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STUDENTS' PERCEPTIONS AND PREFERENCES OF EDUCATIONAL ASSESSMENTS DURING THE INFECTION PREVENTION AND CONTROL COURSE.

ANTOINETTE MOOLMAN

A research report submitted to the Faculty of Health Science, University of the Witwatersrand, Johannesburg in fulfilment of the requirements for the degree of

Master of Science in Nursing

JOHANNESBURG

2018

DECLARATION

I, Antoinette Moolman hereby declare that the following research report is a product of my own research effort. It is being submitted for the degree of Master of Science (Nursing) at the University of the Witwatersrand, Johannesburg. This work has not previously been submitted for any degree or examination at this or any other university.

_____

SIGNATURE

_____

DATE

Protocol Number M160511

DEDICATION

I dedicate this work to my husband Gerhard, family and friends.

Thank you for your love and being a pillar of support throughout the course of the study!

ACKNOWLEDGEMENTS

I wish to extend my gratitude to all people whose contributions led to the successful completion of this research project. In particular, would I like to thank the following people who engaged into my study and who support me during the study to make a success of this research:

- My husband, Gerhard, for the financial support, motivation and patience.
- My children, for understanding and support.
- My supervisor, Andrea Hayward, for her patience, guidance and availability.
- Prof AG Duse, Clinical Microbiology Department who gave me the opportunity and permission to include the infection prevention and control students in the study.
- Prof Donna Kapp, who language edited my research report.
- Support from colleagues, Mark Pringle and Lesley Devenish.
- The participants without whose cooperation the study wouldn't have been a success.

ABSTRACT

Introduction: The competency of the students attending the infection prevention and control course (IPC) at a selected university in Gauteng is of concern because they frequently fail to achieve a pass mark in their final examination. Infection prevention and control is a clinical field and needs a high level of application of what was studied in the IPC course. As the problem of hospital-acquired infections rises, this low competency rate impacts on the number of trained and competent infection prevention and control practitioners and thus on the effective management of the hospital infection rate. The summative marks of the students in a specific study group indicate a problem which may relate to either the teaching, the selection of the students or the assessment methods used. Some effort has already been made to improve teaching. Little could be done regarding selection since due to the shortage of infection prevention and control practitioners, all applicants are accepted onto the course. A concern is that the current use of multiple choice questions as a sole evaluation method is not the best option or method of evaluation for this group of students. The following question needs to be answered: What methods of assessment do the IPC students prefer and what are their perceptions of multiple choice question examinations?

Objective: The objectives of the study were to explore the preferences of IPC students of assessment methods used in the IPC course and to explore the perception of the IPC students of the computer based multiple choice questions method of assessment used in the IPC course.

Methodology: This study made use of an exploratory and qualitative design that included semi-structured interviews which took place in small groups in an attempt to gather in-depth information which was analysed as described by Clarke and Braun (2013). The population in this study consisted of all students registered on the IPC course who took part in examinations from 2011-2016. Semi-structured interviews which took place in six small groups were conducted until saturation was achieved. Trustworthiness was based on the model of Lincoln and Guba.

Results: Three themes and eight subthemes derived from the semi-structured interviews which took place in small groups. Participants discussed broadly the evaluation process, the use of computer based multiple choice questions and alternative methods of assessment regarding their preferences and perception during the IPC course.

Conclusion: The purpose of the study was to gain more insight into students' actual preferences of assessment methods and their perceptions of computer-based multiple choice questions examinations. In order to fulfill the purpose of this study two objectives were set and achieved. The findings showed that timing of testing, the content of examinations and preparation for examination as part of the evaluation process were issues the students needed to deal with to pass. Unfamiliarity with the format, negative marking as an assessment method and English as a language of instruction course increased anxiety of the student participating in the course. Rationale for alternative forms of evaluation and the

recommendations for alternative methods of assessment need to be considered in further changes of the curriculum in future.

Keywords: Infection prevention and control, multiple choice questions, evaluation approaches, evaluation methods, infection prevention and control courses, semi-structured interviews and e-learning in infection prevention and control.

LIST OF ABBREVIATIONS

APIC	Association of Practitioners in Infection Control
CBMCQ	Computer-Based Multiple Choice Question
CDC	Centres for Diseases Control
CR	Constructed- response method of evaluation
Nod	National Department of Health
ET	Elimination testing
HCF	Health care facilities
HAI	Hospital-acquired infection
IPC	Infection Prevention and Control
IPCP	Infection Prevention and Control Practitioner
IWF	Item-writing Flaws
N-Type	Multiple Choice Questions Negative Marking
MEQ	Modified essay questions
MCQ	Multiple choice question
OHSA	The Occupational Health and Safety Administration
PPE	Personal protective equipment
SEQ	Short essay questions
TB	Tuberculosis
USA	United States of America
WHO	World Health Organisation

TABLE OF CONTENT

DECLARATION 1

DEDICATION 2

ACKNOWLEDGEMENTS 3

ABSTRACT 4

LIST OF ABBREVIATIONS 6

TABLE OF CONTENT 7

LIST OF TABLES 12

LIST OF FIGURES 13

CHAPTER ONE: OVERVIEW OF THE STUDY 14

1.0 INTRODUCTION 14

1.1 BACKGROUND OF THE STUDY 15

1.2 PROBLEM STATEMENT 18

1.3 RESEARCH QUESTION 19

1.4 PURPOSE OF THE STUDY 19

1.5 OBJECTIVES OF THE STUDY 19

1.6 SIGNIFICANCE OF THE STUDY 19

1.7 OPERATIONAL TERMS 20

1.7.1 Computer-based Multiple Choice Question 20

1.7.2 Semi-structured interview 21

1.7.3 Small groups 21

1.7.4 Formative and Summative Assessment or Evaluation 22

1.7.5 Infection Prevention and Control Practitioner (IPCP) 23
1.7.6 Item-writing Flaws (IWF) 23
1.7.7 Negative Marking 23
1.7.8 Scarce Skills 23
1.8 OVERVIEW OF RESEARCH METHODS 24
1.9 DATA COLLECTION 24
1.10 DATA ANALYSIS 25
1.11 MEASURES OF TRUSTWORTHINESS 25
1.12 ETHICAL CONSIDERATIONS 26
1.13 OUTLINE OF CHAPTERS 27
1.14 SUMMARY 27
CHAPTER TWO: LITERATURE REVIEW 28
2.1 INTRODUCTION 28
2.2 LITERATURE REVIEW 29
2.2.1 Early Development of Training in IPC 29
2.2.2 Qualities and Competencies Required for an Infection Prevention and Control Practitioner (IPCP). 31
2.2.3 Student Evaluation Approaches 34
2.2.4 Types of Evaluation Methods 38
2.2.5 Negative Marking 46
2.2.6 Computer-Based Versus Non- Computer-based questions 48
2.2.7 Student preferences and perceptions towards evaluation methods 48
2.3 SUMMARY 52

CHAPTER THREE: RESEARCH METHOD 54
3.1 INTRODUCTION 54
3.2 PURPOSE AND OBJECTIVES 54
3.3 RESEARCH DESIGN 54
3.3.1 Qualitative Research 55
3.3.2 Exploratory 56
3.3.3 Descriptive Design 56
3.3.4 Context 57
3.4 RESEARCH METHODS 58
3.4.1 Population 58
3.4.2 Sample and Sampling 58
3.4.3 Setting and site 59
3.4.4 Small groups 60
3.4.5 Semi-structured interviews 60
3.5 DATA COLLECTION 62
3.5.1 Planning the interviews 62
3.5.2 Conducting the interviews 63
3.6 DATA ANALYSIS 64
3.6.1 Approach to Analysis 64
3.7 MEASURES TO ENSURE TRUSTWORTHINESS 70
3.7.1 Credibility 71
3.7.2 Dependability 71

3.7.3 Confirmability 72
3.7.4 Transferability 72
3.8 ETHICAL CONSIDERATIONS 73
3.8.1 Permission to Conduct the Study 73
3.8.2 Informed consent 73
3.8.3 Confidentiality and Anonymity 74
3.9 SUMMARY 75
CHAPTER FOUR: FINDINGS 76
4.1 INTRODUCTION 76
4.2 DISCUSSION OF FINDINGS 76
4.2.1 Demographic Data 77
4.2.2 Emerging Themes and Sub Themes 79
4.2.3 Themes 79
4.3 SUMMARY 93
CHAPTER FIVE: DISCUSSION, RECOMMENDATIONS, LIMITATIONS AND CONCLUSIONS 94
5.1 INTRODUCTION 94
5.2 SUMMARY OF FINDINGS 94
5.3 DISCUSSION OF FINDINGS 95
5.3.1 Discussion of Demographic Data 95
5.3.2 Discussion of Small Group Data. 96
5.3.3 Summary of the Discussion 101
5.4 RECOMMENDATIONS 105

5.4.1 Recommendation for the Nursing Practice 105

5.4.2 Recommendation for the nursing management 106

5.4.3 Recommendation for the nursing research 106

5.4.4 What does this study add? 107

5.5 LIMITATIONS 107

5.6 CONCLUSION 108

REFERENCES 110

APPENDIX 1: ETHICAL CLEARANCE FROM: HUMAN ETHICS COMMITTEE 123

APPENDIX 2: LETTER OF PERMISSION TO CONDUCT THE STUDY 124

APPENDIX 3: INFORMATION LETTER AND CONSENT OF PARTICIPANT 126

APPENDIX 4: PERMISSION FROM THE PARTICIPANT SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS 128

APPENDIX 5: CONSENT FORM FOR THE RECORDING OF SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS 129

APPENDIX 6: INFECTION PREVENTION AND CONTROL (IPC) SEMI-STRUCTURED INTERVIEW QUESTIONS THAT WILL BE USED DURING EVERY GROUP INTERVIEW 130

APPENDIX 7: EXAMPLES OF TYPO TRANSCRIPTIONS OF THE SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS: 132

LIST OF TABLES

		Page
Table 3.1	Availability of respondents.	61
Table 3.2	Clark and Braun (2013) six-step framework for doing a thematic analyssis.	65
Table 3.3	Example of coding transcripts according to the research question.	67
Table 3.4	Themes identified from the transcript.	68
Table 4.1	Age of Participants.	77
Table 4.2	Qualifications of the Participants	78
Table 4.3	IPC Experiences of the participants	78
Table 4.4	Emerging Themes and Sub-Themes	79

LIST OF FIGURES

Page

Figure 3.1 Application of Clark and Braun's (2013) Thematical Analysis Methods 70

CHAPTER ONE

OVERVIEW OF THE STUDY

1.0 INTRODUCTION

There is a scarcity of infection prevention and control (IPC) nurses, capacity and expertise in the South African public healthcare facilities (Zinatsa *et al*., 2018).

Stone *et al*.(2009) refer to a ratio of one Infection Prevention and Control Practitioner (IPCP) to 250 acute care beds and highlight that this is no longer adequate to meet current infection control needs. In this American study performed in 2009 by Stone, the author advised that the ratio of one infection prevention and control practitioner per 167 beds would be more reasonable in order to improve the infection rate in hospitals. In a later study done by Stone *et al*. (2014) it was discovered that there are only 1.2 qualified IPCP's working across healthcare facilities in America and most of the hours of work were devoted to data mangement. South Africa's current staffing levels of infection prevention and control practitioners should be at least 1 to 200 acute care beds (Mahomed *et al*., 2017). No healthcare facilities in the public sector comply with this recommended ratio.

There are only a few dedicated IPC departments in South Africa. When this research started, there were four Universities, one in Pretoria, one in Johannesburg, one in the Western Cape and one in KwaZulu Natal with dedicated IPC departments and a written program for training in IPC. Currently there is only one academic centre that provides an IPC course as a short certificate course. There are no specific admission requirements for the certificate course. The course is completed over a year and comprises of four modules. The entrance criteria to the course are not aligned with those of the university in general as this course is considered to meet the scarce skills

criteria. The course has four modules and is run over four blocks. Attendance of all four modules is compulsory. Formative assessments are conducted on each Monday of blocks two, three and four. Each module test consists of computer-based multiple-choice questions with negative marking as the assessment method. The same method is also used for the summative evaluation.

This study made use of a qualitative design using semi-structured interviews which took place in small groups. The population consisted of all the infection prevention and control students registered on the IPC course between 2011-2016 who took the multiple questions examination at the selected university. The sample of the population was students who were available to participate in the study. It was anticipated that some of the students might no longer be available thus influencing the sample. The semi-structured interviews were performed in six small groups and discussions were done until data saturation was reached. A total of fifteen participants were included in the data collection. The discussions took place at different venues which were convenient to participants since the participants were distributed over a large geographical area. In order to get all the members of the different groups together electronic communication such as teleconferences and Skype were used.

1.1 BACKGROUND OF THE STUDY

There are a number of different assessment or evaluation methods which are traditionally used in nursing. In this study MCQ's and negative marking were used as the evaluation method in both formative and summative examination. A more in-depth discussion of MCQ's can be found in chapter two.

Evidence-based literature distinguishes between MCQ, short essay questions (SEQ) and modified essay questions (MEQ) as different types of evaluation. Khan and Aljarallah (2011: 39) write, "a well-constructed MCQ is superior to MEQ in testing the higher cognitive of undergraduate medical students in a problem-based learning setup".

Using a multiple-choice question (MCQ) format has advantages and disadvantages for teaching and learning (Madwela *et al.,* 2018; Delaram and Sharifi, 2014; Bauer *et al*., 2010). MCQ as a form of evaluation gives the opportunity to assess large numbers of candidates writing examinations. Marking of these evaluations can be done by someone with no knowledge of the subject or by a computer program. MCQ evaluations are objective and allow coverage of a broad part of the curriculum (Madwela *et al*., 2018; Stanger-Hall,2012). If MCQ's are well constructed, they can evaluate different abilities of students (Khan and Aljarallah, 2011). The construction of good quality MCQ questions that not only test factual recall but cognitive thinking as well, is not easy to develop and takes time (Kurdi *et al*., 2016; Khan and Aljarallah, 2011; Delaram and Sharifi, 2014). If an MCQ is not constructed well (in other words it contains item writing flaws), it can offer cues that give the guessing student the opportunity to choose the correct answer (Khan and Aljarallah, 2011; Stanger-Hall, 2012; Sharma and Mutalik, 2014).

Stanger-Hall (2012) and Kurdi et al. (2016) also describe the concept of item-writing flaws (IWF) and how this concept can have an impact on students' performance in MCQ evaluations. Item-writing flaws can make questions either easier or very difficult by leading the candidate in the wrong direction if the candidate does not understand what is asked in the question.

In health-science disciplines, the health professional needs to have the knowledge to make important decisions regarding human life. The professional needs to apply their knowledge to be competent in the field. If the quality of the MCQ's is written at a low cognitive level, it can influence the level of practice and impact on health care decisions (Khan and Aljarallah, 2011). According to Madwela *et al*. (2018) as well as Khan and Aljarallah (2011), multiple choice questions can also hinder critical thinking in introductory science classes due to lack of knowledge and background by the students in completing MCQ's in the correct manner.

Therefore, to base evaluation of students on an MCQ evaluation script as the only evaluation method could increase the risk of bias for that particular group. One could reduce the risk of item writing flaws by using multi-method evaluation approaches such as structured essay question (SEQ's) in combination with MCQ evaluation scripts.

In a study done by Sharma and Mutalik (2014), a comparison between MCQ's and SEQ's showed that students with a strong factual recall capacity score better in MCQ's than they did on SEQ's. But the SEQ evaluations show more intellectual ability to analyse, organize and apply knowledge. The above study also found a correlation between MCQ and SEQ evaluation questions. However if students perform well in MCQ's, they will perform equally well in the SEQ method according to Sharma and Mutalik, (2014).

Delaram and Sharifi (2014) identified that students score higher marks in MCQ evaluations when compared to essay question evaluations. Making use of MCQ's may lead to higher scores by students who do not master the concept of applying their knowledge to particular situations. Therefore, based on the findings of Delaram and Sharifi (2014), if the MCQ method of evaluation only is used, some students

may pass the evaluation without thinking critically and unable to apply the relevant knowledge.

In summary, when considering different types of evaluation questions, the literature indicated that there were positive as well as negative findings for each. . MCQ's can be superior to MEQ in testing higher cognitive skills and in giving a student who does not have the ability to perceive, resolve or apply answers to questions the opportunity to score higher marks. Application of what was taught will influence competence positively in the working environment. A well-balanced question paper with both types of questions gives an equal chance of success to all categories of students. Evidence is needed to assess the IPC student's preference and perceptions of the computer-based multiple choice questions evaluation and the way they are set would influence the compatency of the student.

1.2 PROBLEM STATEMENT

The competency of the students attending the IPC course at a selected university is of concern because they frequently fail to achieve a pass mark. IPC is a clinical field and needs a high level of application of the knowledge gained in the IPC course. This low pass rate impacts on the number of trained and competent IPC practitioners and as hospital-acquired infections rise it eventually impacts on the effective management of the hospital infection rate. The formative and summative marks of the students in the study group indicate a problem which may relate to either the teaching, the selection of the participants, or the assessment methods used. Little could be done regarding selection since due to the shortage of IPC practitioners, all applicants are accepted onto the course. The focus of this study was the assessment method and so teaching methods were not included in the study. Many students failed

to succeed using the present evaluation format. There was a concern that the current use of MCQ's as a sole evaluation method in formative and summative evaluations was not the best method of evaluation for this group of students. Evidence was needed to assess what the IPC student's perceptions and preferences for evaluations were and so their opinions regarding alternative evaluation methods were explored.

1.3 RESEARCH QUESTION

What methods of assessment do the IPC students prefer and what are their perceptions of computer-based multiple choice question examinations?

1.4 PURPOSE OF THE STUDY

The purpose of the study was to gain more insight into students' actual preferences of assessment methods and their perceptions of computer-based multiple choice questions examinations.

1.5 OBJECTIVES OF THE STUDY

The objectives of the study were:

- To explore the preferences of IPC students of assessment methods used in the IPC course.
- To explore the perception of the IPC students of the computer based MCQ method of assessment used in the IPC course.

1.6 SIGNIFICANCE OF THE STUDY

Results, recommendations and prioritisation of identified challenges by the students may lead to meaningful changes in the presentation of the course thus contributing

to the improvement of students' performance scores in the tests and evaluations. This may give future applicants the opportunity to not only increase their marks and strengthen their opportunity for additional studies in their field of speciality but to put competent, knowledgeable IPC practitioners in the field to apply what was taught. It will also strengthen the quality of infection prevention and control nurses in practice and build capacity to decrease the scarcity of infection prevention and control (IPC) specialists. If more competent nurse practitioners with infection control backgrounds are deployed in hospitals, surveillance will improve and there should be an improvement in managing the infections in the healthcare facilities. Control of outbreaks will be managed more effectively and the focus will shift towards prevention of infections and transmission of infection rather than the control of infection.

1.7 OPERATIONAL TERMS

1.7.1 Computer-based Multiple Choice Question

These questions are multiple choice questions that is presented on the computer consisting of a 'problem statement' that is referred to as the 'stem'. This question or problem is followed by four or five options of answers. The IPC students write multiple choice questions that have more than one correct answer and incorrect answers are marked negatively. It is called N-type multiple questions and minimizes the risk of guessing and leading questions during formative and summative evaluations (Byrd, 2018; Glass and Sinha, 2013; Delaram and Sharifi,2014; Khan and Aljarallah, 2011).

1.7.2 Semi-structured interview

A semi-structured interview is a qualitative method of inquiry in research that makes use of pre-determined open ended questions to prompt discussion of any particular topic. They also may increase the response rate. The interviewer may further explore the topic with additional relevant questions.

The participants hear the same questions in the same order. Interviews are the most appropriate when questions are set in a straight-forward manner (Kishita *et al*., 2018). The participant has the opportunity to respond informally in a direct way. The questions are asked according to an interview schedule that is prepared before the interviews are held. In some instances the questions could be set as open ended questions or closed questions and probes such as . “Explain your answer” might be used. ” Brink *et al*. (2014).

1.7.3 Small groups

Harris and Sherblom (2018) clarify a small group as a collection of at least three and usually less than 20 individuals of participants that share their experiences and engage in interactive communication. The characteristics of a small group could be discribed as an ongoing, continious modification of interdependant and interactive input from each participant. The group members share respect for each other. The small groups of participants discuss and explore information initiated by questions. It is described as a complex open system of communication to achieve success. Each group member take leadership. The groups in this study were small groups using semi –structured questions. In some cases there were only two to three participants attending the groups. To bring in semi-structured questions gives more value to the small groups.

1.7.4 Formative and Summative Assessment or Evaluation

Formative and summative assessments are assessment methods that evaluate learning in a particular course. They are methods to assess the knowledge that a student has gained from coursework being done during a particular time frame. Formative and summative assessments have different goals which must be achieved to evaluate students during a course (Broadbent *et al*., 2018; O'Dwyer, 2012).

- **Formative assessments**

The Oxford Living Dictionaries (2014) describe the word formative as "relating to a person's development". The goal of the formative evaluation is to test a low volume of the curriculum during the year in the form of class tests, submission of assignments or completing of portfolios of evidence (Broadbent *et al.,* 2018; O'Dwyer, 2012).

- **Summative assessments**

According to the Free Dictionary (2014), summative assessment means an assessment that has taken place at the end of a specific course and the marks that the student receives for this assessment determine if the student fails or passes. If the student passes it means that the student has reached the standard of that level and can proceed to the next level (Free dictionary, 2014). The summative assessments measure the success of the learning and teaching in the class as well as mastering the skills to function as an infection prevention and control practitioner (IPCP) in the clinical practice. Summative evaluations are conducted as a final examination at the end of the course. This evaluation can count a portion in the course (Broadbent *et al*., 2018; Helminen *et al*., 2016; O'Dwyer, 2012).

1.7.5 Infection Prevention and Control Practitioner (IPCP)

A nurse assigned to a position of a infection prevention and control practitioner should be a registered nurse who holds the qualification of IPC or works in the field of infection prevention and control. Their responsibility is to minimize the transfer or spread of infections in an organization. This person is usually found in healthcare facilities (HCF) (Alyahya *et al.,* 2018).

1.7.6 Item-writing Flaws (IWF)

Item-writing flaws' is a term used in the multiple choice question assessments method of evaluation. It describes the poor or incorrect manner in which the multiple choice questions were designed or formulated (Kurdi *et al.*, 2016).

1.7.7 Negative Marking

Mahjabeen (2017) and Bond *et al*. (2013) refers to negative marking as a method of setting tests and examinations to prevent guessing amongst students in multiple choice question examinations They may be considered by students as "unfair". A study published by Mahjabeen (2017) states that when using the method of negative marking, the benefits or detriments of guessing depend upon the severity of the penalty of an incorrect answer.

1.7.8 Scarce Skills

The Department of Labour refers to scarce and critical skills as "an absolute or relative demand, current or future, for skilled, qualified and experienced people to fill particular roles or professions, occupations or specialisations in the labour market" (Skills Development Act no.7, 2010).

"Scarce skills" are specialised skills that are required in a field of any profession, in this case, infection prevention and control nursing, but that are undersupplied. The lack of these skills is as a result of insufficient persons with the correct knowledge

and background in infection prevention and control when the demand for a particular profession is high. Although there are specialists in the field of Infection prevention and control, there are an insufficient number to meet the country's needs.

1.8 OVERVIEW OF RESEARCH METHODS

The overview of the research method identifies the type of research design selected and introduces the methods used. This study made use of a qualitative design using semi-structured interviews which took place in small groups in an attempt to gather in-depth information. This will be set out in chapter three.

1.9 DATA COLLECTION

Data collection is a term defined as a "systematic gathering of information relevant to the research purpose or specific objectives of the study" (Grove *et al.*; 2015:536). Data collection in this study was done using the focus group technique. Six groups of two to four participants each attended the group meetings. Three areas of interest were addressed including the compilation of the examination, the method of evaluating and their own experience of writing this examination. The participants' signed informed consent before the focus group proceeded. Participants were each allocated a number to use for communication during the group discussions. They were asked to share their perceptions of and preferences for examinations. The focus group discussions were conducted and lasted 30-40 minutes. The discussions were recorded with each participant using a number to maintain anonymity and confidentiality. These discussions were transcribed and analysed. An example of the open-ended questions that encouraged participation can be found in Appendix 6.

1.10 DATA ANALYSIS

Raw data was qualitatively analysed by making use of Clarke and Braun's (2013) thematic analysis explained in chapter 3 which consists of six steps including: familiarisation with data, coding the data by common elements, search for themes, reviewing themes and group the themes, defining and naming themes and writing up the research.

1.11 MEASURES OF TRUSTWORTHINESS

Trustworthiness of the qualitative information was explained by both Padilla-Diaz (2015) and Grassian and Lemire (2018) as four criteria for assessing trustworthiness. Credibility, dependability, confirmability and transferability were included in this study.

The credibility of the study was achieved through prolonged engagement until data saturation had been reached in each of the four interviews which took place. Dependability or evidence that is consistant was achieved by discussing the participants' concerns from most important to least important.

Confirmability included describing and transcribing the group discussions by using verbatim transcripts backed up by the audio material.

Transferability refers to whether the findings can be transferred to different settings. In spite of the small numbers the responses from the participants are considered a true reflection of this specific group of participants and could describe opinions of participants in a similar group.

