.63508      33.48
80.76

-------------------------------------------------------------------------
---------------------------------
-> skills = F, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+---------------------------------------------------------
       score |         9    93.42111    5.363995       84.1
100

-------------------------------------------------------------------------
---------------------------------
-> skills = G, year = 1

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+---------------------------------------------------------
       score |        15    30.33067    19.76559       8.34
62.37

-------------------------------------------------------------------------
---------------------------------
-> skills = G, year = 2

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+---------------------------------------------------------
       score |        21    58.65952    24.56615       7.26
100
```

```
-------------------------------------------------------------------------
---------------------------------
-> skills = G, year = 3

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         8    57.40375    13.77502      34.54
76.83

-------------------------------------------------------------------------
---------------------------------
-> skills = G, year = 4

    Variable |       Obs        Mean    Std. Dev.       Min
Max
-------------
+--------------------------------------------------------
       score |         9    84.49333     17.5056      62.79
100


. by  skills, sort: oneway  score  year, bon tab

-------------------------------------------------------------------------
---------------------------------
-> skills = A

           |          Summary of score
      year |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         1 |      26.544   15.356763          15
         2 |   57.476192   22.599884          21
         3 |   59.390001    10.66945           8
         4 |   83.564444   19.104682           9
-----------+------------------------------------
     Total |   53.440755   26.630332          53

                       Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
-------------------------------------------------------------------------
---
Between groups      19643.5892      3   6547.86308     18.62
0.0000
 Within groups      17233.4886     49    351.70385
-------------------------------------------------------------------------
---
    Total           36877.0779     52   709.174575

Bartlett's test for equal variances:  chi2(3) =   5.5073  Prob>chi2 =
0.138

                          Comparison of score by year
                                 (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+----------------------------------
       2 |    30.9322
         |      0.000
```

```
          |
        3 |     32.846    1.91381
          |      0.001      1.000
          |
        4 |    57.0204    26.0883    24.1744
          |      0.000      0.006      0.064

------------------------------------------------------------------------
---------------------------------
-> skills = B

           |          Summary of score
      year |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         1 |      15.344    10.38734          15
         2 |   55.800477   19.276208          21
         3 |   43.717501   13.216886           8
         4 |       85.48   13.976387           9
-----------+------------------------------------
     Total |   47.566604   28.345752          53

                       Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
------------------------------------------------------------------------
---
Between groups      30053.5278      3   10017.8426     41.86
0.0000
 Within groups      11727.5169     49   239.337081
------------------------------------------------------------------------
---
    Total           41781.0447     52    803.48163

Bartlett's test for equal variances:  chi2(3) =   5.9421  Prob>chi2 =
0.114

                        Comparison of score by year
                               (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+---------------------------------
       2 |    40.4565
         |      0.000
         |
       3 |    28.3735    -12.083
         |      0.001      0.396
         |
       4 |     70.136    29.6795    41.7625
         |      0.000      0.000      0.000

------------------------------------------------------------------------
---------------------------------
-> skills = C

           |          Summary of score
      year |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         1 |   35.713333   26.515071          15
         2 |   81.382381   25.784604          21
         3 |   64.483749    13.90781           8
         4 |   87.464444   15.257143           9
```

```
------------+-----------------------------------
      Total |   66.939245   30.760294          53

                        Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
------------------------------------------------------------------------
---
Between groups      22846.3406      3   7615.44688     14.16
0.0000
 Within groups      26355.8355     49   537.874194
------------------------------------------------------------------------
---
    Total           49202.1761     52   946.195695

Bartlett's test for equal variances:  chi2(3) =   5.6403  Prob>chi2 =
0.130

                          Comparison of score by year
                                 (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+---------------------------------
       2 |     45.669
         |      0.000
         |
       3 |    28.7704   -16.8986
         |      0.040      0.514
         |
       4 |    51.7511    6.08206    22.9807
         |      0.000      1.000      0.281

------------------------------------------------------------------------
---------------------------------
-> skills = D

            |          Summary of score
       year |        Mean   Std. Dev.       Freq.
------------+-----------------------------------
          1 |   23.571333   12.707683          15
          2 |   60.580477   24.720749          21
          3 |   58.906251   17.485525           8
          4 |       89.66    13.45382           9
------------+-----------------------------------
      Total |    54.79151   29.244772          53