1.12 ETHICAL CONSIDERATIONS

Approval to conduct the study was obtained from the following authorities:

- Nursing department peer review.
- Post Graduate Committee of the Faculty of Health Science of the University of the Witwatersrand.
- Ethical clearance was obtained from the University of the Witwatersrand Medical Human Research Science Ethics committee.
- Permission to conduct the study was obtained from the Infection Prevention and Control and Clinical Microbiology department of the School of Pathology to access the contact details of previous students to use the summative evaluations of years 2011-2016 for evaluation.
- Consent was obtained to participate in the study and to allow recording of the focus group activity.
- Participation was voluntary. Participants were briefed about the study and an information letter was sent to each participant by email. Participants were informed about their rights They could withdraw from the study at any time without being victimised or penalised. Written consent was provided to participate in the study and was obtained from all the participants.
- Confidentiality was maintained at all times as explained in the letter to each participant. Hard copies of all the data collected were locked in a safe place which has an electronic code. No names or any form of identification that could link with any of the focus group participants that was used and the results of the study were published anonymously in the research report. Participants participated on a voluntary basis and had the right to withdraw at any stage of the study without fear of prejudice.

1.13 OUTLINE OF CHAPTERS

There are five chapters in this research report.

Chapter one is a brief description of the progress this research project followed.

Chapter two is a broad literature review with all the essential evidence needed to complete the research project.

Chapter three is an outline of the research methods.

Chapter four contains the data analysis and findings.

Chapter five gives the discussion of the findings, the conclusion, the study's limitations and recommendations.

1.14 SUMMARY

This chapter provided the orientation as well as the introduction to the study. The importance of the study was explained as well as the problem statement, the purpose of the study and its objectives. Operational definitions were presented to ensure clarity towards terms used in this report. The following chapter will describe the literature review with a specific focus on perceptions and preferences of students towards computer-based multiple-choice questions.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

According to Brink *et al*. (2014: 54), a literature review is "a generated picture of what is known and not known about the research problem." Furthermore, Brink *et al.* (2014) describe that a literature review is an essential part of the research as it is needed to achieve a more comprehensive view of the theoretical background of what the researcher has decided to study. It is an inclusive review that covers relevant research and supporting documents in print.

This chapter covers a broad literature review. It includes readings on student evaluation approaches, common types of evaluation methods, negative marking, as well as student's perceptions and preferences towards the evaluation and writing of examination scripts including computer and non-computer based evaluations.

The purpose of examinations is well described by Glass and Sinha (2013) as a method to assess learning and retention of knowledge or a skill; therefore, any factor of a study task that influences long-term retention is clearly relevant. Testing is to communicate what you view as important. Tests are a motivator and students will learn what they believe you as the lecturer view as important and valuable. Assessments can also assist to overcome instruction gaps by encouraging students to read broadly and participate in educational opportunities that are available.

Tests have a powerful influence on student teaching and learning. Therefore, is it important to compile formative and summative evaluation scripts which meet curriculum goals Mahjabeen (2017) and Glass and Sinha (2013) state that relevant examination questions must be developed that test factual knowledge, a student's

cognitive ability, the ways students interpret problems and their ability to apply theory to practice.

2.2 LITERATURE REVIEW

2.2.1 Early Development of Training in IPC

- **International**

Hospitals are known as unsafe, dangerous places. Historically, as early as 1847, Ignaz Semmelweis worked in the Viennese maternity hospital and "proved that childbed fever was spread from person to person via the unclean hands of healthcare workers" (Dixon 2011: 58).

By the mid-twentieth century, in Europe, infection prevention and control expanded to include persons other than surgeons although the surgeons' contribution to the control of infectious disease remained important. The training of general practitioners, microbiologists, pathologists and infectious disease physicians, the epidemiology of infectious disease, as well as the control and prevention of hospital-acquired infection (HAI), was highlighted.

From the 1960s, more and more IPC efforts were established and subsequently provided effective implemental infection prevention and control programs. In-house IPC training programs were established and by the 1990s every hospital in the United States was engaged in an IPC program (Dixon, 2011; CDC, 2017). Training for infection prevention and control practitioners (IPCPs) often took place informally, during working hours, between colleagues in different hospitals or by taking short training courses. Most IPCPs received training at the CDC but some IPCP's were trained using the Train-the-Trainer approach (Swan and Mc Donald, 2018; Dixon, 2011).

In 1972, in the USA infection control practitioners formed a professional society, the Association of Practitioners in Infection Control (APIC). The APIC was created to provide education, knowledge and the sharing of infection prevention and control experiences with other IPC practitioners (Swan and Mc Donald, 2018; CDC, 2017; Dixon, 2011).

With strong scientific evidence supporting the value of IPC training programs, the Joint Commission on Accreditation of Hospitals mandated that all the USA hospitals should implement the CDC's IPC programs (Swan and McDonald, 2018; Dixon, 2011).

Infection prevention commenced initially without formal training. However, today globally there are several courses available to nurses wishing to become IPCP. Some of these are affiliated with public universities, colleges and hospitals and others are privately operated educational institutions or healthcare-related associations. The educational levels of IPCP courses vary from simply IPCP learning for personal growth to formal postgraduate degrees. The entrance and exit qualifications are country or region specific. Some of these courses are entirely electronically based (e-based) while others may combine both e-learning and evidence of practical application. The e-based IPC courses described by Swan and McDonald (2018), Klomsri and Tedre (2016) and Garland (2010) make use of one correct answer, multiple choice question (MCQ's) method of evaluation.

South Africa

In South Africa from as early as 2006 there were several IPC courses available that led to either certificate, diploma or a Master's degree. Some were offered by the private hospital sector whilst others were conducted by formal institutions such as the universities. The level of the courses was dependent on the entry level

qualification of the applicant, for example Enrolled nurses from three days to three months; registered nurses, six months. The evaluation method used was MCQ's as well as structured short questions.

Some of the South African universities engaged in IPC training. The University of the Western Cape which targets specific infection prevention and control practitioners (IPCP) offered a postgraduate diploma course. A Master's degree in IPC was also offered. Postgraduate diplomas in IPC and MSc's in Infection Prevention and Control were offered by the University of Stellenbosch.

The University of Pretoria offered an on-line two-year fellowship in IPC run by the University's Department of Internal Medicine. This course was open to anyone in the medical and allied fields and was supported by nurses, medical doctors or other healthcare practitioners who held a minimum of a diploma-level qualification. Further advancement to a Master's degree in IPC was possible through the University's Department of Public Health for those candidates who held higher degrees. The evaluation methods used to evaluate the students in that course was MCQ's.

The University of the Free State had a short course in Infection Prevention and Control which was offered for a few years.

The IPC course provided by the University of the Witwatersrand offered a short course an advanced diploma and Master's programme which was offered by the Nursing department. The certificate course made use of MCQ's as the evaluation.

2.2.2 Qualities and Competencies Required for an Infection Prevention and Control Practitioner (IPCP).

In a paper written by the Infection Control Nurses Association of South Africa (ICSSA) the key competencies of an IPC were identified as "practice within a

specific domain of interest for example infection control. Specific competencies required to work effectively within each domain and key criteria describes each competency and against which performance competence can be measured." ICSSA also describe, identify and define competencies for the IPCP and are considered extremely relevant to ensure quality service delivery. Competencies also provide a framework wherein an IPCP could be evaluated to determine their development within the IPC domain. The level of assessing specified competence is part of the evaluation of reasonably understanding infection prevention and control, critical thinking, reflecting upon specific situations and analysing circumstances to solve challenges professionally.

The National Department of Health developed the National Core Standards (NDoH, 2011) to ensure the same standard across all health care facilities in SA. They include as specialist knowledge, evidence-based practice, teaching and learning, management and leadership and clinical research. The national core standards are also part of the IPCP's basic competencies. There are seven domains. The "patients' rights" is included in the IPCP's first domain. The IPC must ensure the correct intervention so that the patient should not contract a health care associated infection. Domain two is IPC's part of clinical governance and clinical care, in other words for example the IPCP needs to oversee that the patient received the correct antibiotic as part of Antibiotic stewardship. Domain three focuses on clinical support services and the IPCP needs to be able to read and interpret the laboratory reports correctly. Domain four includes the public health sector and controlling the environment therefore needs to identify spaces or areas in the health care facilities which poses high risks. Domain five is leadership and governance. As part of IPC domain five need to incorporate a risk assessment to comply to these domains. Operational

management is domain six and here the IPCP needs to take responsibility of the wellness of the clients in a way that supplies chain management and procures personal protective equipment for the health care workers. The last domain, seven, focuses on the facilities and infrastructure. The IPCP's responsibility regarding domain seven is hygiene and cleanliness, waste management, linen and laundry as well as food services that form part of a health care facility.

The IPCP's responsibilities and competencies for overseeing the implementation of the IPC plan, training of healthcare workers (HCWs) and monitoring the impact of the preventative and control measures in place, in aspects such as surveillance of infections occurring in the facility and incidents or conditions that have the potential to cause infections, undertakes epidemiological investigations to determine the cause of the problem and recommends the necessary education or changes in protocols. It includes identifying and investigating clusters or outbreaks of infection. She needs to react effectively and promptly in isolation of sick clients. The IPCP needs to analyse procedure and device-associated infections and prevent further transmission of the infections. The IPCP needs to create evidence-based interventions to prevent facility-associated infections. They develop and maintain educational programs regarding infection control for all health care employees. Advice to senior leadership on issues related to reduction of infection risks and regulatory requirements are included in this portfolio. As an administrator she needs to initiate and maintain ongoing IPC programs and initiatives for continuous quality assessment, quality improvement and infection risk reduction (e.g. hand hygiene promotion and monitoring, cough etiquette). They are responsible for oversight of optimal supplies of hand hygiene equipment and personal protective equipment (PPE) as well as general supplies. Developing communication networks and liaising with community

resources, like the National Department of Health (NDoH) Tuberculosis (TB) clinics are included.

An IPCP is a person who functions-on the same level as a clinical nursing manager. Therefore, "specialist knowledge is necessary" according to Methar (2010, 15). The duties of an IPCP with regard to outbreaks include gathering surveillance data, investigation of potential outbreaks, identifying clinical links and seeking advice when necessary. In addition to these duties an IPCP is responsible for compiling policies relevant to infection prevention and various other responsibilities included in administration of a successful infection prevention programme.

With reference to the WHO (2009), the core components required by them for a IPC are similar to those described above.

2.2.3 Student Evaluation Approaches

An evaluation approach describes the timing, the methods and the type of examination paper that is to be written. There are a variety of approaches, described in literature and currently used to test student knowledge. In addition, there are particular terms used to describe approaches to testing methods. Assessments and evaluations are usually carried out during a particular time frame, such as weekly, mid-course and so forth. The terms 'assessment' and 'evaluation' are similar when speaking of assessing knowledge. The assessment plan and the purpose of the assessment determine which approach should be taken to assess the curriculum. Bruce *et al*. (2011) give an example to explain how it works. Bruce *et al*. (2011:305) describe the use of formative assessment as (an approach) "to give learner feedback (the purpose), you can do so either formally or informally (an approach) in either a patient care or classroom situation (a context)."

- **Formative evaluation approach**

Formative assessments aim to test the student's knowledge gained during the year. It assists students to identify which learning objectives and needs they are competent in and which require more attention. The students also identify objectives requiring revision and have an advantage to make an appointment with the lecturer to assist with identified areas of the curriculum that appear to be difficult to understand. Bruce *et al.* (2011) describe this as a learning process including a smaller volume work. It is a form of feedback from the students to the lecturer. Examples of formative evaluation are observations, conferences, questioning, drawing concept maps, reflections, in-class activities, student feedback, self-evaluations and self-assessments. The formative evaluations of the IPC course in this study were in the form of multiple choice questions with negative marking. Formative evaluations are not meant to be experienced in a negative way but the method used in the formative evaluation could be a challenge if the students participating in the course are not used to the method of evaluation. This has been highlighted by Broadbent *et al.* (2018) and O'Dwyer (2012).

- **Summative evaluation approach**

Summative evaluation approach takes place at the end of the year and could test the same content that was tested during the year. Summative evaluation could include advice, feedback and revision (Broadbent *et al*, 2018; Helmien *et al*., 2016; O'Dwyer, 2012). In this IPC course the summative evaluation is at the end of the year and it takes the form of a multiple question negative marking examination.

- **Integrated evaluation approach**

An Integrated evaluation approach describes evaluating teaching and learning as an approach to assess the achievements of learning outcomes. It serves to assess a

number of learning outcomes together by making use of a range of assessment evidence from different sources (Brink *et al.,* 2014). It is used in open based learning where the student integrates what is already learned knowledge and skills from other subjects and combines it with new learning material to achieve outcomes. If the student learning consists of an integrated approach, the assessing or evaluation of the student should also take an integrated approach. Therefore, teaching, learning and assessment activities should be developed as a coherent process. (SAQA, 2005). Bruce *et al.* (2011) argue that an integrated assessment is a portfolio of evidence where the student applies the knowledge gained in the course in the form of formative and summative evaluation. A Portfolio of evidence was not part of the evaluation process of the IPC course curriculum at the time of the study. This could be included in future. It will give them the opportunity to explain themselves, it will give them the opportunity to get used to terminology of the course and it will test insight of the students as well as application of theory to practice.

Glass and Sinha (2015) describe MCQ's as an evaluation method that makes use of an integrated approach. It gives the student the opportunity to use former knowledge and new information integrated with each other and then to apply it to answer MCQ's accordingly. These authors believe it is good practice to include mixed assessment methods to evaluate different aspects of a curriculum that includes different learning styles, preferences of students and that takes advantage of technology to design education framework. Different approaches include peer reviews, a portfolio of evidence and simulation assessments.

- **Continuous evaluation approach**

A continuous evaluation approach is a process of assessing that takes place continuously (Polit and Beck, 2017 and Bruce *et al*., 2011). The assessor must

evaluate the students' performance continuously by using various assessment methods and tools. During this process, the assessor counters the weakness of episodic assessments by sampling a range of students learning outputs. The advantage of continuous evaluation approach is that one poor evaluation will not influence the total score of the student significantly. These approaches to assessing take place in the course throughout a year of study.

If it is used in a clinical setting, then a continuous assessment approach could be an advantage to the student in practice because it is familiar to the student. Particular skills are chosen to represent overall nursing competence or ability. In this approach, unlike formative assessment, the coursework marks may be assigned to continuous assessment according to the assessment policies of the institutions. Continuous assessment is not part of the selected IPC course because there are not IPC practitioners in every health care facility that can facilitate the IPC student during training.

- **Episodic evaluation approach**

This assessment approach takes place at a specific time or occasion for example, during summative examinations. This approach is not used in higher education settings where there are large numbers of students. It needs intensive planning that gives the student the opportunity to prepare well for this assessment. Only small samples of students can be assessed and this evaluation method does not reflect a student's typical performance because it is only a once off evaluation of the students' knowledge. Testing does not include a large curriculum (Brink *et al.,* 2014). This approach could be used if the student was absent during evaluation periods and an oral evaluation method is used. This evaluation approach could not have been used in the study groups since the classes were too large. It can be used if there are a small

group of students that really struggle with the course work and need more intensive evaluation during the course.

- **Clinical evaluation approach**

Clinical evaluation approaches try to determine the student's progress towards clinical competence. A variety of competencies can be tested at various stages of any course. Passing tests can be certified as clinically competent if, for example, an expert nurse skilled in the medical procedure assesses a student and finds the student competent and skilled in that particular practice. This process is followed throughout the clinical course schedules (Bruce *et al*., 2011). This approach is generally used in evaluating nursing staff in practice and evaluates if the student is clinically competent in the field. During this study the IPC course did not include practical competency of the students. However, IPC is a clinical course and incorporating a clinical evaluation to the course might bring a more competency based approach. IPC students then learn to apply theoretical knowledge in the healthcare facilities.

2.2.4 Types of Evaluation Methods

There are several different methods of theoretical evaluation. They include multiple-choice questions (MCQ) (Byrd, 2018; Madwela *et al*., 2018; Khan and Aljarallah, 2011), short essay questions (SEQ) and modified essay questions (MEQ) (Sharma and Mutalik, 2014).

Evidence-based literature agrees that MCQ evaluation scripts are increasingly used as an assessment method to test theoretical knowledge of modules in large size classes. Khan and Aljarallah (2011:39) write, "a well-constructed MCQ is superior to MEQ in testing the higher cognitive levels of undergraduate medical students in a problem-based learning setup. If MCQ's are well constructed, they can evaluate

different abilities of students. But to construct good quality MCQ questions that not only tests factual recall, but cognitive thinking is not easy and takes time."

Several studies note that if MCQ's are not constructed well, the statement or question itself can offer cues that give the guessing student the opportunity to choose the correct answer (Kurdi *et al*., 2016; Khan and Aljarallah, 2011; Bond *et al*., 2013).

- **Multiple-Choice Questions (MCQ)**

Madwela *et al*. (2018) and Kurdi *et al*. (2016) explain what a multiple-choice question (MCQ) is and the complexities in setting MCQ's. An MCQ is an examination script consisting of a stem, a key and distracters. The question asked is called the stem, the correct answer is the key and the incorrect answers are the distracters. The examination scripts as found in the infection prevention and control course at the University have a stem and more than one key answer. According to (Kurdi *et al*. (2016), MCQ assessments with a high number of stems and options reduce the chances of a student of attaining a passing grade by purely guessing thus not proving competency. However, this increases the amount of work involved in constructing an MCQ test. One must also consider that if the number of stems is high, the time allocated for writing the test needs to increase.

MCQ's have advantages as well as disadvantages and are well described in the literature. Kurdi *et al*., 2016; Stanger-Hall, 2012; Delaram and Sharifi, 2017; Bond *et al*., 2013 discussed the main advantages of using an MCQ and states that the responses are easy to score and feedback to students is fast. Moreover, relatively low costs are incurred in devising them (Kurdi *et al*., 2016). Another advantage is that the marking is objective. Someone without knowledge of the subject examined can mark the tests or computers can be used to mark the examinations electronically (Kurdi *et al*., 2016). Furthermore, large areas of the syllabus can be covered; many

cognitive abilities can be tested. Additionally, a computer-programmed analysis of the test results is possible that can identify individual item difficulties and discriminations. Thus, high examination reliability is possible (Bauer *et al*., 2010; Garland, 2010). The department that offers the IPC used these advantages of MCQ's questions because they have an administrator who is responsible for marking and the students need to study all the information given to them because the tests cover the broad syllabus.

A further advantage of MCQ's was highlighted by Bond *et al.* (2013) The authors highlight an important advantage of MCQ's as it can assess student reading skills. If a question is misinterpreted in an MCQ, the losses in scores are minimal whereas if an essay question is misread by the student, a greater number of marks can be lost. Bond *et al*. (2013) assert that MCQ evaluations are reliable as they accurately assess objectivity, factual knowledge and produce, a high-level outcome overall. In her study Bond *et al.* (2013) made use of elimination testing that discriminates all levels of knowledge and improves critical thinking. The IPC course does include application questions as well as cognitive questions to test not only recall knowledge but also skills of the IPC students.

A disadvantage of MCQ's is described by Madwela et al. (2018) as poorly written questions that give the students cues to the answer. As identified in the literature, a major problem using MCQ's is Item-Writing Flaws (IWF). Item-writing flaws' is a term used in the multiple choice question assessments method of evaluation. It describes the poor or incorrect manner in which the multiple choice questions were designed or formulated (Delaram and Sharifi, 2017; Stanger-Hall, 2012). Glass and Sinha (2015) are one of the several writers that illustrate the different IWF in developing MCQ examination scripts. Before examinations were given to students,

the examination went through a process of evaluation to confirm that the questions that were asked not include IWF's.

In writing the general guidelines for MCQ's, Glass and Sinha (2015) point out the need to ensure the item can be answered without looking at the options and that the options are 100% true or false. As much information as possible concerning the item should be included in the stem. The stems should be long and the options short. Furthermore, the authors note that those persons who set examinations should avoid superfluous information, difficult and overly complex items, write options that are grammatically consistent and logically compatible and avoid absolutes such as always and never.

Both Stanger-Hall (2012) and Kurdi *et al.* (2016) address the problem of IWF and discuss how such flaws can have an impact on students' performance in MCQ examinations. Item-writing flaws can make questions either easier or harder to answer if the candidate does not understand what is asked in the question. In the health-science disciplines, health professionals need to have the requisite scientific background knowledge necessary to make important decisions about human life. If the quality of the MCQ's is written at a low cognitive level, it can have a major impact on healthcare decisions. If IWFs are limited (or ideally negated) from use in MCQ examinations, then the possibility of increasing a student's score arises. If an examinations script is not properly set, then the student may be disadvantaged as her knowledge is not correctly evaluated.

Some other disadvantages of using MCQ's were identified by Bond *et al*., 2013 and Bauer *et.al*., 2010. These authors both assert that to design a good MCQ question is very difficult and time-consuming and not everyone can develop them without the increased risk of encouraging guessing by the students. Bauer *et.al*. (2011) confirms

that MCQ's could easily be abused by means of guessing. He contrasts MCQ's with essay-based questions noting that in essays, providing a correct answer is not easy without knowledge of the subject matter but with an MCQ, without the knowledge of the subject, leading questions can result in successfully guessing the correct answer. Furthermore, negative marking could eliminate the possibility of guessing answers meaning the student needs to know his or her work by heart (Mahjabeen, 2017).

There are different approaches to the evaluation of MCQ's. Some writers take a recall and application approach (Garland, 2010) and others use Bloom's Taxonomy (Swart, 2010) as a starting point to evaluate an MCQ to determine if it is a well set question or not. Glass and Sinha (2015) showed how MCQ's could be evaluated to make sure it tests recall knowledge or application and if the thinking skills of the student could be evaluated. Furthermore, Glass and Sinha (2015) gave an explanation that where MCQ's were evaluated as low cognitive questions as recall questions. The higher cognitive questions were referred to application and diagnosis; interpretation questions and problem-solving questions. The meaning recall questions are also explained by Glass and Sinha (2015) as those which assess examinee knowledge of definitions or isolation facts. Interpretation questions require examinees to review some information from and reach some conclusions (e.g. diagnosis). Problem-solving questions present a situation and require examinees to take action (e.g. the next step in patient management). In conclusion, to apply the cognitive process to MCQ's is very difficult and not frequently used. In addition to this classification framework Glass and Sinha (2015) note that application of knowledge or recall of questions requires an examinee to reach a conclusion. If a

student needs to make a prediction or select a course of action, it is classified as an application of knowledge.

Verenna *et al.* (2018) use Blooms Taxonomy as a starting point to evaluate MCQ examination questions to establish the cognitive level of every question. Blooms Taxonomy was not initially intended to be used for the evaluation of examination scripts. However, it was found easy to apply to classroom assessments. Verenna *et al.* (2018) explained that Blooms Taxonomy was already in used from 1956 identifies six domains or levels that can be used as assessment criteria to evaluate the cognitive level of an evaluation question. A modified version of this taxonomy is regularly used in nursing education. The examiners could include Blooms Taxonomy in the process to evaluate every question being asked in the examination to decrease IWF's and address different levels of cognitive evaluations in the examination. It can enhance competency and critical thinking of the IPC students in the practical environment.

To study science requires critical thinking and students need to apply their knowledge to practice. Many of the higher education examination scripts make use of MCQ examination methods, especially in science classes. A study done by Stanger-Hall (2012) discussed a constructed-response (CR) method of evaluation and contrasted this evaluation method to that of an MCQ. CR is a type of open – ended essay question that demonstrates cognitive knowledge and reasoning. That means the candidate needs to create a response and include short questions. The purpose was to determine which one of the methods best evaluate critical thinking in students taking science and what, if any, might be the influence of gender bias in these two methods. The outcome was that an MCQ, in combination with the CR evaluation method, show more critical thinking amongst the participants and

increased the scores of the science students. There was also less gender bias found in the CR evaluation method than was found in the MCQ exam evaluations. Verenna *et al.* (2018) favoured MCQ's as a substitute for CR because according to his information educational testing claimed that MCQ's and CR questions provide essentially the same information. Therefore, according to him MCQ's could have been used as a substitute for CR evaluation. Stanger-Hall (2012; 294) recommended that "introducing CR questions encouraged students to learn more and become better critical thinkers and it reduced gender bias. However, student's resistance increased as students adjusted their perceptions of their own critical-thinking abilities."

Evidence supports the view that students with strong factual recall score better in MCQ's than do students who can apply their knowledge in an analytic and organized way. In another perspective, developing modified essay questions for assessing cognitive skills of students is not a simple task and is more frequently associated with writing flaws. In other words, there is no one ideal evaluation method as an assessment process and so too, MCQ and essay type of testing both have advantages and disadvantages.

- **Short Essay Questions (SEQs)**

Short essay questions (SEQs) are designed to assess a student's background knowledge and the way in which a student applies this knowledge obtained from required readings in not more than ten pages (Sharma and Mutalik,2014). This assessment method often takes the format of typed and double-spaced essay answers prepared outside of the classroom. It evaluates a student's ability to condense a large amount of curricula in a few pages testing the cognitive and critical thinking levels. A common example of using SEQs in the field of education is through written

assignments. Most SEQs have a prescribed flow, e.g. an introduction, body and conclusion and references are often required.