                        Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
------------------------------------------------------------------------
---
Between groups      26401.9999      3   8800.66665     23.86
0.0000
 Within groups       18071.349     49   368.803042
------------------------------------------------------------------------
---
    Total            44473.349     52   855.256712

Bartlett's test for equal variances:  chi2(3) =   8.1345  Prob>chi2 =
0.043
```

```
                        Comparison of score by year
                                (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+---------------------------------
       2 |    37.0091
         |      0.000
         |
       3 |    35.3349   -1.67423
         |      0.001      1.000
         |
       4 |    66.0887    29.0795    30.7537
         |      0.000      0.002      0.011

-------------------------------------------------------------------------
---------------------------------
-> skills = E

            |          Summary of score
       year |        Mean   Std. Dev.       Freq.
------------+------------------------------------
          1 |   26.114667   13.973888          15
          2 |   67.432856   20.404553          21
          3 |     59.6075   13.014573           8
          4 |   91.981111   11.270307           9
------------+------------------------------------
      Total |   58.726415   27.999424          53

                        Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
-------------------------------------------------------------------------
---
Between groups      27503.8202      3   9167.94008     33.87
0.0000
 Within groups      13262.5016     49   270.663298
-------------------------------------------------------------------------
---
    Total           40766.3218     52   783.967728

Bartlett's test for equal variances:  chi2(3) =   5.0832  Prob>chi2 =
0.166

                        Comparison of score by year
                                (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+---------------------------------
       2 |    41.3182
         |      0.000
         |
       3 |    33.4928   -7.82536
         |      0.000      1.000
         |
       4 |    65.8664    24.5483    32.3736
         |      0.000      0.003      0.001

-------------------------------------------------------------------------
---------------------------------
-> skills = F
```

```
           |          Summary of score
      year |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         1 |      35.092   14.894285          15
         2 |    67.06762   20.192535          21
         3 |   56.558751   14.635079           8
         4 |   93.421111   5.3639947           9
-----------+------------------------------------
     Total |   60.906793   25.362374          53

                       Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
------------------------------------------------------------------------
---
Between groups      20458.9964      3   6819.66545     25.72
0.0000
 Within groups       12990.004     49   265.102123
------------------------------------------------------------------------
---
    Total           33449.0004     52   643.250007

Bartlett's test for equal variances:  chi2(3) =  12.6251  Prob>chi2 =
0.006

                         Comparison of score by year
                                (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+---------------------------------
       2 |    31.9756
         |      0.000
         |
       3 |    21.4668   -10.5089
         |      0.025      0.760
         |
       4 |    58.3291    26.3535    36.8624
         |      0.000      0.001      0.000

------------------------------------------------------------------------
---------------------------------
-> skills = G

           |          Summary of score
      year |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         1 |   30.330667   19.765587          15
         2 |   58.659523    24.56615          21
         3 |   57.403749   13.775025           8
         4 |   84.493334   17.505596           9
-----------+------------------------------------
     Total |   54.839245   27.246269          53

                       Analysis of Variance
    Source              SS         df      MS            F     Prob >
F
------------------------------------------------------------------------
---
Between groups      17283.4394      3   5761.14647     13.24
0.0000
 Within groups       21319.239     49    435.08651
```

```
------------------------------------------------------------------------
---
    Total           38602.6784     52     742.3592

Bartlett's test for equal variances:  chi2(3) =   3.4354  Prob>chi2 =
0.329

                         Comparison of score by year
                                (Bonferroni)
Row Mean-|
Col Mean |          1          2          3
---------+---------------------------------
       2 |    28.3289
         |      0.001
         |
       3 |    27.0731   -1.25577
         |      0.028      1.000
         |
       4 |    54.1627    25.8338    27.0896
         |      0.000      0.019      0.061


. log close
       log:  C:\Documents and Settings\Eustasius Musenge\My
Documents\msc_nursing.log
  log type:  text
 closed on:  10 Dec 2007, 19:15:13
```