Sharma and Mutalik (2014) and Melovitz Vasan *et al.* (2017) compared MCQ's and structured SEQs. They found that students with a strong factual recall capacity score better in MCQ's than they did on SEQs. However, the SEQs examinations show more intellectual ability is required to analyse, organize and apply knowledge. The above study also found a correlation between MCQ and SEQ examination questions. If students perform well in MCQ's, they will perform equally well in the SEQ method. Short essay questions could be used in the IPC course in a portfolio of evidence that also count towards the year mark. It will give students who are not good in answering MCQ's a chance and students who cannot explain themselves in long essay questions. It will give a broader group of students the chance of achieving competency.

- **Long Essay or Modified Essay Questions (MEQ)**

Sharma and Mutalik (2014) suggest that modified essay questions (MEQ) in the literature consist of questions that focus on practical situations or typically problems that occur in the nursing environment. They often describe a question in the format of scenario or case study. The content of the questions may vary from common clinical situations or conflict situations that impact on the work environment. Sharma and Mutalik (2014:1195) stated "the goal of these questions is to assess the candidate's ability to identify the problem, prioritize the problems or non-compliance from the most important to the lest important, solve the problem logically by applying the theoretical background and practical skills and provide relevant applicable recommendations to resolve the case successfully." In the study conducted by Sharma and Mutalik (2014) there was a strong correlation between

structured essay questions (SEQ) and MEQ. Sharma and Mutalik (2014:1196) "found that the top scoring students as well as the lower scoring students both struggle to solve MCQ's." Many academic departments moved towards MCQ's as a sole evaluation method. There are however many ways that preferences of the IPC students can be met by using long essay or modified essay questions and assignments. An assignment could give the students the opportunity to explain themselves in more detail.

2.2.5 Negative Marking

Bond *et al*. (2013: 1) explain the types of negative marking and what the reasons are to choose MCQ's as evaluation methods. In an MCQ examination, each question corresponds to a mark or point. "N-type multiple choice questions indicate the use of negative marking. The rationale behind using this system is that it minimises the risk of guessing and leading questions during formative and summative evaluations. N-type MCQ scoring briefly works implies that each MCQ question 's value is 1 point per question. For every correct answer, a student receives plus one (+1) point. In negative marking, a point is deducted for every incorrect answer as minus one (-1) point."

Bond *et al*. (2013:1) refers to "negative marking as a method of setting tests and exams to prevent guessing amongst students in multiple-choice question examinations and may be considered by students as unfair." Bond *et al*. (2013) show an analysis of the negative marking method asserting that the benefits or detriments of guessing depend upon the severity of the penalty of an incorrect answer the penalty relative to the level of reward (-2 or +2) for a correct answer and depending on the number options from which the students must choose. From this analysis, it

is possible to calibrate the marking scheme and establish fair penalties. These results of Bond *et al* (2013) were similar to a study by Byrd (2018).

Bond *et al.* (2013) went on to describe the different evaluation options that serve as alternatives to using MCQ's as elimination testing (ET). Elimination testing discriminates at all levels of knowledge and improves critical thinking. Another option is the single answer SA evaluation method where a student needs to choose one correct answer in which the partial knowledge is not evaluated. If all the correct answers are removed in ET, then a full understanding has been shown. Partial knowledge is shown by the removal of a subset of the incorrect answers that reveal partial misinformation. Full misinformation is the result of the elimination of the correct answer only. Not answering a question or removal of all options, showed no knowledge towards the content of work indicated by the question asked. The study carried out by Bond *et al.* (2013:10) concludes results such as "life science students who significantly advantaged by answering the MCQ test evaluation format compared to single answer format under negative marking conditions by rewarding partial knowledge of topics." Surveys showed that students generally preferred ET-style MCQ testing over SA-style testing. Students reported feeling more relaxed taking ET-style MCQ testing and more stressed when sitting SA tests while disagreeing with being distracted by thinking about best tactics for scoring high marks. This study showed that students agreed that ET testing increased their critical thinking skills and concluded by recommending that MCQ type of tests need to be carefully chosen.

In summary the main purpose of using MCQ's with negative marking is to prevent guessing and test critical thinking skills and application skills of the student. In the IPC course it is not necessary to completely discard MCQ's questions but they could

be used in combination with other methods of testing knowledge. This would give an equal opportunity to a broader audience and make examinations more balanced and fair for the majority of students.

2.2.6 Computer-Based Versus Non- Computer-based questions

Computer-Based Multiple-Choice Question (CBMCQ) types of evaluations use only one correct answer when marking an examination script. This question paper is designed on the computer and marked on the computer. It consists of a bank of pre-developed questions and question papers are set accordingly. Komsri and Tedre (2016) and Garland (2010) both studied computer systems organisation where the first-year computer science undergraduate students were evaluated by MCQ and at the end of the year, mixed method examination scripts comprised of MCQ's and essay questions were used. In this study, the formative evaluation method was used as a 'shock and awe' tactic to encourage students to study, but at the end of the year, the MCQ negative marking examinations scripts were changed to multi-methods to give struggling students a chance to obtain a pass mark.

When considering computer based evaluation, are there more advantages than disadvantages and it is possible to use computer based evaluation in the nursing environment according to the authors (Atreja *et al*., 2008). Technology is part of the future and many students are used to using computer-based methods when writing examinations. Retaining some computer-based questions offers familiar options for many students.

2.2.7 Student preferences and perceptions towards evaluation methods

- **Preferences**

The Free Dictionary (2014) defines "preference" as "the right or chance to make a choice". In the literature, Van de Watering *et al.* (2008) discuss their findings

concerning the assessment of student preferences, their perceptions of assessment and their relationships to study patterns when using a variety of assessment types. When participating in a new learning environment, students prefer a variety of evaluation methods such as multiple-choice questions (MCQ), short essay questions (SEQ) and modified essay questions (MEQ) as different types of evaluation rather than one examination method. Furthermore, Van de Watering *et al*. (2008) referred to several interesting studies done with outcomes related to study method scores. For example, students with in-depth study methods preferred writing essay type of examination scripts. On the other hand, students with surface study learning methods preferred to write MCQ examination. This was first noted by Birenhaum and Feldman (1998) then revisited and confirmed Mingo *et al.* (2018). Mingo *et al.* (2018) also discussed MCQ's as an evaluation method which focus more on cognitive level evaluation.

It is an on-going debate that different methods of evaluation encourage either deep or surface learning in students (Mingo *et al*., 2018). In a review done by Mingo *et al.* (2018) it was suggested that students who tend to have good learning skills have a high confidence during their academic study and prefer MEQ type of evaluations. On the contrary, students with poor learning ability and skills have low confidence in their academic performance and prefer the constructed- response method of evaluation (CR). The reason could be found in the available results of the review that indicated low test anxiety measures when writing essay format evaluations. Students with a high test anxiety prefer to write a choice-response type of evaluations. Mingo *et al.* (2018) stated that students used a surface approach of learning prefer to answer MCQ evaluations.

Another interesting characteristic that Van de Watering *et al.* (2008) referred to was related to personal characteristics such as anxiety which can lead to specific attitudes towards different assessment methods. This was also mentioned by Alenezi (2018). In that article, Alenenezi (2018) agrees with Mingo *et al.* (2018) and describes students with high anxiety as preferring examination papers such as MCQ and the students with low anxiety levels preferring essay type of open-ended questions. If it is a few aspects that must be tested with a more in-depth and focused curriculum the preferred methods of evaluation required is an essay or open-ended examination.

Van de Watering *et al*. (2008) conclude in their discussion that if students receive the type of examination questions in the method of evaluation they prefer, it would not necessarily increase the marks of the students. Thus it is not necessarily the case that if you received an examination question in your preferred method, that you would score better in that examination. In most cases, the students have not had a choice of evaluation method.

Mingo *et al*. (2018) found that students with a combination of proficiency and self-assurance in their ability to perform well in examinations experience a more positive attitude towards writing essay type examinations than multiple-choice question examinations. This is compared to students with a combination of low proficiency and low self-assurance in their ability to perform as they prefer the constructive-response method of examinations. Alenezi (2018) states that there is a strong relationship between a student's perception of examination methods and their approaches to learning.

The only dimension in which students preferred essay examinations was for presenting their knowledge in subject matter tests.

Considering the authors mentioned above, in summary MCQ examinations are preferred by students over essay type of examinations but learning approaches need to be taken into consideration as well as the emotional experience of students. When deciding on an evaluation method that factors could influence the scores of the students.

- **Perceptions**

In their article, Van de Watering *et al.* (2008:648) define perception as "the students' act of perceiving the assessment in the course under investigation." From the Latin *perception* or *percipio,* the meaning of the word perception (Oxford English Dictionaries: 2016) is "the action of taking possession, apprehension with the mind or senses." Perception involves recognising and interpreting sensory information. Perception also includes how we respond to the information we receive. It is a process in which sensory information from our environment is drawn and how that information is used to interact with our environment. Perception allows us to take sensory information in and make it into something meaningful. The human body organises and shapes stimuli by learning and noticing our environments. Over time, a memory forms and a person's expectation of what is going to happen in the next situation is generally anticipated.

In the context of Van de Watering's study (2008:648) "no correlation was found between the perceptions of multiple choice questions and resulting grades."

Malovitz *et al*. (2017) compare the perception of students regarding assessment, with the way in which the students understand learning and studying. These authors state that perception determines the way in which they answer assignments and other methods of evaluation. Malovitz *et al.* (2017) furthermore focus on to two learning approaches in their study that were identified by students when they were asked

about their perception of learning for examinations. The two learning approaches that were identified were surface and deep learning approaches. Surface learning can be defined as completing the module with relatively little personal involvement and experiencing the work to be of little consequence. This feeling is said to be associated with rote memorization of the learning module and routine problem-solving. Deep approaches are defined as understanding the work context and actively applying the content in practical situations as well as analysing if and how the application was effective and worthwhile. According to Melovitz Vasan *et al*. (2017) students believe that their better performance in tests are due to changes from the simple memorization (superficial learning) for cued responses to conceptual understanding (deeper learning) that require more constructed responses. This was also a response posed by the participants in the semi-structured interviews during data collection in this study. Students that study the IPC course need to know from the start of the course that they should not use superficial learning approaches to study, but rather to use in-depth methods if they wish to achieve competency.

2.3 SUMMARY

In this chapter, a broad literature review was done to ensure a clear background on the concepts used to ground this study. Headings that were included were history of infection prevention and control (IPC), qualities and competencies required for and IPC practitioner, student evaluation approaches, types of evaluation methods, negative marking, evaluation via computer based approach and student perceptions and preferences towards evaluation types.

In Chapter three, there is a greater focus on the research design and the components that describe the research design, such as the population studied and other components.

CHAPTER THREE

RESEARCH METHOD

3.1 INTRODUCTION

In the previous chapter, a review of the literature was presented. In this chapter the research methods will be described. This includes the research design, study population, study sample, data collection as well as the semi-structured interviews, measures to ensure trustworthiness, ethical considerations and the analysis of data.

3.2 PURPOSE AND OBJECTIVES

The purpose of the study is to explore the perceptions and preferences of students following the qualification in infection prevention and control with regards to the examination methods.

The objectives of the study were:

- To explore the preferences of IPC students of assessment methods used in the IPC course.
- To explore the perception of the IPC students of the computer based MCQ method of assement used in the IPC course.

3.3 RESEARCH DESIGN

An overview of the research design and methods used will be discussed. According to Maree (2016), a research design is an organised plan from the researcher that is systematic, scientific and that discusses all parts of a study in a logical way to solve the research problem.

The overview of the research method identifies the type of research design selected and introduces the methods used. This study made use of a descriptive, exploratory and qualitative design that included semi-structured interviews in an attempt to gather in-depth information which was analysed by the thematically data analysis as described by Clarke and Braun (2013).

3.3.1 Qualitative Research

Qualitative research, according to Grove *et al*. (2015) has been used broadly in nursing education and can be applied to a variety of data. Various in-depth interpretations can be made. It allows the researcher to start with a broad approach and provides the opportunity to attach meaning to unsolved issues, develops the use of concepts and interprets these concepts.

According to Grove *et al*., 2015 and Polit and Beck (2017) a feature of qualitative research is an attempt to understand the phenomenon and does not focus on specific parts of the phenomenon, it focuses on the participants' important interpretations of an event or the participants' circumstances and not on the researcher's view of the situation. More features are described where information is collected without any structured instrument or questionnaire. It captures the context of the situation and when this study method is analysed it narrows information in an organised but intuitive way. This method of research design involves sustained interaction with the people being studied in the understandable language for all parties taking part in the research. In this study, the small group discussions were held in English. Although English was not the home language of most of the participants, it was the language in which they studied and all of the participants had an understanding of English. Because qualitative research allows for in-depth questioning and further probing, it

was felt that this was the method of choice to interrogate the perceptions and preferences of the participants.

3.3.2 Exploratory

According to Doody *et al.* (2013), exploratory research is discussed not only as what the participants say but as a broader and deeper focus on what the participants mean in their reply, the language the participants use and different forms of communication that people use every day when interacting. This would include jokes, anecdotes, teasing and arguing. It focuses on the intensity of the feeling of the participants such as anger, positive or optimistic feelings or negativity towards the topic of discussion. The exploratory approach gives the researcher the opportunity of an in-depth investigation of the participants' perception of the compilation of the examination and their experience towards multiple question evaluations. The use of small groups in this study created a non-threatening intimate space where participants could express honest opinions without the fear of appearing to complain of being labelled whistle blowers. In this study, it was important to be aware of feelings during the discussions that might address their experiences and preferences of multiple-choice question examinations and give a more in-depth meaning towards what the participants felt while writing multiple-choice questions.

3.3.3 Descriptive Design

The use of descriptive design is discussed by Grove *et al*. (2015:256) as a research tool used for "studies where more information is required in a particular field through the provision of a picture of a phenomenon as it occurs naturally. These designs describe the variables in order to answer the research question and there is no intention of establishing a cause-effect relationship." Brink *et al*. (2014), Grove *et al*. (2015) and Maguire and Delahunt (2017) discussed that a descriptive research

designs may be used to identify challenges within the present practice, justify it and make judgments or determine what other professionals in similar situations are doing. Descriptive research designs are also used to develop theories and as gathering of information from a representative sample of the population. Brink *et al*. (2014:113) state the collection of data in descriptive studies can be set as "structured observation, structured questionnaires and interviews or survey studies".

In this study, information regarding preferences and perceptions of the evaluation method is required from participants who were registered for the Infection Prevention and Control (IPC) course. Those who had completed the summative evaluation of the IPC course were included in the research sample to participate in the semi-structured small group interviews. This information from these interviews was necessary to answer the research question what are the IPC students' assessment preferences and what are their perceptions of computer-based multiple-choice question examinations?

3.3.4 Context

Research context refers to the specific circumstances surrounding the event being researched (Rule and John, 2015).

The event in this study is a one year course on Infection Prevention and Control that has been offered at a higher learning institution for the last ten years. Attendance of all course components was compulsory. Each module test consisted of multiple-choice questions as the assessment method. This method was also used for the summative evaluation in spite of a poor pass rate year after year.

The perception and preferences of the students attending this course from 2011 to 2016 were studied to establish their perceptions and preferences around the examination method used.

The method included semi-structured interviews which took place in small groups. Participants were selected from the students who studied at a selected university from 2011 to 2016. All students in the given time frame were invited to a discussion of open-ended questions regarding the compiling, evaluating and writing of computer-based multiple questions.

3.4 RESEARCH METHODS

A research method is a technique used by researchers to structure, gather and analyse information pertaining to research questions. In this study, it includes a census sample of the population, data collection and data analysis.

3.4.1 Population

Population is defined by Burns *et al.* (2011: 250) as a "particular group of individuals or elements, such as people with type-two diabetes, who are the focus of the research. The target population is the entire set of individuals or elements who meet the sampling criteria, such as female, 18 years of age or older, new diagnosis of type two diabetes confirmed by the medical record".

The population in this study consisted of all students registered on the IPC course who took part in the MCQ examinations at the selected university facility from 2011-2016.

3.4.2 Sample and Sampling

The sample in research is a group of people, objects or items that are taken from a larger population to participate in the research project that is chosen. There are different ways in which a sample is selected and the term for that process is sampling. Brink *et al.* (2014: 132) define sampling as a "comprehensive list of sampling elements in the target population". Brink *et al*. (2014:132) also explained census

sampling as “an accidental or availability sampling and includes the choice of readily available participants or objects for the study”. The purpose of sampling is to determine parameters and opinions of the participants that reflect the characteristics of the population.

Census sampling was applied. All students from 2011-2016 who completed the IPC course at this university using the multiple-choice question method of examination were invited to participate. Invitations were sent making use of email databases provided by the Department of Infectious Diseases of the selected university. This selected group was chosen for the study because they completed their final examination using only multiple-choice questions. After this date, the IPCP students wrote summative evaluations where multi-methods were used. The participants were asked to confirm if they would be able to participate in the small group interviews (Table 3.1). Many students come to take this course from all over South Africa and it was recognised that they may not be able to return to participate in this research study.

3.4.3 Setting and site

This study was carried out at one of the univerities that offered the course. The semi-structured interviews were conducted in different venues which were convenient to participants since the participants were distributed over a large geographical area. This included a coffee shop in a city , the selected university, the infection prevention and control department of an academic Hospital and the Head Office of an Emergency Services group. The small group discussions were recorded. In order to increase participation teleconference and Skype ® facilities were used

3.4.4 Small groups

Originally a focus group was considered for this study because it gives the selected group of participants the opportunity to provide individual responses to questions posed by the researcher and then debate the options. Once the responses were received it became evident that the participants that were attending the groups were not sufficient to form focus groups and it was changed to small groups.

3.4.5 Semi-structured interviews

According to Van Teijlingen (2014), Brink et al. (2014) and Polit and Beck (2018) semi-structured interviews make use of predetermined questions that need to be asked. They can be modified based upon the interviewer's perception of what seems most appropriate to response by probes. Question wording can be changed and explanations given, inappropriate questions for a particular interviewee can be omitted, or additional ones included. The purpose of a -semi-structured interviews is a face-to-face interaction exploring attitudes, values, beliefs and motives. This method offers insight into behaviour perceptions and the preferences of the participants attending the interviews. It is an in-depth approach to study the feelings of the participants and is a link between what the participants say during the interview and what happened during the IPC course. The semi-structured interviews capture the ways in which the participants interpret events and experiences during the IPC course. Semi- structured qualitative research interviews seek to cover both factual meaningful as well as feelings of the particular experiences. Semi-structured interviews could take the form of face-to-face interviews, telephonically interviews or electronic interviews such as skype.

During the study, it was difficult to get hold of participants to participate in the semi-structured interviews. Reasons given by participants were that they were not allowed

by their employer to take off to participate in the study. If they really wanted to take part in the study they needed to take leave. The students who attended the IPC course were demographically spread over the country and transport was a challenge from the different provinces. Data collection was changed from focus groups to small groups.

Table 3.1: Availability of the Respondents.

GROUP NUMBER	PARTICIPANTS' ATTENDING THE GROUP	TOTAL INVITATIONS TO THE GROUP
1	3	5
2	2	10
3	2	14
4	4	15
5	2	28
6	2	20
Total	15	92

The participants were geographically wide-spread and were employed full time. This made it difficult to meet the participant numbers set out in the proposal resulting in the groups became smaller in number. The students who were available to participate were grouped according to geographical location forming small groups. Open-ended questions were used as the researcher had no preconceived views of the information that was offered. It was anticipated that some of the students might no longer be available thus influencing the sample. Saturation was reached after six groups of two

to four participants were conducted. Fifteen participants attended to group discussions.

3.5 DATA COLLECTION

Data collection according to Grove *et al*. (2015:536) is a "systematic gathering of information relevant to the research purpose or specific objectives of the study".

In the study data collection was done using semi-structured interviews which took place in small groups. Semi structured interviews explored the participant preferences of the evaluations and perceptions of the MCQ type of examinations undertaken. After receiving approval from the institution and appropriate committees (Appendices 1) data were collected from the participants. The data collection plan for this study included planning and conducting interviews, analysing the recordings and reviewing recordings.

3.5.1 Planning the interviews

Doody *et al*. (2013) explained that to plan and organise a group, one needs to reflect on the purpose of the study as good preparation is required before conducting the group discussions.

Discussions were arranged and semi-structured interviews were conducted in small groups. The groups were divided according to the geographic area in which the participants resided or worked.

Before invitations were sent out to the participants, consent from the Head of the Clinical Microbiology Department for access to the database was obtained. Recruitment of the participants for each group was coordinated by the researcher. All of the students who completed the IPC course from 2011-2016 were invited via email to participate in the study.

Attached to the invitation was a letter of consent to take part in the study and consent for recording the meeting.

3.5.2 Conducting the interviews

Between December 2016 and March 2017, fifteen participants took part in six small group interviews. The group discussions were opened with a welcome and an introduction. Each meeting started with the researcher reading the letter of information to ensure that the participants fully understood the purpose of the group. Permission was obtained from all participants for audio recording of the meeting. (Appendices 3-5). The semi-structured questions approved by the ethics committee were put to the groups. Additional probes were used to obtain clarification and greater depth when necessary. Group discussions averaged between 30-45 minutes in time. The questions asked to participants in each group were:

1. What did you feel about the system of examining students using computer based MCQ's?
2. What alternative approaches to assessment would you have preferred?
3. What type of assessment do you think might have improved your marks?

The development of the probe questions was an iterative process between the researcher and her supervisor that included on-going literature review and brainstorming. The probes were designed to clarify the experiences and preferences of the participants who had already performed a summative evaluation.

All interviews were held at sites familiar to participants during the day. Each group was led by the researcher.

Following the introduction, the discussions were recorded with each participant using a number to maintain anonymity and confidentiality as far as possible. The discussions continued with questions about perception and preferences concerning

evaluations and the MCQ method. The participants had the opportunity to explain their preferences and perceptions of the examination and to offer recommendations about writing and preparing for these examinations. Probes were used to obtain greater in-depth understanding of the information. During these interviews, field notes were written for use during analysis.

3.6 DATA ANALYSIS

Brink *et al.* (2012:172) define data analysis "as a scientific and systematic way of organising, categorising, ordering, manipulating, interpreting, summarising, reporting and describing collected data into a meaningful structural form for an easy discussion of research data." The data varies with the method of research data collection. In qualitative research, it is important to be open and non-judgemental about the experience of the participants' thus allowing an unbiased interpretation.

3.6.1 Approach to Analysis

In this study data analysis was done concurrently with the data collection and involved creative conceptual identification, organising, reporting and description of the themes brought about by the collected raw data (Clarke and Braun, 2013; Maguire and Delahunt, 2017). Raw data from the semi-structured interviews were analysed by making use of Clarke and Braun's (2013) thematic analysis methods which consist of six steps including:

Table 3.2 Clarke and Braun (2013) six-step framework for doing a thematic analysis.

STEP	EXPLANATION OF THE STEP FROM BRAUN AND CLARKE (2013)
Step 1: Become familiar with data	The researcher needs to familiarise him or herself with the data collected. The data needs to be read and listened to. The audio records give a broader picture of the information
Step 2: Generate initial codes	Coding is an analytic process to refine data in a systematic manner by labelling important features of relevant data. This process uses the broad research question as a guide to analysis.
Step 3: Search for themes	A theme is a pattern that relate to the research question. Codes form the basis and themes are built from the codes. By grouping the codes, themes are formed that give meaning to the collected data. This step ends by collating the relevant codes into themes.
Step 4: Review themes	The themes need to reflect a relevant story from the full data. Refining of the themes may result in combining themes

	together or discarding a theme if it does not define the nature of the data.
Step 5: Define themes and sub-themes	The researcher needs to evaluate the importance and necessity of each theme by asking questions. They need to identify the role and the story that every theme is telling.
Step 6: Write up	Writing up involves putting together the data with narratives that tell the story and compare it with existing literature.

Step 1: Familiarisation with data

The researcher familiarised herself with the content of the transcription data by listening many times to the audio material collected during the data collection. Transcription of the complete text was done by the researcher and validated by re-reading the transcription whilst listening to the recording. Following this, the transcribed data was read a number of times and the meanings were identified, understood and organised. The researcher needs to be familiar with the data before continuing with the analysis. Maguire and Delahunt (2017) discuss that during familiarising yourself with the transcription, it is useful to make notes from the transcriptions.

Step 2: Generate initial codes

In qualitative research this is the step where the data is organised in a systematic way. Coding reduces data from large parts to smaller meaningful parts of transcriptions. Coding can take place in different ways and will be determined by the

research questions. Passages of text that were linked by similar or common thoughts and ideas were grouped into categories that would become the basis of the themes. This study's research questions were; what method of assessment do the IPC students prefer and what are their perceptions of computer based multiple choice questions?

The researcher identified and grouped the like statements and recurrent issues in each of the transcripts and codes were allocated. Codes were compared and discussed before moving to the next step of data analysis.

Table: 3.3 Examples of coding transcripts according to the research question

RESEARCH QUESTION	EXAMPLES OF CODING
Preferred methods of assessment by the IPC students	• Assignments. • Portfolio of evidence
Perceptions of computer based multiple questions?	• negative marking unfair, • don't understand the questions

Step 3: Search for common themes

Themes are recurrent issues that form a pattern that captures something significant or interesting in data collected. As Clark and Braun (2013) and Maguire and Delahunt (2017) explained there are no hard and fast rules about what make a theme. A theme needs to be significant. Significance is the character of a theme. If there is a small data set, there may be overlapping between coding and identifying pre-limiting themes.

In this study the codes were examined and themes extracted. Several codes were identified that related to the research questions regarding the preferred methods of assessment as well as the perceptions of computer based multiple choice questions.

At the end of this step the codes were organised into themes that spoke to the research question.

Table 3.4 Example of the development of a theme identified from the coding

Theme:	Sub-theme:	Code:
Alternative evaluation approaches	Multi-method evaluation	Essays and assignments

Step 4: Reviewing the themes

Reviewing of themes in step four refers to reviewing, modifying and developing the themes that were identified from the codes. Clarke and Braun, (2013) and Maguire and Delahunt, (2017) suggest asking the question: Do the themes make sense?

Data associated with each theme was read and its support for each theme was considered. The next step was to decide whether the themes applied to the context of the data. According to Maguire and Delahunt (2017; 3358) "themes should be coherent and they should be distinct from each other."

Maguire and Delahunt (2017;3358) also asked the following useful questions to evaluate that the chosen themes are correct.

- "Do the themes make sense?"
- "Does the data support the themes?"
- "Am I trying to fit too much in the theme?"
- "If these themes overlap, are they really separate themes?"
- Are there other themes with this data?"

Once this step was completed three themes emerged and were deemed to represent the data. Peer review was sought and consensus was achieved.

Step 5: Defining themes

This step involves on-going analysis to refine the distinctive features of each theme and the overall story each theme tells. These themes were related back to the objectives of the study as well as the research question. A detailed analysis of each theme was written down. Questions identified by Clark and Braun (2013:10) such as "what story does this theme tell?" and "How does this theme fit into the overall story about the data?" were asked while defining and naming themes. The importance of each theme was identified and an informative name for each theme was compiled.

Step 6: Writing up the report

The full data set was compiled where the themes and sub-themes were put together to form a flow or a sequence of data analysis of the project. Codes, sub-themes and themes were presented to the supervisor of the study and peers to confirm the accuracy and make modifications. The final step in the process was writing up of all the themes and sub-themes obtained from the interviews regarding the preferences and perceptions of the examinations put forward by the participants.

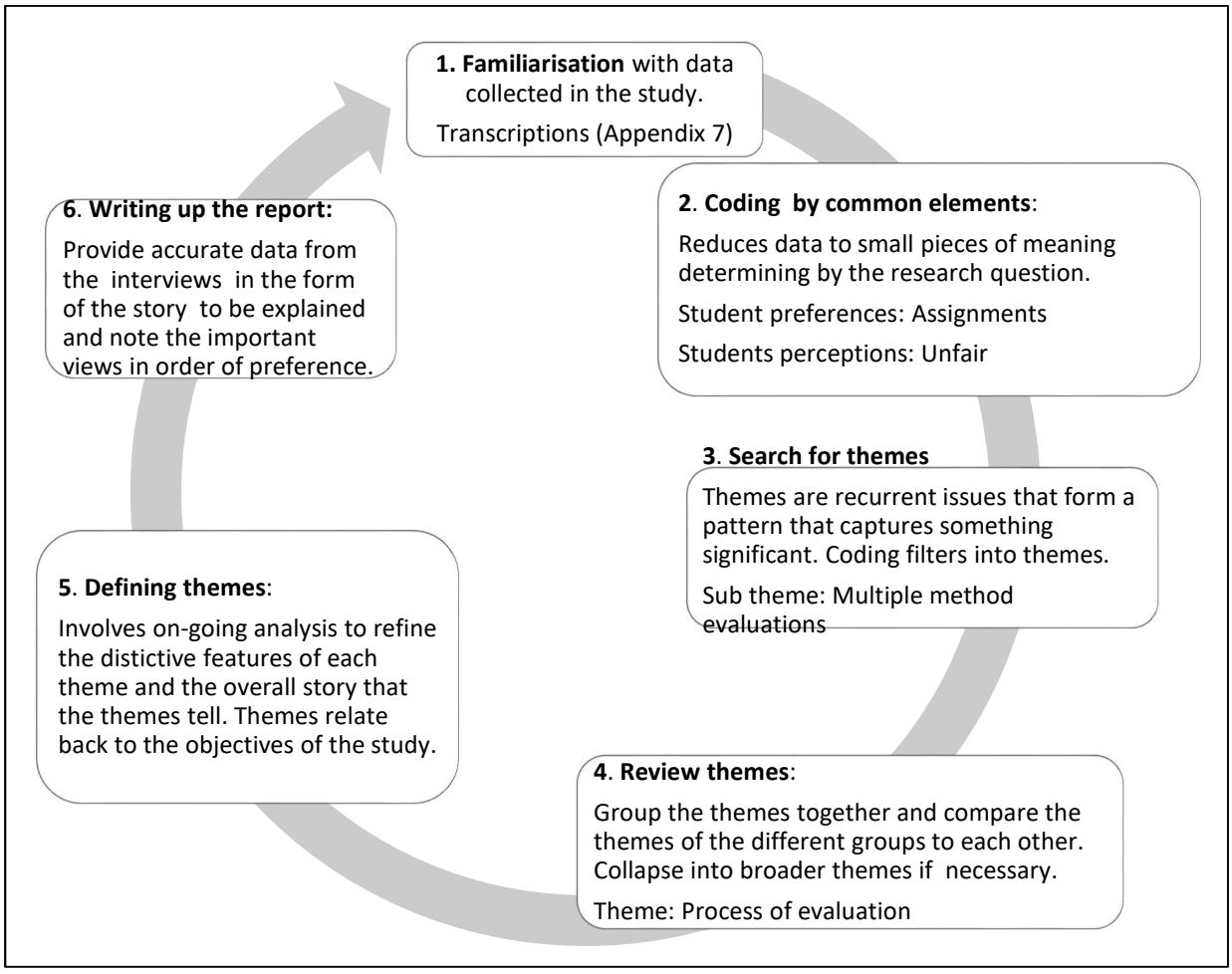

Figure: 3.1: Application of Clarke and Braun's (2013) Thematic Analysis Methods

3.7 MEASURES TO ENSURE TRUSTWORTHINESS

The trustworthiness of the qualitative information was based on the model of Lincoln and Guba (1985) who proposed criteria for assessing trustworthiness. These included credibility, dependability, confirmability and transferability. These criteria informed research results with an aim to support exploratory qualitative research findings.

3.7.1 Credibility

Loh (2013: 5), explained what needed to be present with credibility as one of the criteria of trustworthiness when conducting a qualitative research study. “Credibility (internal validity) included prolonged engagement, persistent observation, triangulation (sources, methods, investigators), peer debriefing, negative case analysis and referential adequacy.” Grassian and Lemire (2018) explained credibility as “how well the analysis process was followed during the research and how applicable the chosen themes are in covering the research findings with all the relevant inclusions and exclusions to judge the similarities within and differences between the categories.”

The credibility of the study was achieved through prolonged engagement until data saturation has been reached during the interviews. It also used member checking which involves getting concordance between the recorded data and the transcribed data from the participants’ perspectives.

3.7.2 Dependability

According to Brink *et al.* (2014), the enquiry auditor, generally a peer follows the process of the researcher in the study and determines if the process followed in the study is dependable. Padilla-Diaz (2015 and Grassian and Lemire (2018) discuss the importance of dependability as it is important to take into account both the factors of instability and factors inducing changes.

In order for dependability to be achieved each step of the process was fully documented so that in future researchers would be able to conduct the research again using a similar sample as recommended by Loh (2013). In this study data collection was described and data analysis conformed to the well-known data analysis methods

of Clarke and Braun (2013). In addition, some members of the Nursing Department were asked for opinions on the selected themes.

3.7.3 Confirmability

Polit and Beck (2017:585) describe confirmability as a "congruency between two or more independent people about the data accuracy." In this study the audio material transcribed by the researcher was confirmed as an accurate replica as the researcher repeatedly reviewed the audiotapes. The supervisor had also attended the interviews and was able to confirm the content. Both the recordings and the transcriptions were locked in a secure place requiring a security code known only to the researcher. Confirmability includes describing and verbatim transcribing of the group's discussions backed up by audio material and notes made in the group discussions. Loh (2013:5) confirms that confirmability "guarantees that the findings, conclusions and recommendations are supported by data and that there is an internal agreement between the investigator's interpretations and the actual evidence."

3.7.4 Transferability

Burns *et al*. (2013) explains that text can be transferred from one context to another. Transferability was ensured in this study as there was a clear and distinct description of context, selection of participants, the data collection and the analysis processes. These steps were recorded and transparent. To demonstrate transferability in this study a rich and vigorous presentation of findings with appropriate quotations are presented in Chapter 4.

Transferability was ensured by including a detailed explanation of data collection and analysis affording other researchers the opportunity to apply this method to similar situations.

3.8 ETHICAL CONSIDERATIONS

The term ethics is clearly explained by Geyer *et al*., (2013: 143). "... ethics refers to the well-founded standards of right and wrong that prescribe what humans ought to do, usually in terms of rights, obligations, benefits to society, fairness or specific virtues. They are standards imposed on us by society." Furthermore, Geyer *et al*. (2013) also discussed that the ethics refer to standards as a basis to shape life and behaviour. Ethics permission is necessary in a research to protect the participants as well as the researcher from harm. The following ethical principles were taken into consideration in this study to protect the participants

- permission to conduct the study,
- informed consent,
- confidentiality and anonymity.

3.8.1 Permission to Conduct the Study

Prior to obtaining the approval to conduct the study, the study protocol was written, submitted and presented to the Department of Nursing for peer review then to the school of Therapeutics Sciences Assessors Group. After that process, it was submitted to the Medical Research Ethics Committee (Human) where ethical clearance was obtained (M160511- Appendix 1). Permission to conduct the study was also obtained from the Infection Prevention and Control and Clinical Microbiology Department to access the contact details of previous students.

3.8.2 Informed consent

According to Brink *et al*. (2014), the World Medical Association's *Declaration of Helsinki* reiterates parts of the Nuremberg Code and emphasises the importance of written consent. Brink *et al*. (2014:33) also note that "The Nuremberg Code and the Declaration of Helsinki provide the foundation for numerous ethical research

guidelines developed by government and professional organisations involved in the conduct of research on human participants all over the world."

In this study, participation was voluntary. The participants signed informed consent forms (Appendix 4) to take part in the small group discussions and to allow recording of the group activity (Appendix 5).

Participants were briefed about the study and an information letter was developed and provided to each participant by email. (Appendix 3). Participants were informed about their rights to withdraw from the study at any time without victimisation or penalty.

3.8.3 Confidentiality and Anonymity

Brink *et al.* (2014: 37) clearly explain that "a participant who agrees to participate in research has the right to expect that the information collected from or about him/her will remain anonymous and confidential. Anonymity literally means namelessness. The process of ensuring anonymity refers to the researcher's act of keeping the participants' identities a secret with regard to their participation in the research study." Furthermore, the authors Brink *et al*. (2014:37) note that "it is preferable that even the researcher should not be able to link a participant with his or her data…..by distributing questionnaires and requiring that they are returned without any identifying details, the researcher ensures that the participants' responses remain anonymous." Anonymity between the researcher and the participants and between participants within the group was not always possible since some of the participants were known to the researcher and to each other. There was however no form of identification linked to the verbatim transcription since each participant was given a number to use during the interviews.

Confidentiality was maintained at all times as was explained in the letters to each participant (Appendix 3). Hard copies of all the data collected were locked in a safe place which had an electronic code known only to the researcher. No names or any form of identification that could link with any of the focus group participants were used and the results of the study were published anonymously in the research report. Participation was on a voluntary basis and participants had the right to withdraw at any stage of the study.

3.9 SUMMARY

This chapter described the research design that was chosen to address the purpose of the study and research objectives appropriately. Included in this chapter were the following headings: the research design, study population, study sample, data collection as well as the questions asked in the group interviews, the analysis of data, measures to ensure trustworthiness and ethical considerations. In Chapter four, the analysis of the findings of the semi-structured interviews which took place in small groups will be discussed.

CHAPTER FOUR

FINDINGS

4.1 INTRODUCTION

Chapter three described the research design and included the study population, study sample, data collection as well as the open-ended questions asked in the small group interviews, measures to ensure trustworthiness and ethical considerations. The purpose of this study was to gain insight into students' preferences of assessment methods and their perceptions of computer-based MCQ examinations. Small groups and semi-structured interviews were used because there was a challenge to arrange groups big enough for focus groups. Probe questions were used as the interviews played out. Each interview continued until no new evidence was forthcoming. Clarke and Braun's (2013) method of analysis as described in chapter three was followed. This chapter describes findings and the interpretation of the data obtained from the small group discussions in this study.

4.2 DISCUSSION OF FINDINGS

Demographic data as specified in appendix 6 which included age, experience and study background was collected from each interview participant in order to examine whether any trend in this data might have influenced the findings. This will be presented before the themes and subthemes. This data was collected and analysed to determine if there was any relevance regarding the age, experience or study background on the results of the study.

4.2.1 Demographic Data

The IPC students came from all parts of South Africa as well as from other parts of Africa including Nigeria, Botswana, Uganda and Zimbabwe.

When considering the age group of the participants who attended the semi-structured interviews fifty-three percent (53%) of the participants were between 31-40 years of age, twenty percent (20%) of participants were between 41-50 years of age, seven percent (7%) were older than 50 years of age while 20% of the participants' ages were not recorded. Nearly a third (27%) of the participants were over the age of 40.

Table 4.1: Age of Participants

AGE GROUP	TOTAL	%
No age recorded	3	20
20-30 Years	0	0
31-40 years	8	53
41-50 Years	3	20
51 and above	1	7
Total	15	

When considering qualifications, (Table 4.3) the majority of the participants (53.3%) held nursing degrees. It must be noted that some of these degrees may have been post graduate degrees and not have included IPC content but might have contained MCQ's as an evaluation method. Thirty-three percent (33.3%) of participants held nursing diplomas while thirteen percent (13.3%) held other qualifications.

Table 4.2 Qualifications of the Participants

QUALIFICATIONS	TOTAL	%
Nursing degree.	8	53.3
Diploma in nursing (General, Psychiatric, Community) and Midwifery.	3	20.1
Diploma in General Nursing.	2	13.3
Diploma in Emergency Services.	0	0
Other: state which course.	2	13.3
Total	15	

Table 4.3 shows the IPC experience of the participants that attended the semi-structured interviews. Eight (53.4%) had between 1-10 years' experience in IPC, one (6.7%) had more than 10 years' experience, one (6.7%) had less than 1-year experience while five (33.3%) had no previous experience in IPC. Thus six had little or no experience.

Table 4.3 IPC Experience of the Participants

YEARS' EXPERIENCE AS IPC NURSE	TOTAL	%
No experience	5	33.3
Less than one year	1	6.7
1-5 years	7	46.7
5-10 Years	1	6.7
Longer than 10 years	1	6.7

Total	15	

4.2.2 Emerging Themes and Sub Themes

The six steps of Clark and Braun (2013) were used to analyse the transcriptions. Once the researcher had become familiar with the data in the transcriptions, grouping took place according to similarities and codes were allocated. These codes served to reduce the data into smaller portions and sub-themes and were guided by the research questions. Three themes with eight sub-themes emerged (Table 4.4).

Table 4.4: Emerging Themes and Sub-Themes

Theme	Sub Theme
The evaluation process	• Timing of testing • Content of examinations • Preparation for examinations
The use of computer based MCQ's	• Unfamiliarity with format • Negative marking • Influence of language
Alternative methods of assessment	• Rationale for alternative forms of evaluation. • Recommendations for alternative types of testing

4.2.3 Themes

To facilitate readability, excerpts will be quoted in each theme and sub-theme. They will then be discussed and re-contextualised later by reference to relevant literature.

Students are not always in agreement with each other however, this is natural and discussion on these points are encouraged in the groups.

Theme one: Evaluation Process

The evaluation process used by the Clinical Microbiology Department of Infection Prevention and Control (IPC) is multiple choice questions (MCQ's) with negative marking (N-type questions) as explained in Bauer *et al.* (2010).

When asked what they felt about the type of evaluation that has been used a participant replied:

> *G4P5: "For me, it was very difficult… It was a shock to me... the negative marking..."*

On exploring further, three sub themes emerged from this theme and are discussed below.

- **Timing of testing**

The IPC course ran on a block release system. From 2011 to 2013 the scheduling of the tests (formative evaluation) were held on the last the Friday of the same block. This was changed to the Monday of the following block in 2014.

The participant group were therefore a mix of participants, some who wrote the tests at the end of the block and some who wrote on the Monday of the following block. The resulting discussion gave additional depth to the topic. When the effect of the changed formative evaluation was discussed, many participants agreed that writing the test in the next block was more convenient and preferable. They had this to say:

> *G5P3: "We were told that the students would have been attending the week block and then at the end of the week they write the examination. That is tough."*

G5P2: "You need to remember we wrote the tests immediately after the block was completed. So, it is better to do the test if [when] *you are coming back to the next block."*

Only one participant felt differently.

G4P5: *"Maybe we can write the test before we leave the institution."*

- **Content of examinations**

The participants complained about the amount of content that they were required to master for each evaluation.

G3P1: "This course is too much. The content is bulky."

G4P1:" To me, it was too much work and the time was too short."

G4P2:" If it was spread across the year the load will be a little bit better."

Participants in some of the interviews differ in opinion when asked about their perceptions of content evaluated by the method of MCQ's. Some agreed that the chosen MCQ method did, in fact, evaluate a broader curriculum:

G3P5: "Yes, it covered all the necessary topics that were covered in the course. There were questions out of every week's [work….]. *It covered everything."*

G4P5: "Yes, the examination was balanced."

One of the concerns of the participants in this study was apparent inconsistency between the content covered in class and the content evaluated. Some participants perceived that there was no correlation.

G1P2: "I would say the volume of work covered versus the examination questions. I don't think there was a correlation in time. Some topics spent a lot of time being learned about or being lectured on, but when the paper comes it wasn't there".

G1P4: "there was no correlation between what was covered in the lectures and that covered in the papers. No correlation!"

G1P2: "I don't think that it was correlated [to] *the course content. It is amazing stuff to learn and then comes the test and that* [section] *wasn't even asked."*

G2P4:" We knew from the beginning the microbiology is a big part of that, but I did think that there was not a big balance between the questions. All the topics were covered, but there was not a balance between them. I think there should be more balance between the different topics in the exam."

Two participants did however feel that the summative evaluation was a fair balance between microbiology and Infection prevention and control

G4P1: "Final examination was balanced but not the tests."

G4P6:" The final examination was balanced."

There was a strong belief that there were questions in the evaluations that were not taught in the class. That made completing the examination very difficult.

G6P3: "There were things we were tested on that were not taught. I even lost my voice due to stress. The examination really needs to be looked into. It is unnecessarily complicated."

- **Preparation for examinations**

When study methods for evaluations were considered the participants discussed whether it was necessary to change their study methods for this N-type of evaluation method. They shared their perceptions of the appropriateness of either in-depth or superficial learning as the best study method for this type of evaluation. Students disagree and some feel that good preparation is necessary for MCQ's.

G2P3:" ...need to prepare thoroughly and in detail..."

Some of the students disagreed and thought it was not necessary to study in detail for MCQ examinations.

> *G1P2: "If I prepared for the more essay type of question, [I] spend more time memorising on list and content, on specific detail at length …. if I think you prepare for multiple choices you are focusing more on the volume than the detail."*

In the different interview groups, the participants discussed many ways to study. Some of them changed their study methods whilst others learned to read the questions more carefully.

> *G2P4 "One thing I have learned through the program is to read your questions very carefully……. Actually, the way you read if you prepared for the MCQ exam is different to when you prepare for a written examination or an oral examination."*
>
> *G4P2: "I used different study methods."*

There were participants who did not change their study method.

> *G1P3: "I mean the way I prepared for examinations is the same way I prepared for any other examinations. I don't think there was too many differences…. just in your head the concept of change a bit."*

Some uncertain students changed their study method, searched for clarity and formed groups:

> *G2P4: "Definitely I am going to study differently. There is a huge difference between the two. MCQ you get much more details. Finer points that you need to look into. With the longer questions, you need to have the knowledge, but*

you can at least explain yourself. [These are] *totally different ways of studying."*

G4P6: "Some of us used different types of study. Some of us use mind maps. We do different types of study. For me, I study on my own and then attend a group discussion. I need to search for clarity."

When considering revision for the summative evaluation, the participants emphasised that they needed revision before the examinations as part of the preparation.

G5P3 "Now it is the final of the year.... going through all the work. I think we need to do a bit more revision."

Summary of theme one:

For many of the participants, the content in the IPC course is overwhelming Evaluation at the end of the block week increased their stress. They felt there was insufficient time allowed for studying. It was therefore suggested that the tests should be written when students return to Block 2, 3 and 4, as there would have been a longer period to study.

There were complaints from the participants that there was inconsistently in the content inclusion in the evaluations with regards to both what had been covered in class as well as the volume of the content.

The participants felt the MCQ examinations required a study method that included knowing the work really well to eliminate guessing. The participants discussed many different studying methods. Some of them changed their study methods whilst others learned to read the questions more carefully. During the discussions, it was clear that the study methods differ from person to person.

Theme two: The use of computer based MCQ's

Whilst computer based evaluation methods are seen as one of the future trends for evaluating students, this is only happening at present for some of the degree nursing evaluations. Forty-seven percent of the participants held diplomas and not degrees and had either not been exposed to MCQ's or had minimal experience of this method of evaluation. Considering that many (27%) of the participants were over the age of 40 and they have expressed that they were not exposed to MCQ's negative marking as an examination method (Byrd et al, 2018).

- **Unfamiliarity with format**

All the participants agreed that they were not accustomed to negative marking and regarded it as a challenge.

> *G1P3: "I think there is a different concept to bear in mind. You need to be conscious that it is negative marking because if you have something wrong, you will get a minus mark on it."*

Nursing participants particularly are not used to multiple choice questions (MCQ's).

> *G6P1: "I have never had a multiple choice question paper* [before]."
>
> *G6P2: "The test, multiple choice questions are not a type of examination I do well in. I had never had a multiple choice in my life."*

They added that they were not exposed to writing N-type examinations during their undergraduate studies.

> *G1P3: "It was quite tricky because it was not a system we are used to. Our papers are long question papers in the examinations and then also multiple-choice papers but not with negative marking. So, it is not something we are used to."*

G1P2:" I am more used to single multiple choice ... I was used to longer questions [essay type] ..."

One of the participants had previously undergone evaluations with negative marking and during the discussion expressed that it was not challenge.

G1P4: "It is not the first time I was being exposed to negative marking..."

According to the participants, the examination with multiple choice negative marking increased their anxiety and resulted in them feeling demotivated. They also complained that there were 'trick' questions and were of the opinion that the examination was set to catch one out.

G1P3: ".....set up to catch you out."

G5P3: "Especially if it is the final examinations... they have trick questions"

Some of the participants agreed that they became more used to this method of examination by the end of the year after writing the test in the same format throughout the blocks.

G4P2: "It is a matter of wording. Need to do the test on different occasions so that you can be used to the negative marking."

Although the examination method was new, the students acknowledged that the method of examination was explained to them before writing the formative and summative evaluations.

G1P3: "Yes, it was explained, but it was a new concept to get used to."

G2P3: "Information was given to me about the negative marking of the questions."

G3P5: "The whole process of negative marking was explained."

Although the examination method was explained to all students, it took a while to get used to this method of examination.

G1P2: "I agree. At the end of the year we understood but the first exam [test]…. *it was a challenge."*

- **Negative Marking**

The use of MCQ's with negative marking is not uncommon in many Health Care Faculties, however it is not commonly used in the Nursing subjects and certainly not common in the diploma courses which accounted for the majority of the participants. Negative marking if correctly understood, is believed to discourage guessing of the responses and therefore students' marks should be more credible. During the Infection Prevention and Control course, the students completed three formative evaluations (tests in block 2, 3 and 4) as well as an examination at the end of the study year. The formative and summative evaluations were written making use of the same examination method consisting of N-type multiple choice questions.

Although there were strong feelings about the challenges of the examination method, there was not only negative feedback regarding the MCQ's marking evaluations. Some of the positive comments included:

G3P1: "MCQ in terms of the other [aspects] *is best because it makes someone think."*

G3P2: "So it makes someone read."

Reading and understanding of questions is very important if one wishes to prevent the impact of negative marking. The students realized very quickly during the year that they needed to read the questions carefully to understand the meaning clearly.

G2P4: "I had to read the questions more than once."

G2P4: "One thing I have learned through the program is to read your questions very carefully, it can be one word or one sentence in between that can make a difference in what you understand."

G3P1: "Multiple choice questions are the best, it makes someone think. So, it makes someone read."

Negative marking as a method of setting tests and examinations preventing guessing amongst students in multiple choice question examinations may be considered by students as 'unfair'. Many participants from the study shared the same perception as the following participant.

G6P3: "Negative marking is unfair and not a good reflection of the learner's knowledge and performance."

The participants admitted that they sometimes guessed the answers. Negative marking made this more difficult.

G6P3: "Multiple choice questions, especially negative marking is good for spotting."

G6P2: "I was guessing most of the time."

The evaluation by MCQ's with negative marking increased the anxiety levels of the participants. One described it as follows:

G5P3: "…especially if it is the final examinations there have to be trick questions, but for me, it felt outrageous. I feel I couldn't breathe. I was under water. I felt what is going on …."

- **Influence of language**

Many of the participants in this study believed there was a possibility that the language used in setting the multiple-choice question (MCQ) examination could have been the reason for the poor performance of the students who participated in the IPC course. They complained that English was not their first language and thus is a barrier to understanding questions. The use of scientific vocabulary was a challenge.

> *G1P4: "…I do think that the English language was not the first language of many of the students... that is probably why some of the students find it so extremely difficult…me included"*
>
> *G2P4: "Not always our first language. Yes, I think some of the questions, I think, might be a language barrier. Some of the words and the sentences were put in the academic language of microbiology and made it a bit difficult for me."*
>
> *G3P1: "Number one, English is not the first language."*

There were however some participants who believed language were not a barrier.

> *G4P5: "The questions were clear.... The English is fine. We understand English……."*

Summary of theme two

In summary the participants felt that MCQ's were new to most participants and the fact that they were coupled to negative marking created an even greater challenge. This left the participants feeling concerned and confused about the fairness of the evaluations. They agreed that this might have increased the guessing of the answers. The perception amongst the participants was that negative marking increased anxiety and was set to catch one out.

The participants did believe that their results were low as English was not their first language.

There were some participants that did not experience challenges in understanding the way the questions were set however the answers were very similar to each other and that made it difficult to choose the correct answer. Participants agreed that questions needed to be read very carefully as marks could be lost because of misreading a question and choosing the incorrect answer.

Theme three: Alternative methods of assessment

There are different types of adult evaluation already discussed in chapter two. The different types of evaluation evaluate different aspects of cognitive thinking (Verenna *et al*., 2018)

- **Rationale for alternative forms of evaluation**

The participants felt strongly about the method of examination All of them had completed some form of qualification since leaving school and so had experienced different forms of evaluation and competency assessment. Various methods were mentioned in the discussions but most had experienced short essay type questions requiring paragraphs and longer essay type questions. They were not used to the MCQ N-type setup. One participant believed:

> *G1P2: "It is a limitation in terms of ...can you really articulate and apply understanding in situations with multiple* [choice] *questions? I don't know if it is possible."*

The structure of the questions in the exams seems to be very important to the participants in order to give the opportunity to think and apply their coursework and

not only recall the information learned. Application as this participant pointed out is very important.

> *G1P2: "In real life, unfortunately, you need to take what you learned and apply it in your particulate situation - staff, budget, people and organizational culture whatever it is. It is a limitation if you cannot really articulate and apply understanding of a situation within multiple questions."*

In this study, the participants felt strongly that they were not good at writing MCQ's. The participants are used to explaining themselves in an examination:

> *G2P4: "...I agree with a little bit of longer questions. You will be able to explain yourself."*
>
> *G3P5: "If you have an examination where you can explain yourself you get more marks."*
>
> *G4P5: "Our nurses are used to applying most of the time."*

Participants thus tended to favour multi-method examinations.

> *G1P4: "I think a mix* [of] *multiple choice questions (MCQ), short questions and long questions. Then you can test whenever a person can think through a situation and can apply their mind."*

- **Recommendations for alternative types of testing**

The participants are used to explaining themselves in an examination and prefer multi-method examinations.

> *G4P6: "They need to mix the questions like open questions and multiple choice questions not only multiple questions. One needs to explain like in depth".*
>
> *G1P4: "I think a mix, a MCQ, short questions and long questions…."*

G3P1: "If you mix questions…oral with essay type of questions to help students to get more marks. I think it is a good idea."

During the group discussions course work, oral examinations, essay type and short questions, problem based scenarios and assignments were considered.

Assignments were introduced into IPC course together with the tests in 2014. The participants agreed that this kind of evaluation method could assist in increasing the marks. A number of evaluation methods were considered positively. When considering use of the alternative evaluation methods, the participants commented as follows:

G1P3: "The assessment was good and it helps boost your marks."

G1P3: "I think the assessment mark counting towards your final mark… it is fair."

G2P4: "I like the idea of scenarios."

G4P5: "I think scenarios can work."

G1P4: "…. You are used to orals."

G1P2: "I prefer oral by a panel…."

The participants suggested that it might be helpful if a clinical facilitator could assess or assist the IPC students clinically especially if it is a new field for the student. They suggested that the IPC lecturers could work with the student in practical sessions, advising and assessing the students.

G1P1: "With nursing, it is both theory and practice for the nurses."

G4P2: "There needs to be more practical [exposure]*."*

Summary of theme three

The alternative methods of assessment were examined in this theme as well as the concerns with the present form of evaluation.

The participants agreed that they were used to explaining themselves in previous studies and preferred multi-method examination approaches. They recommended examination approaches such as combinations of short questions, long essay questions, assignments, more practical sessions and orals.

4.3 SUMMARY

In chapter four, the detailed analysis of the findings of three themes and eight sub-themes that emerged was given. These themes were extracted using the thematic analysis approach developed by Clark and Braun (2013).

Three sub-themes emerged from theme one. This theme discussed the participants' perception of the way the examination was compiled as well as the method of evaluation presently used in the infection control course.

The second theme describes the experiences of the use of computer based Multiple-Choice Question (MCQ) examinations. Three sub-themes provided more clarity on the participants' unfamiliarity with the format of questions, negative marking and the influence of language proficiency of the students writing the examinations.

Theme three focused more on the exploration of the preference of examination methods of the students completing the IPC course. The participants' discussions focused on the rationale for alternative forms of evaluation and recommendations for alternative evaluation processes.

Chapter five will conclude the report with the discussion of findings supported by literature, limitations and recommendations for future nursing research.

CHAPTER FIVE

DISCUSSION, RECOMMENDATIONS LIMITATIONS AND CONCLUSIONS,

5.1 INTRODUCTION

In this final chapter a summary of the research report is described. This chapter connects chapter two and the findings in chapter four. The discussion focuses on the main findings, recommendations and limitations for future nursing research. A conclusion is reached from the findings. In addition, this chapter reflects on the lessons learned and identifies the preferences and perceptions of the infection prevention and control course. The research methodology followed the qualitative manner of semi-structured interviews. These took place in small group discussions and captured real-life information in a social setting. Themes and sub-themes were revealed. Literature was used to compare and support the interpretation of the participants' comments.

5.2 SUMMARY OF FINDINGS

The purpose of the study was to gain more insight into students' actual preferences of assessment methods and their perceptions of computer based multiple choice question examinations. Consideration of these preferences and perceptions may help future students improve their understanding and competency in a field of patient care which remains desperately short of nursing expertise.

The objectives of the study were:

- To explore the preference of the IPC students of assessment methods used in the IPC course.
- To explore the perception of the IPC students of the computer based MCQ method of assessment used in the IPC course.

5.3 DISCUSSION OF FINDINGS

Infection prevention and control is a new nursing discipline in South Africa in spite of being studied for many years in the United States of America and Europe (Dixon, 2011). Students registering for the IPC course come from many different hospitals. There is a large range in age as well as their experience in IPC.

5.3.1 Discussion of Demographic Data

In this study, 73% of participants were between 31-50 years of age confirming that these nurses had considerable nursing experience generally and represented an older generation of nurses. Some may not have been exposed to infection prevention as a formal discipline during their training. These experienced participants' did not struggled to understand new terminology. At the start of the course the participants found it difficult to get used to studying but as the year progressed experience gave them a great advantage. Van de Watering *et al.* (2008) posit that inexperience can create a barrier to studying and understanding of new terminology. Fifty-three percent of participants were university graduates. Exposure to the academic environment may have fostered an interest in participating in research and may be the reason for the larger number of degreed participants in the group discussions. These participants may have been previously exposed to MCQ's since this is a

method of evaluation frequently used at universities. This could have influenced their perceptions of MCQ examinations and the preparation for such an examination. The experience in infection prevention of nine participants that attended the semi-structured interviews was between one and more than 10 years. This gave these participants some advantage particularly with skills however they still felt that multi method assessments were preferable. Rose *et al.*, 2018 confirm that nurses in the age group 40-60 year with experience do have an advantage over students without experience when answering examinations.

Five participants had no experience. The inexperienced participants were required to learn a new subject without practical experience. This, they said made studying much more difficult. Byrd (2018) confirms that inexperienced participants required to learn a new subject without practical experience find the subject more difficult.

The bulk of the participants were employed in government hospitals (46.7%) whereas only 20% came from the private institutions. The reason for the low representation of private sector students was thought to be that the private sector hospitals offer their own infection control courses and only the students that have the need to specialise further in an advanced diploma or postgraduate degree attend the course at the university. The success or lack of competency could not be linked to the institution sector and so this was not considered to play a roll.

In general, the demographic data played no role in influencing the perceptions of this group of participants.

5.3.2 Discussion of Small Group Data.

Three themes and eight subthemes emerged from the data. This section will discuss these themes.

- **The evaluation process**

Perceptions are assessed making use of formative and summative assessment approaches. These assessments have different goals and different methods of evaluation are commonly used (Bruce et al., 2011). The participants in the semi-structured interviews considered the evaluation process for competency as difficult since only one method of examination was used. They perceived that this method limited their ability to explain or express themselves. Sharma and Mutalik (2014) also stated that to focus on only one examination method such as MCQ's hindered the ability of the students to express themselves and resulted in failure to achieve competency

Three subthemes emerge from this theme.

During the period under investigation changes were made to the day on which the block test would be written and it was moved to the Monday of the following block in 2014. The participants agreed that writing tests in the following blocks gives the students the opportunity to spend more time to master the difficult concepts and they find the evaluation less of a challenge. Literature (Helmien et al., 2016, O'Dwyer, 2012 and Bruce *et al*., 2011) focuses on other aspects of formative and summative evaluation such as open or closed book evaluation and whether it is preferable to write evaluations in the morning or in the afternoon to increase marks of students. When asked about this many of the participants in this study felt that the time of day of testing was of less concern than the method of the testing. They did however agree that writing the test in the next block was better since the volume of work covered in each block was excessive.

The participants stated that the IPC course covered a broad section of knowledge and they understood the reason for choosing MCQ's as the method of evaluation since it

can cover a broad curriculum. Some participants believed that the curriculum was fully covered in the examination however the majority of participants felt that there were aspects of the content that was not fully evaluated.

No consensus was reached on the manner in which to prepare for these evaluations. Generally scientific subjects require critical thinking and students need to apply their knowledge to practice. Stanger-Hall (2012) commented that the style of examination could influence how much students learned as well as their ability to become critical thinkers however they do not comment on the method or type of preparation for this to take place.

The use of computer based MCQ's

Byrd (2018), Madwela et al (2018), Delaram and Sharifi (2017) and Stanger-hall (2012) highlighted an important advantage of multiple choice questions (MCQ's) as the student's reading skills and understanding were tested. Participants learn from the start to read the questions carefully.

Under the theme of using computer based MCQ's, three subthemes emerged. These were unfamiliarity with format, negative marking and the influence of language.

Historically from 2011 both the formative and summative evaluations of the IPC course were multiple choice questions with negative marking. O'Dwyer (2012), Stanger-Hall (2012) and Bauer *et al.* (2010) explained the complexities of setting MCQ's. When using N-type MCQ's any incorrect option that is selected incurs a negative mark. This type of question is used to prevent the guessing of answers. Multiple choice questions (MCQ's) as a sole evaluation method in formative and summative evaluations was a challenge for most of the students because they were not used to the evaluation method. These challenges identified by the participants in this study are controversial. Bond *et al.* (2013) disagree with this study. According

to them, nurses are used to writing MCQ examinations. The IPC course also made use of negative marking and the participants' perception was that this made it even more difficult to master this method of evaluation. The participants in this study felt very strongly that they prefer writing essay type examinations because they could explain themselves. The participants felt that MCQ's were "unfair". Bond *et al*. (2013) confirmed the feelings of the participants of unfairness when referring to negative marking or N-type MCQ's as a method to prevent guessing amongst students. On the other hand, Bond *et al.* (2013) felt that using discrimination levels to develop negatively marked questions might improve the critical thinking of the students and increase their performance. Stanger-Hall (2012) disagrees with Bond *et al.* (2013) and agrees with the participants in this study. Stanger-Hall (2012) believed that mixed examination methods tests critical thinking to a maximum. Stanger-Hall (2012) also referred to students with high anxiety levels preferring MCQ examinations in their study. In this study the participants disagreed. They suggested that those with higher anxiety levels preferred writing an essay type of an examination.

There are eleven languages spoken in South Africa. This makes teaching and learning a challenge in the South African context. There were participants who agree that language was a barrier as it was not their first language. Translation of questions from one language to another often changes the meaning of the sentence and the vocabulary also differs from language to language. In non-English speaking homes, children master their mother tongue first and second languages such as English are taught at a later stage. Mastering another language later in life can be very challenging (Dale, 2013). Students participating in this course experienced similar challenges. Most of the participants in the interviews were of the opinion that there

was a possibility that the language difficulty used in setting the MCQ exam could have been be the reason for the poor competency of the students who participated in the IPC course. There were participants that complained that the way the exam was set and the English language that was used made the examination extremely challenging. The participants who really struggled to understand the questions asked in the examination might not have known the meaning of the words used in the questions. Kurdi *et al.* (2016) suggest that if a question is misinterpreted in MCQ's, the loss in scores are minimal whereas if an essay question assessment is misread, the student may lose considerably more marks. Because IPC is a fairly new discipline some terminology is unfamiliar in the clinical setting. If the students had not read their examination paper carefully they would have lost marks. For the English speaking participants, it was not difficult to understand the questions.

The participants were forced to read the questions carefully from the onset of the course and to make sure that they understand what was asked before selecting the correct answer. The negative marking posed a challenge for even the participants who did speak and understand the English. They felt uncertain of committing to an answer. The allocation of negative marking increased the risk of failing the question. Mahjabeen (2017) explains that allocation of marks to N-type of questions could be fair if the allocation is correct and influences marks of the students positively. Alternative methods of evaluation are not necessarily easier to set or to understand.

- **Alternative methods of assessment**

Most of the participants agree strongly that they are not used to the type of questions asked in the IPC examinations and this can have an influence in their marks. More recently assignments were included as formative assessments. The participants were

very positive towards assignments and agree that it gave them the opportunity to explain their knowledge.

The participants in the groups have not referred to the use of a portfolio of evidence but felt a strong need for different evaluation methods that have not yet been used in the IPC course as yet.

All the participants in the interviews would prefer the inclusion of oral examinations conducted according to a rubric and questions that would incorporate scenarios as an evaluation method as they are more familiar with such an evaluation than multiple choice questions with negative marking. Alenezi (2018) confirms that the advantage of oral examinations is to improve talkative skill, enhance communication and restore confidence but it could be very stressful for the person that is being evaluated whereas scenarios as an evaluation method enhance the students' ability to apply their knowledge. It could therefore enhance the IPC students' competency and application if used in the course.

The participants in the difference interviews agreed that it would be of value if a clinical facilitator could assess or assist the IPC students in the clinical setting particularly if it is a new field for the student. IPC educators could work with the student in practice and by doing so would provide an opportunity to advise the student on the job. Methar *et al*. (2011) confirm that IPC is a clinical field of training and competency is built in the clinical environment where educators could support the students.

5.3.3 Summary of the Discussion

To the best of the researcher's knowledge, this study is the first nursing study to examine the educational success of the IPC course of its kind to be conducted in the

IPC department of the university from the nursing perspective. It addresses education in a very new and scarce skill in South Africa. This study answers the set objectives.

- Exploring the preferences of IPC students of assessment methods used in the IPC course.
- Exploring perceptions of the IPC students of the computer based MCQ method of assessment used in the IPC course.

The participants' opinions of successful evaluations lay in choosing the best time to write the formative evaluations. More time was needed to master new terminology as well as the opportunity to broaden their practical skills in the workplace from block to block. The extra time would give the opportunity to familiarise themselves with the content of the work.

Effective communication and understanding is also an important challenge for the participants in order to find success in the course and master the curriculum. There were participants who believed that their marks were very low as English was not their first language. Understanding the way, the questions were set because English was not their first language and finding that the answers were very similar made it difficult to choose the correct answer. The participants however confirmed that the invigilators were on hand to assist with clarification of questions if necessary. Questions needed to be read very carefully because marks would be lost as a result of misreading a question and choosing the incorrect answer. The negative marking exacerbated this. The participants continuously questioned the need for the negative marking. It was a difficult system to get used to. All the participants agreed that they were not accustomed to negative marking. The perception amongst the students was that the method of evaluation was set to catch them out. The student's feelings towards the N-type of questions remained negative. It is perceived to be a method to

prevent guessing but was unfamiliar and unfair. It was a difficult system to get used to. Their preference for long essay type questions where they could express themselves more easily was repeated frequently. The participants were not totally negative about the MCQ form of examination. They felt that this kind of evaluation did teach the students to think before answering the questions. They also realised that they needed to read the questions carefully in order to understand the meaning of the question.

The participants preferred flexibility of evaluation methods rather than one method. Their preference for long essay type questions where they could express themselves more easily was repeated frequently. They believed that assignments assisted them to improve their marks.

They would like to see a summative examination that contains a number of different methods from all the different approaches of evaluation. They suggested making use of a continuous evaluation approach under the supervision of a clinical facilitator who would be responsible for ensuring compliance in the clinical skills. The participants who have had the opportunity to write an essay also enjoyed the integrated approach where they were able to explain themselves through completing an assessment during the IPC course.

The experience of MCQ evaluations makes the participants anxious and they realised that they need to choose the correct study method to increase the possibly of obtaining competency. The participants also realised that the final preparation for different evaluation approaches needs to be managed differently.

This, added to the fact that they were learning in a second or third language made it difficult to understand the questions asked thus increasing the difficulty of the

MCQ's. Generally mixed type of questions were preferred rather than tests and examinations using only one type of method.

The participants found the class work challenging as it sometimes felt as though they received excessive information. They referred to it as "information overload". They believed that they needed more contact time to bridge the gaps in their knowledge deficit.

In each of the interviews the participants discussed many ways to study. Some of them had changed their study methods whilst, others learned to read the questions more carefully. Some of the participants had not realised the need for an in-depth study approach for an N-type of examination as describes in a study by Mingo *et al.* (2018). The method of study they most often used was superficial learning.

The participants found the class work challenging as it sometimes felt as though it was excessive information. They referred to it as "information overload". They believed that they needed more contact time to bridge the gaps in their knowledge deficit. They realised that they needed to make appointments with educators to assist them with content that they hadn't mastered.

The participants discussed many ways to study. Some of them had changed their study methods whilst, others learned to read the questions more carefully. Some of the participants had not realised the need for an in-depth study approach for an N-type of examination as also describes in a study by Mingo *et al.* (2018). The method of study they most often used was superficial learning.

5.4 RECOMMENDATIONS

Recommendations are based on the findings of the study. This research examined the preferences and perceptions of examination methods of the students completing the IPC course and the perceptions of IPC students with regard to the way the examination is compiled and their opinions of completing this examination.

The recommendations have been grouped into three parts, those that will influence direct nursing care, those that require decisions of nursing management or require insertion into a training programme and lastly those that need more research.

5.4.1 Recommendation for the Nursing Practice

The IPC nurse practitioner needs to incorporate management skills, education skills and infection control skills in their clinical environments. The IPC course equips the nurse in practice to sustain surveillance programs which identify and enable one to manage outbreaks early and needs to be incorporated in the curriculum of the IPC students. Evaluation of the IPC student need to be in a way that the IPC student could explain themselves by using multi method examination methods.

IPC staffing according to Stone (2014) regarding bed occupancy needs to be taken into consideration when the scope of an IPC program, the complexity of the health care facility, the characteristics of the patient population and the unique or urgent needs of the facility and community is planned. Examination questions need to take all these aspects into account. Students could be skilled in the way to read and answer a multiple choice negative marking question. A mock test could be given to the students to give them the opportunity to exercise before writing an exam that counts for marks. Students also could complete a portfolio of evidence that gives them guidance and direction to use in their position as IPC practitioner.

5.4.2 Recommendation for the nursing management

Exposure to an IPC environment will assist the student to apply theory in practice. Exposure enhance experience of the student that has been trained. More practical examination methods is recommended in the IPC curriculum to give the students the ability to critical analyse and think creatively by using scenario's as assignments in the IPC curriculum. It will evaluate critical thinking and application of that what was studied during the course of the study. The management of the healthcare facility could involve IPC students working in other departments in containing outbreak situations and develop teaching, learning and assessment activities as a coherent process. (SAQA, 2005).

5.4.3 Recommendation for the nursing research

Further research is required on the infection prevention and control course regarding incorporating mini point prevalence studies into the IPC course to equip the students with practical knowledge in identifying hospital acquired infections.

More research could be done to identify if a portfolio of evidence could make a difference in improving competency of the IPC students while they are on the course.

Multiple choice questions being used in the question bank should be rated for cognitive levels according to Blooms' taxonomy. Evaluate which questions have application values and which questions are recall questions.

Examination methods could be changed so that evaluation start in the beginning of the year with equal mix methods questions to accommodate all students' preferences and then move to more multiple choice questions as used in the current evaluation method.

5.4.4 What does this study add?

This study added knowledge regarding the infection prevention and control students' preferences and perceptions after completing their course examinations. Some minor amendments regarding the way the examinations were structured could make a difference in the performance of the students.

One of these amendments, without changing the examination method, includes a detailed explanation to the students of what N-type MCQ examination questions entail and how the N-type MCQ needs to be answered. One needs to provide examples of such questions to the students when the course commences. Providing a "mock test" in the first block will provide valuable exposure to the questions being asked and how to answer them appropriately.

From the onset, the students need to know that they should make use of an in-depth study method and need to know the content of the curriculum as guessing incorrect answers will result in even lower marks than would have been the case if they did not answer the question at all.

The use of other evaluation approaches such as assignments and portfolio of evidence could assist the students in achieving competency.

5.5 LIMITATIONS

The study was a small sample (n=15) carried out in a university setting using post graduate students that work full time. Some of the participants who did not live in Gauteng were not able to participate while others were able to take leave to participate in the semi-structured interviews which took place in small groups discussions.

Participant selection was based on a census sample. Due to the small sample the findings cannot be generalised to all students. However, the purpose of this exploratory study was to discover the preferences and perceptions of the students towards MCQ negative marking. Saturation was achieved in spite of the small numbers.

The researcher accepts that there may be different interpretations and thus different themes extracted from the narratives in other contextual settings. This is possible because the method used in the analysis of the data is subjective.

5.6 CONCLUSION

In order to fulfil the purpose of this study two objectives were set and achieved. The study's purpose was to gain more insight into students' actual perception and preferences of assessment methods and their perceptions of multiple choice questions examinations in the IPC course at a selected university.

The findings of the study showed that the participants who attend the semi-structured interviews which took place in small groups discussions were overwhelmed and found the method used for the examination very difficult to understand. For many it was the first time in their lives that they were exposed to a multiple choice negative marking method of examination. They prefer a multi method questions to be able to explain or express themselves.

The participant's perception regarding the way the examination was compiled was that it was an unfair method and selected to catch them out. This created a challenge for the students. The participants learned to read their questions carefully before choosing any answer that might be incorrect.

The participants agree that the way forward to increase the competency of the IPC students included development of study guides, a varied method approach to evaluation and if MCQ's are to be used, the students need to be taught how to understand and complete that type of evaluation. They appreciated assignments as an add-on to assist with increasing the marks.

There was also representation (5%) of participants from other institutions including laboratories, Emergency Services and Department of Correctional Services. This confirms that IPC is useful in more than one field of interest and the application of IPC principles could be used in preventing transmission of infectious diseases in communal settings such as the police cells. Other medical and non-medical fields are also interested and infection prevention and control should be included into the training of these personnel. This includes laboratory personnel. Training must also be extended to include these fields.

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APPENDIX 1: ETHICAL CLEARANCE FROM: HUMAN ETHICS COMMITTEE (MEDICAL)

R14/49 Ms Antoinette Moolman

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160511

NAME: (Principal Investigator)	Ms Antoinette Moolman
DEPARTMENT:	Nursing Education
PROJECT TITLE:	Students' Perceptions and Preferences of Computer Based Multiple Choice Question Examinations during the Infection Prevention and Control Course
DATE CONSIDERED:	27/05/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Andrea Hayward
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	20/07/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office, Secretary in Room [redacted]

I/We fully understand the the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated,from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially review in May and will therefore be due in the month May each year.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 2: LETTER OF PERMISSION TO CONDUCT THE STUDY

The Head of Microbiology Department

Room 3T11, Level 3

[redacted]

7 York Road

PARK TOWN, Gauteng

RSA

Request permission to conduct a research study using IPC students 'examination results from 2011- 2016.

Dear Prof. A Duse

My name is Antoinette Moolman; I am a Masters student, studying Infection Prevention and control- Nursing Science at [redacted] As part of the requirement to fulfil the course I have to conduct a research study.

The aim of this study is to gain more insight into students' perceptions and actual preferences of computer based marking multiple questions examination method, into the effect of these on writing multiple choice questions. This study consists of a qualitative design and will include four semi-structured interviews which took place in small groups of five participants who attended the Infection Prevention and Control course from 2011 to 2016 and have experience of multiple choice questions.

In order to obtain historical evidence on scores obtained by students, I will examine the final examination of students for the years 2011 – 2016.

Participation will be voluntary and a written informed consent will be obtained from participants. Confidentiality will be maintained at all times and anonymity will be assured during reporting and publication of research results.

I therefore request permission to access the electronic records of the students' performance.

The result of the study will be made available in the form of a report.

Regards

A Moolman

Phone no: 0834165977

E-mail address: Antoinette.moolman[redacted]

APPENDIX 3: INFORMATION LETTER AND CONSENT OF PARTICIPANT

INFORMATION LETTER: RESEARCH PARTICIPANT

Dear Participants

My name is Antoinette Moolman. I am a postgraduate student at university of [redacted], in the Department of Nursing Education for the degree of Master of Science in Nursing (Infection Prevention and Control). I am conducting a research on preferences and perceptions of students who attended the IPC course at [redacted] University from 2011 to 2016. The title of my study is:

STUDENTS' PERCEPTIONS AND PREFERENCES OF EDUCATIONAL ASSESSMENTS DURING THE INFECTION PREVENTION AND CONTROL COURSE

You will form part of a group. Participants will be asked to share their perceptions and preferences for examinations. The group will then discuss these perceptions and preferences. The discussions will be recorded with each participant using a number to maintain anonymity and confidentiality. These discussions will then be transcribed and analysed.

The semi-structured interviews which took place in small groups discussion will take a proximal 45-60 minutes to complete. Each of the participants in the group will get a number on a card to ensure confidentiality of each group member (No names will be used). When a group member answers a question, this group member must begin his or her answer with the number of his or her card and then express his or her feelings towards the open ended question.

Participation is voluntary, you may choose to participate or withdraw from the study at any time. Please note that I will do everything in my power to adhere to confidentiality but unfortunately confidentiality cannot be guaranteed in a semi-structured interviews which took place in small groups discussion despite the use of study numbers instead of names.

Findings from the study will be communicated to you on written request and any appropriate authority for planning and implementation of educational programs.

Thank you for taking time to read the information letter. Should you require any further information regarding the study or your right as a participant, you are welcome to contact the ethical committee of the University of the [redacted] using the following details:

- Protocol Ref No: M160511
- Chairperson: peter.cleaton-jones1[redacted]
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Or myself at the Department of Microbiology Infection Prevention and Control or email me using the following address: Antoinette.moolman@[redacted]

Yours Faithfully,

Antoinette Moolman

MSc Nursing Student

APPENDIX 4: PERMISSION FROM THE PARTICIPANT SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS

I agreed to participate in this study. I have read and understood the content of information sheet and I have been given the opportunity to ask questions, where deemed necessary, about the study and its procedures.

All information will remain confidential and my name will not appear anywhere on the report written.

I hereby agree to participate in the study.

.....

Name of participant

....

Signature Date

If you have any questions or concerns about this study, please contact Mrs Antoinette Moolman by email: antoinette.moolman@[redacted].

APPENDIX 5: CONSENT FORM FOR THE RECORDING

OF SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS.

I, the undersigned understand that the discussion will be recorded. There will be no consequences for me if I do not want to participate in the semi-structured interviews which took place in small groups.

I understand that the information from the recording will be transcribed and transcripts will be given codes and my name will not be mentioned. I was also informed that the recording device will be locked in a safe which has an electronic code and will be destroyed after two years following publication of five years if there is no publication.

I therefore consent to the recording of the semi-structured interviews in small groups during the course of this study.

Participant's signature: _____ Date: _____

APPENDIX 6: INFECTION PREVENTION AND CONTROL (IPC)

SEMI-STRUCTURED INTERVIEWS

QUESTIONS THAT WILL BE USED DURING

EVERY GROUP INTERVIEW

Demographic information from the group members:

Item	**Answer**
Age	
Registration: • Nursing degree	
• Diploma in Nursing: (General, Psychiatric& Community) and Midwife	
• Diploma in General Nursing	
• Diploma in Emergency Services	
• Other: State which course	
Did you hold an IPC position when you did the IPC training course?	
Do you hold an IPC position at the moment?	
How long have you worked in an IPC post? (Mark the applicable years) • Less than 1 year	
• 1-5 years	
• 5-10 years	
• Longer than 10 years	
You are employed at: • Private Clinic	
• Private Hospital	
• Government Clinic	
• Government Hospital	
• Other: (e.g. Laboratories or Emergency Services)	

Examples of open ended leading questions that encourage participation in the group are:

Think of your final IPC examination and then tell me about:

1. What did you feel about the system of examining students using computer based MCQ's?
2. What alternative approaches to assessment would you have preferred?
3. What type of assessment do you think might have improved your marks?

APPENDIX 7: EXAMPLES OF TYPO TRANSCRIPTIONS OF THE SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS:

Linking Themes, Subthemes and coding to the research Question

RESEARCH QUESTION	THEMES	SUB THEMES	CODING
Preferred method of assessment	The evaluation process	Timing of testing	*"..it is writing on the Monday as writing on the Friday."*
Perception of the method of assessment	The evaluation process	Content of examination	*"Final exam was balance but not the tests.."*
Perception of computer based multiple questions	The evaluation process	Preparation for the exam	*"I prepared for exams in the same way.."*
Preferred method of assessment	The use of computer based MCQ's	Unfamiliarity with the format	*"..they didn't give negative marking at all.."*
Perception of computer based multiple questions	The use of computer based MCQ's	Influence of language	*"English language was not the first language."*
Preferred method of assessment	The use of computer based MCQ's	Rationale for alternative forms of evaluation	*"..longer questions you will be able to explain yourself."*
Preferred method of assessment	Alternative methods of assessment	Recommendation for alternative types of testing	*"The assignment was good and it helps bust your marks."*

Group1:

3(G1P3): "It was quite tricky because it was not a system we are not use to. In our training they didn't give negative marking at all. (Unfamiliarly with the format) *So the concept was something new that you have to get used to. I must say the exams were quite tricky sort of set up to catch you out. But we managed it."*

3(G1P3): "Our papers normally are I am talking of short course paramedics. Our papers are long question paper in the exams and then also multiple choice papers but not worth negative marking. So it is not something we are used to."

2(G1P2): "The way the multiple choice questions were set up. I am more using to a single multiple choice you have the question and only one right answer. Where true [or] *false and the answer you know that is choose the rightest…… …. I was use to lot more longer open ended questions and explain way ….*

4(G1P4): "It is not the first time I was been exposed to negative marking but I do think that because English language was not the first language (Influence of language) *of many of the students that's probably why some of the students find it so extremely difficult."*

3(G1P3) "…. I think there is a different concept to bear in mind. You need to be conscious that it is negative marking because if you have something wrong will get a minus mark on it. It happened in the beginning but we get used to it……..... I mean the way I prepared for exams in the same way (Preparation for examinations)

2(G1P2): "If you prepare for the more essay type of question spend more time memorising on list and content on specific detail at length. There if I think you prepared for multiple choices you are focussing more on the volume than the detail."

3(G1P3): "The assignment was good and it helps bust your marks." (Recommendation for alternative types of testing)

3(G1P3): ……I find the orals very stressful but there is place for it. I suppose."

Group 2:

3(G2P3) "……My experience with the exams with regards to the MCQ was [a] *big challenge. Sometimes the answers look similar…….*

4(G2P4): "…….is to read your questions very carefully as she said it can be one word or one sentence in between that can make a difference …. longer questions you will be able to explain yourself. (Rational for alternative forms of evaluation) *Not always our first language it might be difficult to express yourself.*

4(G2P4): "……. assignments are a very good thing because it gives you change to really prepare a proper document to really enhance your year-end score….

4(G2P4): "Definitely I am going to study differently. There is huge difference between the two. MCQ you got much more details. Finer points that you need to look into. With the longer questions you need to have the knowledge but you can at least explain yourself. [There are] total different ways of studying."

3(G2P3): "……._essay type of questions, ……. needs to prepare thoroughly in detail……..

4(G2P4): "……..I think it might be a language barrier. Some of the words and the sentences was put in the academic language of microbiology make it a bit difficult to me. I had to read the questions more than once to start going on in the question…."

4(G2P4):" …… there should be more than a balance between the short and the longer questions…". the short question isn't that big problem but the negative marking was for me very stressful…"

Group 4:

5(G4P5): "It was a shock to me the negative marking……

2(G4P2): "……. the majority of the questions they were interlink because it in a sentence that was change and whether you get the answer is correct. It is a matter of wording…."

(G4P3): "Although it was challenging it gives you a change to know all the work that has done. Through the course of the year not doing guess work."

1(G4P1): "Agree with the tests as it is writing on the Monday as writing on the Friday. Rather do practical on a Friday. If the curriculum changes that you get scenarios and questions to do between block…. So students in future, need to do something between the blocks, to force you as student to read theory on the subject."

5(G4P5): "Yes it will work (All agree)."

6 (G4P6): "Some of us used a different type of study. Some of us use mind maps, some of us use. We do different types of study. For me I study on my own and then attend a group discussion. I need to search for clarity"

6(G4P6): …. "They need to mix the questions like open questions and multiple questions not only multiple questions. One needs to explain like in dept."

1 (G4P1): "I agree with explanation you need to explain."

1(G4P1): "Final exam was balance but not the tests." (Content of examinations)

STUDENTS' PERCEPTIONS AND PREFERENCES OF EDUCATIONAL ASSESSMENTS DURING THE INFECTION PREVENTION AND CONTROL COURSE.

ANTOINETTE MOOLMAN

A research report submitted to the Faculty of Health Science, University of the Witwatersrand, Johannesburg in fulfilment of the requirements for the degree of

Master of Science in Nursing

JOHANNESBURG

2018

DECLARATION

I, Antoinette Moolman hereby declare that the following research report is a product of my own research effort. It is being submitted for the degree of Master of Science (Nursing) at the University of the Witwatersrand, Johannesburg. This work has not previously been submitted for any degree or examination at this or any other university.

_____

SIGNATURE

_____

DATE

Protocol Number M160511

DEDICATION

I dedicate this work to my husband Gerhard, family and friends.

Thank you for your love and being a pillar of support throughout the course of the study!

ACKNOWLEDGEMENTS

I wish to extend my gratitude to all people whose contributions led to the successful completion of this research project. In particular, would I like to thank the following people who engaged into my study and who support me during the study to make a success of this research:

- My husband, Gerhard, for the financial support, motivation and patience.
- My children, for understanding and support.
- My supervisor, Andrea Hayward, for her patience, guidance and availability.
- Prof AG Duse, Clinical Microbiology Department who gave me the opportunity and permission to include the infection prevention and control students in the study.
- Prof Donna Kapp, who language edited my research report.
- Support from colleagues, Mark Pringle and Lesley Devenish.
- The participants without whose cooperation the study wouldn't have been a success.

ABSTRACT

Introduction: The competency of the students attending the infection prevention and control course (IPC) at a selected university in Gauteng is of concern because they frequently fail to achieve a pass mark in their final examination. Infection prevention and control is a clinical field and needs a high level of application of what was studied in the IPC course. As the problem of hospital-acquired infections rises, this low competency rate impacts on the number of trained and competent infection prevention and control practitioners and thus on the effective management of the hospital infection rate. The summative marks of the students in a specific study group indicate a problem which may relate to either the teaching, the selection of the students or the assessment methods used. Some effort has already been made to improve teaching. Little could be done regarding selection since due to the shortage of infection prevention and control practitioners, all applicants are accepted onto the course. A concern is that the current use of multiple choice questions as a sole evaluation method is not the best option or method of evaluation for this group of students. The following question needs to be answered: What methods of assessment do the IPC students prefer and what are their perceptions of multiple choice question examinations?

Objective: The objectives of the study were to explore the preferences of IPC students of assessment methods used in the IPC course and to explore the perception of the IPC students of the computer based multiple choice questions method of assessment used in the IPC course.

Methodology: This study made use of an exploratory and qualitative design that included semi-structured interviews which took place in small groups in an attempt to gather in-depth information which was analysed as described by Clarke and Braun (2013). The population in this study consisted of all students registered on the IPC course who took part in examinations from 2011-2016. Semi-structured interviews which took place in six small groups were conducted until saturation was achieved. Trustworthiness was based on the model of Lincoln and Guba.

Results: Three themes and eight subthemes derived from the semi-structured interviews which took place in small groups. Participants discussed broadly the evaluation process, the use of computer based multiple choice questions and alternative methods of assessment regarding their preferences and perception during the IPC course.

Conclusion: The purpose of the study was to gain more insight into students' actual preferences of assessment methods and their perceptions of computer-based multiple choice questions examinations. In order to fulfill the purpose of this study two objectives were set and achieved. The findings showed that timing of testing, the content of examinations and preparation for examination as part of the evaluation process were issues the students needed to deal with to pass. Unfamiliarity with the format, negative marking as an assessment method and English as a language of instruction course increased anxiety of the student participating in the course. Rationale for alternative forms of evaluation and the

recommendations for alternative methods of assessment need to be considered in further changes of the curriculum in future.

Keywords: Infection prevention and control, multiple choice questions, evaluation approaches, evaluation methods, infection prevention and control courses, semi-structured interviews and e-learning in infection prevention and control.

LIST OF ABBREVIATIONS

APIC	Association of Practitioners in Infection Control
CBMCQ	Computer-Based Multiple Choice Question
CDC	Centres for Diseases Control
CR	Constructed- response method of evaluation
Nod	National Department of Health
ET	Elimination testing
HCF	Health care facilities
HAI	Hospital-acquired infection
IPC	Infection Prevention and Control
IPCP	Infection Prevention and Control Practitioner
IWF	Item-writing Flaws
N-Type	Multiple Choice Questions Negative Marking
MEQ	Modified essay questions
MCQ	Multiple choice question
OHSA	The Occupational Health and Safety Administration
PPE	Personal protective equipment
SEQ	Short essay questions
TB	Tuberculosis
USA	United States of America
WHO	World Health Organisation

TABLE OF CONTENT

DECLARATION 1

DEDICATION 2

ACKNOWLEDGEMENTS 3

ABSTRACT 4

LIST OF ABBREVIATIONS 6

TABLE OF CONTENT 7

LIST OF TABLES 12

LIST OF FIGURES 13

CHAPTER ONE: OVERVIEW OF THE STUDY 14

1.0 INTRODUCTION 14

1.1 BACKGROUND OF THE STUDY 15

1.2 PROBLEM STATEMENT 18

1.3 RESEARCH QUESTION 19

1.4 PURPOSE OF THE STUDY 19

1.5 OBJECTIVES OF THE STUDY 19

1.6 SIGNIFICANCE OF THE STUDY 19

1.7 OPERATIONAL TERMS 20

1.7.1 Computer-based Multiple Choice Question 20

1.7.2 Semi-structured interview 21

1.7.3 Small groups 21

1.7.4 Formative and Summative Assessment or Evaluation 22

1.7.5 Infection Prevention and Control Practitioner (IPCP) 23
1.7.6 Item-writing Flaws (IWF) 23
1.7.7 Negative Marking 23
1.7.8 Scarce Skills 23
1.8 OVERVIEW OF RESEARCH METHODS 24
1.9 DATA COLLECTION 24
1.10 DATA ANALYSIS 25
1.11 MEASURES OF TRUSTWORTHINESS 25
1.12 ETHICAL CONSIDERATIONS 26
1.13 OUTLINE OF CHAPTERS 27
1.14 SUMMARY 27
CHAPTER TWO: LITERATURE REVIEW 28
2.1 INTRODUCTION 28
2.2 LITERATURE REVIEW 29
2.2.1 Early Development of Training in IPC 29
2.2.2 Qualities and Competencies Required for an Infection Prevention and Control Practitioner (IPCP). 31
2.2.3 Student Evaluation Approaches 34
2.2.4 Types of Evaluation Methods 38
2.2.5 Negative Marking 46
2.2.6 Computer-Based Versus Non- Computer-based questions 48
2.2.7 Student preferences and perceptions towards evaluation methods 48
2.3 SUMMARY 52

CHAPTER THREE: RESEARCH METHOD 54
3.1 INTRODUCTION 54
3.2 PURPOSE AND OBJECTIVES 54
3.3 RESEARCH DESIGN 54
3.3.1 Qualitative Research 55
3.3.2 Exploratory 56
3.3.3 Descriptive Design 56
3.3.4 Context 57
3.4 RESEARCH METHODS 58
3.4.1 Population 58
3.4.2 Sample and Sampling 58
3.4.3 Setting and site 59
3.4.4 Small groups 60
3.4.5 Semi-structured interviews 60
3.5 DATA COLLECTION 62
3.5.1 Planning the interviews 62
3.5.2 Conducting the interviews 63
3.6 DATA ANALYSIS 64
3.6.1 Approach to Analysis 64
3.7 MEASURES TO ENSURE TRUSTWORTHINESS 70
3.7.1 Credibility 71
3.7.2 Dependability 71

3.7.3 Confirmability 72
3.7.4 Transferability 72
3.8 ETHICAL CONSIDERATIONS 73
3.8.1 Permission to Conduct the Study 73
3.8.2 Informed consent 73
3.8.3 Confidentiality and Anonymity 74
3.9 SUMMARY 75
CHAPTER FOUR: FINDINGS 76
4.1 INTRODUCTION 76
4.2 DISCUSSION OF FINDINGS 76
4.2.1 Demographic Data 77
4.2.2 Emerging Themes and Sub Themes 79
4.2.3 Themes 79
4.3 SUMMARY 93
CHAPTER FIVE: DISCUSSION, RECOMMENDATIONS, LIMITATIONS AND CONCLUSIONS 94
5.1 INTRODUCTION 94
5.2 SUMMARY OF FINDINGS 94
5.3 DISCUSSION OF FINDINGS 95
5.3.1 Discussion of Demographic Data 95
5.3.2 Discussion of Small Group Data. 96
5.3.3 Summary of the Discussion 101
5.4 RECOMMENDATIONS 105

5.4.1 Recommendation for the Nursing Practice 105

5.4.2 Recommendation for the nursing management 106

5.4.3 Recommendation for the nursing research 106

5.4.4 What does this study add? 107

5.5 LIMITATIONS 107

5.6 CONCLUSION 108

REFERENCES 110

APPENDIX 1: ETHICAL CLEARANCE FROM: HUMAN ETHICS COMMITTEE 123

APPENDIX 2: LETTER OF PERMISSION TO CONDUCT THE STUDY 124

APPENDIX 3: INFORMATION LETTER AND CONSENT OF PARTICIPANT 126

APPENDIX 4: PERMISSION FROM THE PARTICIPANT SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS 128

APPENDIX 5: CONSENT FORM FOR THE RECORDING OF SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS 129

APPENDIX 6: INFECTION PREVENTION AND CONTROL (IPC) SEMI-STRUCTURED INTERVIEW QUESTIONS THAT WILL BE USED DURING EVERY GROUP INTERVIEW 130

APPENDIX 7: EXAMPLES OF TYPO TRANSCRIPTIONS OF THE SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS: 132

LIST OF TABLES

		Page
Table 3.1	Availability of respondents.	61
Table 3.2	Clark and Braun (2013) six-step framework for doing a thematic analyssis.	65
Table 3.3	Example of coding transcripts according to the research question.	67
Table 3.4	Themes identified from the transcript.	68
Table 4.1	Age of Participants.	77
Table 4.2	Qualifications of the Participants	78
Table 4.3	IPC Experiences of the participants	78
Table 4.4	Emerging Themes and Sub-Themes	79

LIST OF FIGURES

Page

Figure 3.1 Application of Clark and Braun's (2013) Thematical Analysis Methods 70

CHAPTER ONE

OVERVIEW OF THE STUDY

1.0 INTRODUCTION

There is a scarcity of infection prevention and control (IPC) nurses, capacity and expertise in the South African public healthcare facilities (Zinatsa *et al*., 2018).

Stone *et al*.(2009) refer to a ratio of one Infection Prevention and Control Practitioner (IPCP) to 250 acute care beds and highlight that this is no longer adequate to meet current infection control needs. In this American study performed in 2009 by Stone, the author advised that the ratio of one infection prevention and control practitioner per 167 beds would be more reasonable in order to improve the infection rate in hospitals. In a later study done by Stone *et al*. (2014) it was discovered that there are only 1.2 qualified IPCP's working across healthcare facilities in America and most of the hours of work were devoted to data mangement. South Africa's current staffing levels of infection prevention and control practitioners should be at least 1 to 200 acute care beds (Mahomed *et al*., 2017). No healthcare facilities in the public sector comply with this recommended ratio.

There are only a few dedicated IPC departments in South Africa. When this research started, there were four Universities, one in Pretoria, one in Johannesburg, one in the Western Cape and one in KwaZulu Natal with dedicated IPC departments and a written program for training in IPC. Currently there is only one academic centre that provides an IPC course as a short certificate course. There are no specific admission requirements for the certificate course. The course is completed over a year and comprises of four modules. The entrance criteria to the course are not aligned with those of the university in general as this course is considered to meet the scarce skills

criteria. The course has four modules and is run over four blocks. Attendance of all four modules is compulsory. Formative assessments are conducted on each Monday of blocks two, three and four. Each module test consists of computer-based multiple-choice questions with negative marking as the assessment method. The same method is also used for the summative evaluation.

This study made use of a qualitative design using semi-structured interviews which took place in small groups. The population consisted of all the infection prevention and control students registered on the IPC course between 2011-2016 who took the multiple questions examination at the selected university. The sample of the population was students who were available to participate in the study. It was anticipated that some of the students might no longer be available thus influencing the sample. The semi-structured interviews were performed in six small groups and discussions were done until data saturation was reached. A total of fifteen participants were included in the data collection. The discussions took place at different venues which were convenient to participants since the participants were distributed over a large geographical area. In order to get all the members of the different groups together electronic communication such as teleconferences and Skype were used.

1.1 BACKGROUND OF THE STUDY

There are a number of different assessment or evaluation methods which are traditionally used in nursing. In this study MCQ's and negative marking were used as the evaluation method in both formative and summative examination. A more in-depth discussion of MCQ's can be found in chapter two.

Evidence-based literature distinguishes between MCQ, short essay questions (SEQ) and modified essay questions (MEQ) as different types of evaluation. Khan and Aljarallah (2011: 39) write, "a well-constructed MCQ is superior to MEQ in testing the higher cognitive of undergraduate medical students in a problem-based learning setup".

Using a multiple-choice question (MCQ) format has advantages and disadvantages for teaching and learning (Madwela *et al.,* 2018; Delaram and Sharifi, 2014; Bauer *et al*., 2010). MCQ as a form of evaluation gives the opportunity to assess large numbers of candidates writing examinations. Marking of these evaluations can be done by someone with no knowledge of the subject or by a computer program. MCQ evaluations are objective and allow coverage of a broad part of the curriculum (Madwela *et al*., 2018; Stanger-Hall,2012). If MCQ's are well constructed, they can evaluate different abilities of students (Khan and Aljarallah, 2011). The construction of good quality MCQ questions that not only test factual recall but cognitive thinking as well, is not easy to develop and takes time (Kurdi *et al*., 2016; Khan and Aljarallah, 2011; Delaram and Sharifi, 2014). If an MCQ is not constructed well (in other words it contains item writing flaws), it can offer cues that give the guessing student the opportunity to choose the correct answer (Khan and Aljarallah, 2011; Stanger-Hall, 2012; Sharma and Mutalik, 2014).

Stanger-Hall (2012) and Kurdi et al. (2016) also describe the concept of item-writing flaws (IWF) and how this concept can have an impact on students' performance in MCQ evaluations. Item-writing flaws can make questions either easier or very difficult by leading the candidate in the wrong direction if the candidate does not understand what is asked in the question.

In health-science disciplines, the health professional needs to have the knowledge to make important decisions regarding human life. The professional needs to apply their knowledge to be competent in the field. If the quality of the MCQ's is written at a low cognitive level, it can influence the level of practice and impact on health care decisions (Khan and Aljarallah, 2011). According to Madwela *et al*. (2018) as well as Khan and Aljarallah (2011), multiple choice questions can also hinder critical thinking in introductory science classes due to lack of knowledge and background by the students in completing MCQ's in the correct manner.

Therefore, to base evaluation of students on an MCQ evaluation script as the only evaluation method could increase the risk of bias for that particular group. One could reduce the risk of item writing flaws by using multi-method evaluation approaches such as structured essay question (SEQ's) in combination with MCQ evaluation scripts.

In a study done by Sharma and Mutalik (2014), a comparison between MCQ's and SEQ's showed that students with a strong factual recall capacity score better in MCQ's than they did on SEQ's. But the SEQ evaluations show more intellectual ability to analyse, organize and apply knowledge. The above study also found a correlation between MCQ and SEQ evaluation questions. However if students perform well in MCQ's, they will perform equally well in the SEQ method according to Sharma and Mutalik, (2014).

Delaram and Sharifi (2014) identified that students score higher marks in MCQ evaluations when compared to essay question evaluations. Making use of MCQ's may lead to higher scores by students who do not master the concept of applying their knowledge to particular situations. Therefore, based on the findings of Delaram and Sharifi (2014), if the MCQ method of evaluation only is used, some students

may pass the evaluation without thinking critically and unable to apply the relevant knowledge.

In summary, when considering different types of evaluation questions, the literature indicated that there were positive as well as negative findings for each. . MCQ's can be superior to MEQ in testing higher cognitive skills and in giving a student who does not have the ability to perceive, resolve or apply answers to questions the opportunity to score higher marks. Application of what was taught will influence competence positively in the working environment. A well-balanced question paper with both types of questions gives an equal chance of success to all categories of students. Evidence is needed to assess the IPC student's preference and perceptions of the computer-based multiple choice questions evaluation and the way they are set would influence the compatency of the student.

1.2 PROBLEM STATEMENT

The competency of the students attending the IPC course at a selected university is of concern because they frequently fail to achieve a pass mark. IPC is a clinical field and needs a high level of application of the knowledge gained in the IPC course. This low pass rate impacts on the number of trained and competent IPC practitioners and as hospital-acquired infections rise it eventually impacts on the effective management of the hospital infection rate. The formative and summative marks of the students in the study group indicate a problem which may relate to either the teaching, the selection of the participants, or the assessment methods used. Little could be done regarding selection since due to the shortage of IPC practitioners, all applicants are accepted onto the course. The focus of this study was the assessment method and so teaching methods were not included in the study. Many students failed

to succeed using the present evaluation format. There was a concern that the current use of MCQ's as a sole evaluation method in formative and summative evaluations was not the best method of evaluation for this group of students. Evidence was needed to assess what the IPC student's perceptions and preferences for evaluations were and so their opinions regarding alternative evaluation methods were explored.

1.3 RESEARCH QUESTION

What methods of assessment do the IPC students prefer and what are their perceptions of computer-based multiple choice question examinations?

1.4 PURPOSE OF THE STUDY

The purpose of the study was to gain more insight into students' actual preferences of assessment methods and their perceptions of computer-based multiple choice questions examinations.

1.5 OBJECTIVES OF THE STUDY

The objectives of the study were:

- To explore the preferences of IPC students of assessment methods used in the IPC course.
- To explore the perception of the IPC students of the computer based MCQ method of assessment used in the IPC course.

1.6 SIGNIFICANCE OF THE STUDY

Results, recommendations and prioritisation of identified challenges by the students may lead to meaningful changes in the presentation of the course thus contributing

to the improvement of students' performance scores in the tests and evaluations. This may give future applicants the opportunity to not only increase their marks and strengthen their opportunity for additional studies in their field of speciality but to put competent, knowledgeable IPC practitioners in the field to apply what was taught. It will also strengthen the quality of infection prevention and control nurses in practice and build capacity to decrease the scarcity of infection prevention and control (IPC) specialists. If more competent nurse practitioners with infection control backgrounds are deployed in hospitals, surveillance will improve and there should be an improvement in managing the infections in the healthcare facilities. Control of outbreaks will be managed more effectively and the focus will shift towards prevention of infections and transmission of infection rather than the control of infection.

1.7 OPERATIONAL TERMS

1.7.1 Computer-based Multiple Choice Question

These questions are multiple choice questions that is presented on the computer consisting of a 'problem statement' that is referred to as the 'stem'. This question or problem is followed by four or five options of answers. The IPC students write multiple choice questions that have more than one correct answer and incorrect answers are marked negatively. It is called N-type multiple questions and minimizes the risk of guessing and leading questions during formative and summative evaluations (Byrd, 2018; Glass and Sinha, 2013; Delaram and Sharifi,2014; Khan and Aljarallah, 2011).

1.7.2 Semi-structured interview

A semi-structured interview is a qualitative method of inquiry in research that makes use of pre-determined open ended questions to prompt discussion of any particular topic. They also may increase the response rate. The interviewer may further explore the topic with additional relevant questions.

The participants hear the same questions in the same order. Interviews are the most appropriate when questions are set in a straight-forward manner (Kishita *et al*., 2018). The participant has the opportunity to respond informally in a direct way. The questions are asked according to an interview schedule that is prepared before the interviews are held. In some instances the questions could be set as open ended questions or closed questions and probes such as . “Explain your answer” might be used. ” Brink *et al*. (2014).

1.7.3 Small groups

Harris and Sherblom (2018) clarify a small group as a collection of at least three and usually less than 20 individuals of participants that share their experiences and engage in interactive communication. The characteristics of a small group could be discribed as an ongoing, continious modification of interdependant and interactive input from each participant. The group members share respect for each other. The small groups of participants discuss and explore information initiated by questions. It is described as a complex open system of communication to achieve success. Each group member take leadership. The groups in this study were small groups using semi –structured questions. In some cases there were only two to three participants attending the groups. To bring in semi-structured questions gives more value to the small groups.

1.7.4 Formative and Summative Assessment or Evaluation

Formative and summative assessments are assessment methods that evaluate learning in a particular course. They are methods to assess the knowledge that a student has gained from coursework being done during a particular time frame. Formative and summative assessments have different goals which must be achieved to evaluate students during a course (Broadbent *et al*., 2018; O'Dwyer, 2012).

- **Formative assessments**

The Oxford Living Dictionaries (2014) describe the word formative as "relating to a person's development". The goal of the formative evaluation is to test a low volume of the curriculum during the year in the form of class tests, submission of assignments or completing of portfolios of evidence (Broadbent *et al.,* 2018; O'Dwyer, 2012).

- **Summative assessments**

According to the Free Dictionary (2014), summative assessment means an assessment that has taken place at the end of a specific course and the marks that the student receives for this assessment determine if the student fails or passes. If the student passes it means that the student has reached the standard of that level and can proceed to the next level (Free dictionary, 2014). The summative assessments measure the success of the learning and teaching in the class as well as mastering the skills to function as an infection prevention and control practitioner (IPCP) in the clinical practice. Summative evaluations are conducted as a final examination at the end of the course. This evaluation can count a portion in the course (Broadbent *et al*., 2018; Helminen *et al*., 2016; O'Dwyer, 2012).

1.7.5 Infection Prevention and Control Practitioner (IPCP)

A nurse assigned to a position of a infection prevention and control practitioner should be a registered nurse who holds the qualification of IPC or works in the field of infection prevention and control. Their responsibility is to minimize the transfer or spread of infections in an organization. This person is usually found in healthcare facilities (HCF) (Alyahya *et al.,* 2018).

1.7.6 Item-writing Flaws (IWF)

Item-writing flaws' is a term used in the multiple choice question assessments method of evaluation. It describes the poor or incorrect manner in which the multiple choice questions were designed or formulated (Kurdi *et al.*, 2016).

1.7.7 Negative Marking

Mahjabeen (2017) and Bond *et al*. (2013) refers to negative marking as a method of setting tests and examinations to prevent guessing amongst students in multiple choice question examinations They may be considered by students as "unfair". A study published by Mahjabeen (2017) states that when using the method of negative marking, the benefits or detriments of guessing depend upon the severity of the penalty of an incorrect answer.

1.7.8 Scarce Skills

The Department of Labour refers to scarce and critical skills as "an absolute or relative demand, current or future, for skilled, qualified and experienced people to fill particular roles or professions, occupations or specialisations in the labour market" (Skills Development Act no.7, 2010).

"Scarce skills" are specialised skills that are required in a field of any profession, in this case, infection prevention and control nursing, but that are undersupplied. The lack of these skills is as a result of insufficient persons with the correct knowledge

and background in infection prevention and control when the demand for a particular profession is high. Although there are specialists in the field of Infection prevention and control, there are an insufficient number to meet the country's needs.

1.8 OVERVIEW OF RESEARCH METHODS

The overview of the research method identifies the type of research design selected and introduces the methods used. This study made use of a qualitative design using semi-structured interviews which took place in small groups in an attempt to gather in-depth information. This will be set out in chapter three.

1.9 DATA COLLECTION

Data collection is a term defined as a "systematic gathering of information relevant to the research purpose or specific objectives of the study" (Grove *et al.*; 2015:536). Data collection in this study was done using the focus group technique. Six groups of two to four participants each attended the group meetings. Three areas of interest were addressed including the compilation of the examination, the method of evaluating and their own experience of writing this examination. The participants' signed informed consent before the focus group proceeded. Participants were each allocated a number to use for communication during the group discussions. They were asked to share their perceptions of and preferences for examinations. The focus group discussions were conducted and lasted 30-40 minutes. The discussions were recorded with each participant using a number to maintain anonymity and confidentiality. These discussions were transcribed and analysed. An example of the open-ended questions that encouraged participation can be found in Appendix 6.

1.10 DATA ANALYSIS

Raw data was qualitatively analysed by making use of Clarke and Braun's (2013) thematic analysis explained in chapter 3 which consists of six steps including: familiarisation with data, coding the data by common elements, search for themes, reviewing themes and group the themes, defining and naming themes and writing up the research.

1.11 MEASURES OF TRUSTWORTHINESS

Trustworthiness of the qualitative information was explained by both Padilla-Diaz (2015) and Grassian and Lemire (2018) as four criteria for assessing trustworthiness. Credibility, dependability, confirmability and transferability were included in this study.

The credibility of the study was achieved through prolonged engagement until data saturation had been reached in each of the four interviews which took place. Dependability or evidence that is consistant was achieved by discussing the participants' concerns from most important to least important.

Confirmability included describing and transcribing the group discussions by using verbatim transcripts backed up by the audio material.

Transferability refers to whether the findings can be transferred to different settings. In spite of the small numbers the responses from the participants are considered a true reflection of this specific group of participants and could describe opinions of participants in a similar group.

1.12 ETHICAL CONSIDERATIONS

Approval to conduct the study was obtained from the following authorities:

- Nursing department peer review.
- Post Graduate Committee of the Faculty of Health Science of the University of the Witwatersrand.
- Ethical clearance was obtained from the University of the Witwatersrand Medical Human Research Science Ethics committee.
- Permission to conduct the study was obtained from the Infection Prevention and Control and Clinical Microbiology department of the School of Pathology to access the contact details of previous students to use the summative evaluations of years 2011-2016 for evaluation.
- Consent was obtained to participate in the study and to allow recording of the focus group activity.
- Participation was voluntary. Participants were briefed about the study and an information letter was sent to each participant by email. Participants were informed about their rights They could withdraw from the study at any time without being victimised or penalised. Written consent was provided to participate in the study and was obtained from all the participants.
- Confidentiality was maintained at all times as explained in the letter to each participant. Hard copies of all the data collected were locked in a safe place which has an electronic code. No names or any form of identification that could link with any of the focus group participants that was used and the results of the study were published anonymously in the research report. Participants participated on a voluntary basis and had the right to withdraw at any stage of the study without fear of prejudice.

1.13 OUTLINE OF CHAPTERS

There are five chapters in this research report.

Chapter one is a brief description of the progress this research project followed.

Chapter two is a broad literature review with all the essential evidence needed to complete the research project.

Chapter three is an outline of the research methods.

Chapter four contains the data analysis and findings.

Chapter five gives the discussion of the findings, the conclusion, the study's limitations and recommendations.

1.14 SUMMARY

This chapter provided the orientation as well as the introduction to the study. The importance of the study was explained as well as the problem statement, the purpose of the study and its objectives. Operational definitions were presented to ensure clarity towards terms used in this report. The following chapter will describe the literature review with a specific focus on perceptions and preferences of students towards computer-based multiple-choice questions.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

According to Brink *et al*. (2014: 54), a literature review is "a generated picture of what is known and not known about the research problem." Furthermore, Brink *et al.* (2014) describe that a literature review is an essential part of the research as it is needed to achieve a more comprehensive view of the theoretical background of what the researcher has decided to study. It is an inclusive review that covers relevant research and supporting documents in print.

This chapter covers a broad literature review. It includes readings on student evaluation approaches, common types of evaluation methods, negative marking, as well as student's perceptions and preferences towards the evaluation and writing of examination scripts including computer and non-computer based evaluations.

The purpose of examinations is well described by Glass and Sinha (2013) as a method to assess learning and retention of knowledge or a skill; therefore, any factor of a study task that influences long-term retention is clearly relevant. Testing is to communicate what you view as important. Tests are a motivator and students will learn what they believe you as the lecturer view as important and valuable. Assessments can also assist to overcome instruction gaps by encouraging students to read broadly and participate in educational opportunities that are available.

Tests have a powerful influence on student teaching and learning. Therefore, is it important to compile formative and summative evaluation scripts which meet curriculum goals Mahjabeen (2017) and Glass and Sinha (2013) state that relevant examination questions must be developed that test factual knowledge, a student's

cognitive ability, the ways students interpret problems and their ability to apply theory to practice.

2.2 LITERATURE REVIEW

2.2.1 Early Development of Training in IPC

- **International**

Hospitals are known as unsafe, dangerous places. Historically, as early as 1847, Ignaz Semmelweis worked in the Viennese maternity hospital and "proved that childbed fever was spread from person to person via the unclean hands of healthcare workers" (Dixon 2011: 58).

By the mid-twentieth century, in Europe, infection prevention and control expanded to include persons other than surgeons although the surgeons' contribution to the control of infectious disease remained important. The training of general practitioners, microbiologists, pathologists and infectious disease physicians, the epidemiology of infectious disease, as well as the control and prevention of hospital-acquired infection (HAI), was highlighted.

From the 1960s, more and more IPC efforts were established and subsequently provided effective implemental infection prevention and control programs. In-house IPC training programs were established and by the 1990s every hospital in the United States was engaged in an IPC program (Dixon, 2011; CDC, 2017). Training for infection prevention and control practitioners (IPCPs) often took place informally, during working hours, between colleagues in different hospitals or by taking short training courses. Most IPCPs received training at the CDC but some IPCP's were trained using the Train-the-Trainer approach (Swan and Mc Donald, 2018; Dixon, 2011).

In 1972, in the USA infection control practitioners formed a professional society, the Association of Practitioners in Infection Control (APIC). The APIC was created to provide education, knowledge and the sharing of infection prevention and control experiences with other IPC practitioners (Swan and Mc Donald, 2018; CDC, 2017; Dixon, 2011).

With strong scientific evidence supporting the value of IPC training programs, the Joint Commission on Accreditation of Hospitals mandated that all the USA hospitals should implement the CDC's IPC programs (Swan and McDonald, 2018; Dixon, 2011).

Infection prevention commenced initially without formal training. However, today globally there are several courses available to nurses wishing to become IPCP. Some of these are affiliated with public universities, colleges and hospitals and others are privately operated educational institutions or healthcare-related associations. The educational levels of IPCP courses vary from simply IPCP learning for personal growth to formal postgraduate degrees. The entrance and exit qualifications are country or region specific. Some of these courses are entirely electronically based (e-based) while others may combine both e-learning and evidence of practical application. The e-based IPC courses described by Swan and McDonald (2018), Klomsri and Tedre (2016) and Garland (2010) make use of one correct answer, multiple choice question (MCQ's) method of evaluation.

South Africa

In South Africa from as early as 2006 there were several IPC courses available that led to either certificate, diploma or a Master's degree. Some were offered by the private hospital sector whilst others were conducted by formal institutions such as the universities. The level of the courses was dependent on the entry level

qualification of the applicant, for example Enrolled nurses from three days to three months; registered nurses, six months. The evaluation method used was MCQ's as well as structured short questions.

Some of the South African universities engaged in IPC training. The University of the Western Cape which targets specific infection prevention and control practitioners (IPCP) offered a postgraduate diploma course. A Master's degree in IPC was also offered. Postgraduate diplomas in IPC and MSc's in Infection Prevention and Control were offered by the University of Stellenbosch.

The University of Pretoria offered an on-line two-year fellowship in IPC run by the University's Department of Internal Medicine. This course was open to anyone in the medical and allied fields and was supported by nurses, medical doctors or other healthcare practitioners who held a minimum of a diploma-level qualification. Further advancement to a Master's degree in IPC was possible through the University's Department of Public Health for those candidates who held higher degrees. The evaluation methods used to evaluate the students in that course was MCQ's.

The University of the Free State had a short course in Infection Prevention and Control which was offered for a few years.

The IPC course provided by the University of the Witwatersrand offered a short course an advanced diploma and Master's programme which was offered by the Nursing department. The certificate course made use of MCQ's as the evaluation.

2.2.2 Qualities and Competencies Required for an Infection Prevention and Control Practitioner (IPCP).

In a paper written by the Infection Control Nurses Association of South Africa (ICSSA) the key competencies of an IPC were identified as "practice within a

specific domain of interest for example infection control. Specific competencies required to work effectively within each domain and key criteria describes each competency and against which performance competence can be measured." ICSSA also describe, identify and define competencies for the IPCP and are considered extremely relevant to ensure quality service delivery. Competencies also provide a framework wherein an IPCP could be evaluated to determine their development within the IPC domain. The level of assessing specified competence is part of the evaluation of reasonably understanding infection prevention and control, critical thinking, reflecting upon specific situations and analysing circumstances to solve challenges professionally.

The National Department of Health developed the National Core Standards (NDoH, 2011) to ensure the same standard across all health care facilities in SA. They include as specialist knowledge, evidence-based practice, teaching and learning, management and leadership and clinical research. The national core standards are also part of the IPCP's basic competencies. There are seven domains. The "patients' rights" is included in the IPCP's first domain. The IPC must ensure the correct intervention so that the patient should not contract a health care associated infection. Domain two is IPC's part of clinical governance and clinical care, in other words for example the IPCP needs to oversee that the patient received the correct antibiotic as part of Antibiotic stewardship. Domain three focuses on clinical support services and the IPCP needs to be able to read and interpret the laboratory reports correctly. Domain four includes the public health sector and controlling the environment therefore needs to identify spaces or areas in the health care facilities which poses high risks. Domain five is leadership and governance. As part of IPC domain five need to incorporate a risk assessment to comply to these domains. Operational

management is domain six and here the IPCP needs to take responsibility of the wellness of the clients in a way that supplies chain management and procures personal protective equipment for the health care workers. The last domain, seven, focuses on the facilities and infrastructure. The IPCP's responsibility regarding domain seven is hygiene and cleanliness, waste management, linen and laundry as well as food services that form part of a health care facility.

The IPCP's responsibilities and competencies for overseeing the implementation of the IPC plan, training of healthcare workers (HCWs) and monitoring the impact of the preventative and control measures in place, in aspects such as surveillance of infections occurring in the facility and incidents or conditions that have the potential to cause infections, undertakes epidemiological investigations to determine the cause of the problem and recommends the necessary education or changes in protocols. It includes identifying and investigating clusters or outbreaks of infection. She needs to react effectively and promptly in isolation of sick clients. The IPCP needs to analyse procedure and device-associated infections and prevent further transmission of the infections. The IPCP needs to create evidence-based interventions to prevent facility-associated infections. They develop and maintain educational programs regarding infection control for all health care employees. Advice to senior leadership on issues related to reduction of infection risks and regulatory requirements are included in this portfolio. As an administrator she needs to initiate and maintain ongoing IPC programs and initiatives for continuous quality assessment, quality improvement and infection risk reduction (e.g. hand hygiene promotion and monitoring, cough etiquette). They are responsible for oversight of optimal supplies of hand hygiene equipment and personal protective equipment (PPE) as well as general supplies. Developing communication networks and liaising with community

resources, like the National Department of Health (NDoH) Tuberculosis (TB) clinics are included.

An IPCP is a person who functions-on the same level as a clinical nursing manager. Therefore, "specialist knowledge is necessary" according to Methar (2010, 15). The duties of an IPCP with regard to outbreaks include gathering surveillance data, investigation of potential outbreaks, identifying clinical links and seeking advice when necessary. In addition to these duties an IPCP is responsible for compiling policies relevant to infection prevention and various other responsibilities included in administration of a successful infection prevention programme.

With reference to the WHO (2009), the core components required by them for a IPC are similar to those described above.

2.2.3 Student Evaluation Approaches

An evaluation approach describes the timing, the methods and the type of examination paper that is to be written. There are a variety of approaches, described in literature and currently used to test student knowledge. In addition, there are particular terms used to describe approaches to testing methods. Assessments and evaluations are usually carried out during a particular time frame, such as weekly, mid-course and so forth. The terms 'assessment' and 'evaluation' are similar when speaking of assessing knowledge. The assessment plan and the purpose of the assessment determine which approach should be taken to assess the curriculum. Bruce *et al*. (2011) give an example to explain how it works. Bruce *et al*. (2011:305) describe the use of formative assessment as (an approach) "to give learner feedback (the purpose), you can do so either formally or informally (an approach) in either a patient care or classroom situation (a context)."

- **Formative evaluation approach**

Formative assessments aim to test the student's knowledge gained during the year. It assists students to identify which learning objectives and needs they are competent in and which require more attention. The students also identify objectives requiring revision and have an advantage to make an appointment with the lecturer to assist with identified areas of the curriculum that appear to be difficult to understand. Bruce *et al.* (2011) describe this as a learning process including a smaller volume work. It is a form of feedback from the students to the lecturer. Examples of formative evaluation are observations, conferences, questioning, drawing concept maps, reflections, in-class activities, student feedback, self-evaluations and self-assessments. The formative evaluations of the IPC course in this study were in the form of multiple choice questions with negative marking. Formative evaluations are not meant to be experienced in a negative way but the method used in the formative evaluation could be a challenge if the students participating in the course are not used to the method of evaluation. This has been highlighted by Broadbent *et al.* (2018) and O'Dwyer (2012).

- **Summative evaluation approach**

Summative evaluation approach takes place at the end of the year and could test the same content that was tested during the year. Summative evaluation could include advice, feedback and revision (Broadbent *et al*, 2018; Helmien *et al*., 2016; O'Dwyer, 2012). In this IPC course the summative evaluation is at the end of the year and it takes the form of a multiple question negative marking examination.

- **Integrated evaluation approach**

An Integrated evaluation approach describes evaluating teaching and learning as an approach to assess the achievements of learning outcomes. It serves to assess a

number of learning outcomes together by making use of a range of assessment evidence from different sources (Brink *et al.,* 2014). It is used in open based learning where the student integrates what is already learned knowledge and skills from other subjects and combines it with new learning material to achieve outcomes. If the student learning consists of an integrated approach, the assessing or evaluation of the student should also take an integrated approach. Therefore, teaching, learning and assessment activities should be developed as a coherent process. (SAQA, 2005). Bruce *et al.* (2011) argue that an integrated assessment is a portfolio of evidence where the student applies the knowledge gained in the course in the form of formative and summative evaluation. A Portfolio of evidence was not part of the evaluation process of the IPC course curriculum at the time of the study. This could be included in future. It will give them the opportunity to explain themselves, it will give them the opportunity to get used to terminology of the course and it will test insight of the students as well as application of theory to practice.

Glass and Sinha (2015) describe MCQ's as an evaluation method that makes use of an integrated approach. It gives the student the opportunity to use former knowledge and new information integrated with each other and then to apply it to answer MCQ's accordingly. These authors believe it is good practice to include mixed assessment methods to evaluate different aspects of a curriculum that includes different learning styles, preferences of students and that takes advantage of technology to design education framework. Different approaches include peer reviews, a portfolio of evidence and simulation assessments.

- **Continuous evaluation approach**

A continuous evaluation approach is a process of assessing that takes place continuously (Polit and Beck, 2017 and Bruce *et al*., 2011). The assessor must

evaluate the students' performance continuously by using various assessment methods and tools. During this process, the assessor counters the weakness of episodic assessments by sampling a range of students learning outputs. The advantage of continuous evaluation approach is that one poor evaluation will not influence the total score of the student significantly. These approaches to assessing take place in the course throughout a year of study.

If it is used in a clinical setting, then a continuous assessment approach could be an advantage to the student in practice because it is familiar to the student. Particular skills are chosen to represent overall nursing competence or ability. In this approach, unlike formative assessment, the coursework marks may be assigned to continuous assessment according to the assessment policies of the institutions. Continuous assessment is not part of the selected IPC course because there are not IPC practitioners in every health care facility that can facilitate the IPC student during training.

- **Episodic evaluation approach**

This assessment approach takes place at a specific time or occasion for example, during summative examinations. This approach is not used in higher education settings where there are large numbers of students. It needs intensive planning that gives the student the opportunity to prepare well for this assessment. Only small samples of students can be assessed and this evaluation method does not reflect a student's typical performance because it is only a once off evaluation of the students' knowledge. Testing does not include a large curriculum (Brink *et al.,* 2014). This approach could be used if the student was absent during evaluation periods and an oral evaluation method is used. This evaluation approach could not have been used in the study groups since the classes were too large. It can be used if there are a small

group of students that really struggle with the course work and need more intensive evaluation during the course.

- **Clinical evaluation approach**

Clinical evaluation approaches try to determine the student's progress towards clinical competence. A variety of competencies can be tested at various stages of any course. Passing tests can be certified as clinically competent if, for example, an expert nurse skilled in the medical procedure assesses a student and finds the student competent and skilled in that particular practice. This process is followed throughout the clinical course schedules (Bruce *et al*., 2011). This approach is generally used in evaluating nursing staff in practice and evaluates if the student is clinically competent in the field. During this study the IPC course did not include practical competency of the students. However, IPC is a clinical course and incorporating a clinical evaluation to the course might bring a more competency based approach. IPC students then learn to apply theoretical knowledge in the healthcare facilities.

2.2.4 Types of Evaluation Methods

There are several different methods of theoretical evaluation. They include multiple-choice questions (MCQ) (Byrd, 2018; Madwela *et al*., 2018; Khan and Aljarallah, 2011), short essay questions (SEQ) and modified essay questions (MEQ) (Sharma and Mutalik, 2014).

Evidence-based literature agrees that MCQ evaluation scripts are increasingly used as an assessment method to test theoretical knowledge of modules in large size classes. Khan and Aljarallah (2011:39) write, "a well-constructed MCQ is superior to MEQ in testing the higher cognitive levels of undergraduate medical students in a problem-based learning setup. If MCQ's are well constructed, they can evaluate

different abilities of students. But to construct good quality MCQ questions that not only tests factual recall, but cognitive thinking is not easy and takes time."

Several studies note that if MCQ's are not constructed well, the statement or question itself can offer cues that give the guessing student the opportunity to choose the correct answer (Kurdi *et al*., 2016; Khan and Aljarallah, 2011; Bond *et al*., 2013).

- **Multiple-Choice Questions (MCQ)**

Madwela *et al*. (2018) and Kurdi *et al*. (2016) explain what a multiple-choice question (MCQ) is and the complexities in setting MCQ's. An MCQ is an examination script consisting of a stem, a key and distracters. The question asked is called the stem, the correct answer is the key and the incorrect answers are the distracters. The examination scripts as found in the infection prevention and control course at the University have a stem and more than one key answer. According to (Kurdi *et al*. (2016), MCQ assessments with a high number of stems and options reduce the chances of a student of attaining a passing grade by purely guessing thus not proving competency. However, this increases the amount of work involved in constructing an MCQ test. One must also consider that if the number of stems is high, the time allocated for writing the test needs to increase.

MCQ's have advantages as well as disadvantages and are well described in the literature. Kurdi *et al*., 2016; Stanger-Hall, 2012; Delaram and Sharifi, 2017; Bond *et al*., 2013 discussed the main advantages of using an MCQ and states that the responses are easy to score and feedback to students is fast. Moreover, relatively low costs are incurred in devising them (Kurdi *et al*., 2016). Another advantage is that the marking is objective. Someone without knowledge of the subject examined can mark the tests or computers can be used to mark the examinations electronically (Kurdi *et al*., 2016). Furthermore, large areas of the syllabus can be covered; many

cognitive abilities can be tested. Additionally, a computer-programmed analysis of the test results is possible that can identify individual item difficulties and discriminations. Thus, high examination reliability is possible (Bauer *et al*., 2010; Garland, 2010). The department that offers the IPC used these advantages of MCQ's questions because they have an administrator who is responsible for marking and the students need to study all the information given to them because the tests cover the broad syllabus.

A further advantage of MCQ's was highlighted by Bond *et al.* (2013) The authors highlight an important advantage of MCQ's as it can assess student reading skills. If a question is misinterpreted in an MCQ, the losses in scores are minimal whereas if an essay question is misread by the student, a greater number of marks can be lost. Bond *et al*. (2013) assert that MCQ evaluations are reliable as they accurately assess objectivity, factual knowledge and produce, a high-level outcome overall. In her study Bond *et al.* (2013) made use of elimination testing that discriminates all levels of knowledge and improves critical thinking. The IPC course does include application questions as well as cognitive questions to test not only recall knowledge but also skills of the IPC students.

A disadvantage of MCQ's is described by Madwela et al. (2018) as poorly written questions that give the students cues to the answer. As identified in the literature, a major problem using MCQ's is Item-Writing Flaws (IWF). Item-writing flaws' is a term used in the multiple choice question assessments method of evaluation. It describes the poor or incorrect manner in which the multiple choice questions were designed or formulated (Delaram and Sharifi, 2017; Stanger-Hall, 2012). Glass and Sinha (2015) are one of the several writers that illustrate the different IWF in developing MCQ examination scripts. Before examinations were given to students,

the examination went through a process of evaluation to confirm that the questions that were asked not include IWF's.

In writing the general guidelines for MCQ's, Glass and Sinha (2015) point out the need to ensure the item can be answered without looking at the options and that the options are 100% true or false. As much information as possible concerning the item should be included in the stem. The stems should be long and the options short. Furthermore, the authors note that those persons who set examinations should avoid superfluous information, difficult and overly complex items, write options that are grammatically consistent and logically compatible and avoid absolutes such as always and never.

Both Stanger-Hall (2012) and Kurdi *et al.* (2016) address the problem of IWF and discuss how such flaws can have an impact on students' performance in MCQ examinations. Item-writing flaws can make questions either easier or harder to answer if the candidate does not understand what is asked in the question. In the health-science disciplines, health professionals need to have the requisite scientific background knowledge necessary to make important decisions about human life. If the quality of the MCQ's is written at a low cognitive level, it can have a major impact on healthcare decisions. If IWFs are limited (or ideally negated) from use in MCQ examinations, then the possibility of increasing a student's score arises. If an examinations script is not properly set, then the student may be disadvantaged as her knowledge is not correctly evaluated.

Some other disadvantages of using MCQ's were identified by Bond *et al*., 2013 and Bauer *et.al*., 2010. These authors both assert that to design a good MCQ question is very difficult and time-consuming and not everyone can develop them without the increased risk of encouraging guessing by the students. Bauer *et.al*. (2011) confirms

that MCQ's could easily be abused by means of guessing. He contrasts MCQ's with essay-based questions noting that in essays, providing a correct answer is not easy without knowledge of the subject matter but with an MCQ, without the knowledge of the subject, leading questions can result in successfully guessing the correct answer. Furthermore, negative marking could eliminate the possibility of guessing answers meaning the student needs to know his or her work by heart (Mahjabeen, 2017).

There are different approaches to the evaluation of MCQ's. Some writers take a recall and application approach (Garland, 2010) and others use Bloom's Taxonomy (Swart, 2010) as a starting point to evaluate an MCQ to determine if it is a well set question or not. Glass and Sinha (2015) showed how MCQ's could be evaluated to make sure it tests recall knowledge or application and if the thinking skills of the student could be evaluated. Furthermore, Glass and Sinha (2015) gave an explanation that where MCQ's were evaluated as low cognitive questions as recall questions. The higher cognitive questions were referred to application and diagnosis; interpretation questions and problem-solving questions. The meaning recall questions are also explained by Glass and Sinha (2015) as those which assess examinee knowledge of definitions or isolation facts. Interpretation questions require examinees to review some information from and reach some conclusions (e.g. diagnosis). Problem-solving questions present a situation and require examinees to take action (e.g. the next step in patient management). In conclusion, to apply the cognitive process to MCQ's is very difficult and not frequently used. In addition to this classification framework Glass and Sinha (2015) note that application of knowledge or recall of questions requires an examinee to reach a conclusion. If a

student needs to make a prediction or select a course of action, it is classified as an application of knowledge.

Verenna *et al.* (2018) use Blooms Taxonomy as a starting point to evaluate MCQ examination questions to establish the cognitive level of every question. Blooms Taxonomy was not initially intended to be used for the evaluation of examination scripts. However, it was found easy to apply to classroom assessments. Verenna *et al.* (2018) explained that Blooms Taxonomy was already in used from 1956 identifies six domains or levels that can be used as assessment criteria to evaluate the cognitive level of an evaluation question. A modified version of this taxonomy is regularly used in nursing education. The examiners could include Blooms Taxonomy in the process to evaluate every question being asked in the examination to decrease IWF's and address different levels of cognitive evaluations in the examination. It can enhance competency and critical thinking of the IPC students in the practical environment.

To study science requires critical thinking and students need to apply their knowledge to practice. Many of the higher education examination scripts make use of MCQ examination methods, especially in science classes. A study done by Stanger-Hall (2012) discussed a constructed-response (CR) method of evaluation and contrasted this evaluation method to that of an MCQ. CR is a type of open – ended essay question that demonstrates cognitive knowledge and reasoning. That means the candidate needs to create a response and include short questions. The purpose was to determine which one of the methods best evaluate critical thinking in students taking science and what, if any, might be the influence of gender bias in these two methods. The outcome was that an MCQ, in combination with the CR evaluation method, show more critical thinking amongst the participants and

increased the scores of the science students. There was also less gender bias found in the CR evaluation method than was found in the MCQ exam evaluations. Verenna *et al.* (2018) favoured MCQ's as a substitute for CR because according to his information educational testing claimed that MCQ's and CR questions provide essentially the same information. Therefore, according to him MCQ's could have been used as a substitute for CR evaluation. Stanger-Hall (2012; 294) recommended that "introducing CR questions encouraged students to learn more and become better critical thinkers and it reduced gender bias. However, student's resistance increased as students adjusted their perceptions of their own critical-thinking abilities."

Evidence supports the view that students with strong factual recall score better in MCQ's than do students who can apply their knowledge in an analytic and organized way. In another perspective, developing modified essay questions for assessing cognitive skills of students is not a simple task and is more frequently associated with writing flaws. In other words, there is no one ideal evaluation method as an assessment process and so too, MCQ and essay type of testing both have advantages and disadvantages.

- **Short Essay Questions (SEQs)**

Short essay questions (SEQs) are designed to assess a student's background knowledge and the way in which a student applies this knowledge obtained from required readings in not more than ten pages (Sharma and Mutalik,2014). This assessment method often takes the format of typed and double-spaced essay answers prepared outside of the classroom. It evaluates a student's ability to condense a large amount of curricula in a few pages testing the cognitive and critical thinking levels. A common example of using SEQs in the field of education is through written

assignments. Most SEQs have a prescribed flow, e.g. an introduction, body and conclusion and references are often required.

Sharma and Mutalik (2014) and Melovitz Vasan *et al.* (2017) compared MCQ's and structured SEQs. They found that students with a strong factual recall capacity score better in MCQ's than they did on SEQs. However, the SEQs examinations show more intellectual ability is required to analyse, organize and apply knowledge. The above study also found a correlation between MCQ and SEQ examination questions. If students perform well in MCQ's, they will perform equally well in the SEQ method. Short essay questions could be used in the IPC course in a portfolio of evidence that also count towards the year mark. It will give students who are not good in answering MCQ's a chance and students who cannot explain themselves in long essay questions. It will give a broader group of students the chance of achieving competency.

- **Long Essay or Modified Essay Questions (MEQ)**

Sharma and Mutalik (2014) suggest that modified essay questions (MEQ) in the literature consist of questions that focus on practical situations or typically problems that occur in the nursing environment. They often describe a question in the format of scenario or case study. The content of the questions may vary from common clinical situations or conflict situations that impact on the work environment. Sharma and Mutalik (2014:1195) stated "the goal of these questions is to assess the candidate's ability to identify the problem, prioritize the problems or non-compliance from the most important to the lest important, solve the problem logically by applying the theoretical background and practical skills and provide relevant applicable recommendations to resolve the case successfully." In the study conducted by Sharma and Mutalik (2014) there was a strong correlation between

structured essay questions (SEQ) and MEQ. Sharma and Mutalik (2014:1196) "found that the top scoring students as well as the lower scoring students both struggle to solve MCQ's." Many academic departments moved towards MCQ's as a sole evaluation method. There are however many ways that preferences of the IPC students can be met by using long essay or modified essay questions and assignments. An assignment could give the students the opportunity to explain themselves in more detail.

2.2.5 Negative Marking

Bond *et al*. (2013: 1) explain the types of negative marking and what the reasons are to choose MCQ's as evaluation methods. In an MCQ examination, each question corresponds to a mark or point. "N-type multiple choice questions indicate the use of negative marking. The rationale behind using this system is that it minimises the risk of guessing and leading questions during formative and summative evaluations. N-type MCQ scoring briefly works implies that each MCQ question 's value is 1 point per question. For every correct answer, a student receives plus one (+1) point. In negative marking, a point is deducted for every incorrect answer as minus one (-1) point."

Bond *et al*. (2013:1) refers to "negative marking as a method of setting tests and exams to prevent guessing amongst students in multiple-choice question examinations and may be considered by students as unfair." Bond *et al*. (2013) show an analysis of the negative marking method asserting that the benefits or detriments of guessing depend upon the severity of the penalty of an incorrect answer the penalty relative to the level of reward (-2 or +2) for a correct answer and depending on the number options from which the students must choose. From this analysis, it

is possible to calibrate the marking scheme and establish fair penalties. These results of Bond *et al* (2013) were similar to a study by Byrd (2018).

Bond *et al.* (2013) went on to describe the different evaluation options that serve as alternatives to using MCQ's as elimination testing (ET). Elimination testing discriminates at all levels of knowledge and improves critical thinking. Another option is the single answer SA evaluation method where a student needs to choose one correct answer in which the partial knowledge is not evaluated. If all the correct answers are removed in ET, then a full understanding has been shown. Partial knowledge is shown by the removal of a subset of the incorrect answers that reveal partial misinformation. Full misinformation is the result of the elimination of the correct answer only. Not answering a question or removal of all options, showed no knowledge towards the content of work indicated by the question asked. The study carried out by Bond *et al.* (2013:10) concludes results such as "life science students who significantly advantaged by answering the MCQ test evaluation format compared to single answer format under negative marking conditions by rewarding partial knowledge of topics." Surveys showed that students generally preferred ET-style MCQ testing over SA-style testing. Students reported feeling more relaxed taking ET-style MCQ testing and more stressed when sitting SA tests while disagreeing with being distracted by thinking about best tactics for scoring high marks. This study showed that students agreed that ET testing increased their critical thinking skills and concluded by recommending that MCQ type of tests need to be carefully chosen.

In summary the main purpose of using MCQ's with negative marking is to prevent guessing and test critical thinking skills and application skills of the student. In the IPC course it is not necessary to completely discard MCQ's questions but they could

be used in combination with other methods of testing knowledge. This would give an equal opportunity to a broader audience and make examinations more balanced and fair for the majority of students.

2.2.6 Computer-Based Versus Non- Computer-based questions

Computer-Based Multiple-Choice Question (CBMCQ) types of evaluations use only one correct answer when marking an examination script. This question paper is designed on the computer and marked on the computer. It consists of a bank of pre-developed questions and question papers are set accordingly. Komsri and Tedre (2016) and Garland (2010) both studied computer systems organisation where the first-year computer science undergraduate students were evaluated by MCQ and at the end of the year, mixed method examination scripts comprised of MCQ's and essay questions were used. In this study, the formative evaluation method was used as a 'shock and awe' tactic to encourage students to study, but at the end of the year, the MCQ negative marking examinations scripts were changed to multi-methods to give struggling students a chance to obtain a pass mark.

When considering computer based evaluation, are there more advantages than disadvantages and it is possible to use computer based evaluation in the nursing environment according to the authors (Atreja *et al*., 2008). Technology is part of the future and many students are used to using computer-based methods when writing examinations. Retaining some computer-based questions offers familiar options for many students.

2.2.7 Student preferences and perceptions towards evaluation methods

- **Preferences**

The Free Dictionary (2014) defines "preference" as "the right or chance to make a choice". In the literature, Van de Watering *et al.* (2008) discuss their findings

concerning the assessment of student preferences, their perceptions of assessment and their relationships to study patterns when using a variety of assessment types. When participating in a new learning environment, students prefer a variety of evaluation methods such as multiple-choice questions (MCQ), short essay questions (SEQ) and modified essay questions (MEQ) as different types of evaluation rather than one examination method. Furthermore, Van de Watering *et al*. (2008) referred to several interesting studies done with outcomes related to study method scores. For example, students with in-depth study methods preferred writing essay type of examination scripts. On the other hand, students with surface study learning methods preferred to write MCQ examination. This was first noted by Birenhaum and Feldman (1998) then revisited and confirmed Mingo *et al.* (2018). Mingo *et al.* (2018) also discussed MCQ's as an evaluation method which focus more on cognitive level evaluation.

It is an on-going debate that different methods of evaluation encourage either deep or surface learning in students (Mingo *et al*., 2018). In a review done by Mingo *et al.* (2018) it was suggested that students who tend to have good learning skills have a high confidence during their academic study and prefer MEQ type of evaluations. On the contrary, students with poor learning ability and skills have low confidence in their academic performance and prefer the constructed- response method of evaluation (CR). The reason could be found in the available results of the review that indicated low test anxiety measures when writing essay format evaluations. Students with a high test anxiety prefer to write a choice-response type of evaluations. Mingo *et al.* (2018) stated that students used a surface approach of learning prefer to answer MCQ evaluations.

Another interesting characteristic that Van de Watering *et al.* (2008) referred to was related to personal characteristics such as anxiety which can lead to specific attitudes towards different assessment methods. This was also mentioned by Alenezi (2018). In that article, Alenenezi (2018) agrees with Mingo *et al.* (2018) and describes students with high anxiety as preferring examination papers such as MCQ and the students with low anxiety levels preferring essay type of open-ended questions. If it is a few aspects that must be tested with a more in-depth and focused curriculum the preferred methods of evaluation required is an essay or open-ended examination.

Van de Watering *et al*. (2008) conclude in their discussion that if students receive the type of examination questions in the method of evaluation they prefer, it would not necessarily increase the marks of the students. Thus it is not necessarily the case that if you received an examination question in your preferred method, that you would score better in that examination. In most cases, the students have not had a choice of evaluation method.

Mingo *et al*. (2018) found that students with a combination of proficiency and self-assurance in their ability to perform well in examinations experience a more positive attitude towards writing essay type examinations than multiple-choice question examinations. This is compared to students with a combination of low proficiency and low self-assurance in their ability to perform as they prefer the constructive-response method of examinations. Alenezi (2018) states that there is a strong relationship between a student's perception of examination methods and their approaches to learning.

The only dimension in which students preferred essay examinations was for presenting their knowledge in subject matter tests.

Considering the authors mentioned above, in summary MCQ examinations are preferred by students over essay type of examinations but learning approaches need to be taken into consideration as well as the emotional experience of students. When deciding on an evaluation method that factors could influence the scores of the students.

- **Perceptions**

In their article, Van de Watering *et al.* (2008:648) define perception as "the students' act of perceiving the assessment in the course under investigation." From the Latin *perception* or *percipio,* the meaning of the word perception (Oxford English Dictionaries: 2016) is "the action of taking possession, apprehension with the mind or senses." Perception involves recognising and interpreting sensory information. Perception also includes how we respond to the information we receive. It is a process in which sensory information from our environment is drawn and how that information is used to interact with our environment. Perception allows us to take sensory information in and make it into something meaningful. The human body organises and shapes stimuli by learning and noticing our environments. Over time, a memory forms and a person's expectation of what is going to happen in the next situation is generally anticipated.

In the context of Van de Watering's study (2008:648) "no correlation was found between the perceptions of multiple choice questions and resulting grades."

Malovitz *et al*. (2017) compare the perception of students regarding assessment, with the way in which the students understand learning and studying. These authors state that perception determines the way in which they answer assignments and other methods of evaluation. Malovitz *et al.* (2017) furthermore focus on to two learning approaches in their study that were identified by students when they were asked

about their perception of learning for examinations. The two learning approaches that were identified were surface and deep learning approaches. Surface learning can be defined as completing the module with relatively little personal involvement and experiencing the work to be of little consequence. This feeling is said to be associated with rote memorization of the learning module and routine problem-solving. Deep approaches are defined as understanding the work context and actively applying the content in practical situations as well as analysing if and how the application was effective and worthwhile. According to Melovitz Vasan *et al*. (2017) students believe that their better performance in tests are due to changes from the simple memorization (superficial learning) for cued responses to conceptual understanding (deeper learning) that require more constructed responses. This was also a response posed by the participants in the semi-structured interviews during data collection in this study. Students that study the IPC course need to know from the start of the course that they should not use superficial learning approaches to study, but rather to use in-depth methods if they wish to achieve competency.

2.3 SUMMARY

In this chapter, a broad literature review was done to ensure a clear background on the concepts used to ground this study. Headings that were included were history of infection prevention and control (IPC), qualities and competencies required for and IPC practitioner, student evaluation approaches, types of evaluation methods, negative marking, evaluation via computer based approach and student perceptions and preferences towards evaluation types.

In Chapter three, there is a greater focus on the research design and the components that describe the research design, such as the population studied and other components.

CHAPTER THREE

RESEARCH METHOD

3.1 INTRODUCTION

In the previous chapter, a review of the literature was presented. In this chapter the research methods will be described. This includes the research design, study population, study sample, data collection as well as the semi-structured interviews, measures to ensure trustworthiness, ethical considerations and the analysis of data.

3.2 PURPOSE AND OBJECTIVES

The purpose of the study is to explore the perceptions and preferences of students following the qualification in infection prevention and control with regards to the examination methods.

The objectives of the study were:

- To explore the preferences of IPC students of assessment methods used in the IPC course.
- To explore the perception of the IPC students of the computer based MCQ method of assement used in the IPC course.

3.3 RESEARCH DESIGN

An overview of the research design and methods used will be discussed. According to Maree (2016), a research design is an organised plan from the researcher that is systematic, scientific and that discusses all parts of a study in a logical way to solve the research problem.

The overview of the research method identifies the type of research design selected and introduces the methods used. This study made use of a descriptive, exploratory and qualitative design that included semi-structured interviews in an attempt to gather in-depth information which was analysed by the thematically data analysis as described by Clarke and Braun (2013).

3.3.1 Qualitative Research

Qualitative research, according to Grove *et al*. (2015) has been used broadly in nursing education and can be applied to a variety of data. Various in-depth interpretations can be made. It allows the researcher to start with a broad approach and provides the opportunity to attach meaning to unsolved issues, develops the use of concepts and interprets these concepts.

According to Grove *et al*., 2015 and Polit and Beck (2017) a feature of qualitative research is an attempt to understand the phenomenon and does not focus on specific parts of the phenomenon, it focuses on the participants' important interpretations of an event or the participants' circumstances and not on the researcher's view of the situation. More features are described where information is collected without any structured instrument or questionnaire. It captures the context of the situation and when this study method is analysed it narrows information in an organised but intuitive way. This method of research design involves sustained interaction with the people being studied in the understandable language for all parties taking part in the research. In this study, the small group discussions were held in English. Although English was not the home language of most of the participants, it was the language in which they studied and all of the participants had an understanding of English. Because qualitative research allows for in-depth questioning and further probing, it

was felt that this was the method of choice to interrogate the perceptions and preferences of the participants.

3.3.2 Exploratory

According to Doody *et al.* (2013), exploratory research is discussed not only as what the participants say but as a broader and deeper focus on what the participants mean in their reply, the language the participants use and different forms of communication that people use every day when interacting. This would include jokes, anecdotes, teasing and arguing. It focuses on the intensity of the feeling of the participants such as anger, positive or optimistic feelings or negativity towards the topic of discussion. The exploratory approach gives the researcher the opportunity of an in-depth investigation of the participants' perception of the compilation of the examination and their experience towards multiple question evaluations. The use of small groups in this study created a non-threatening intimate space where participants could express honest opinions without the fear of appearing to complain of being labelled whistle blowers. In this study, it was important to be aware of feelings during the discussions that might address their experiences and preferences of multiple-choice question examinations and give a more in-depth meaning towards what the participants felt while writing multiple-choice questions.

3.3.3 Descriptive Design

The use of descriptive design is discussed by Grove *et al*. (2015:256) as a research tool used for "studies where more information is required in a particular field through the provision of a picture of a phenomenon as it occurs naturally. These designs describe the variables in order to answer the research question and there is no intention of establishing a cause-effect relationship." Brink *et al*. (2014), Grove *et al*. (2015) and Maguire and Delahunt (2017) discussed that a descriptive research

designs may be used to identify challenges within the present practice, justify it and make judgments or determine what other professionals in similar situations are doing. Descriptive research designs are also used to develop theories and as gathering of information from a representative sample of the population. Brink *et al*. (2014:113) state the collection of data in descriptive studies can be set as "structured observation, structured questionnaires and interviews or survey studies".

In this study, information regarding preferences and perceptions of the evaluation method is required from participants who were registered for the Infection Prevention and Control (IPC) course. Those who had completed the summative evaluation of the IPC course were included in the research sample to participate in the semi-structured small group interviews. This information from these interviews was necessary to answer the research question what are the IPC students' assessment preferences and what are their perceptions of computer-based multiple-choice question examinations?

3.3.4 Context

Research context refers to the specific circumstances surrounding the event being researched (Rule and John, 2015).

The event in this study is a one year course on Infection Prevention and Control that has been offered at a higher learning institution for the last ten years. Attendance of all course components was compulsory. Each module test consisted of multiple-choice questions as the assessment method. This method was also used for the summative evaluation in spite of a poor pass rate year after year.

The perception and preferences of the students attending this course from 2011 to 2016 were studied to establish their perceptions and preferences around the examination method used.

The method included semi-structured interviews which took place in small groups. Participants were selected from the students who studied at a selected university from 2011 to 2016. All students in the given time frame were invited to a discussion of open-ended questions regarding the compiling, evaluating and writing of computer-based multiple questions.

3.4 RESEARCH METHODS

A research method is a technique used by researchers to structure, gather and analyse information pertaining to research questions. In this study, it includes a census sample of the population, data collection and data analysis.

3.4.1 Population

Population is defined by Burns *et al.* (2011: 250) as a "particular group of individuals or elements, such as people with type-two diabetes, who are the focus of the research. The target population is the entire set of individuals or elements who meet the sampling criteria, such as female, 18 years of age or older, new diagnosis of type two diabetes confirmed by the medical record".

The population in this study consisted of all students registered on the IPC course who took part in the MCQ examinations at the selected university facility from 2011-2016.

3.4.2 Sample and Sampling

The sample in research is a group of people, objects or items that are taken from a larger population to participate in the research project that is chosen. There are different ways in which a sample is selected and the term for that process is sampling. Brink *et al.* (2014: 132) define sampling as a "comprehensive list of sampling elements in the target population". Brink *et al*. (2014:132) also explained census

sampling as “an accidental or availability sampling and includes the choice of readily available participants or objects for the study”. The purpose of sampling is to determine parameters and opinions of the participants that reflect the characteristics of the population.

Census sampling was applied. All students from 2011-2016 who completed the IPC course at this university using the multiple-choice question method of examination were invited to participate. Invitations were sent making use of email databases provided by the Department of Infectious Diseases of the selected university. This selected group was chosen for the study because they completed their final examination using only multiple-choice questions. After this date, the IPCP students wrote summative evaluations where multi-methods were used. The participants were asked to confirm if they would be able to participate in the small group interviews (Table 3.1). Many students come to take this course from all over South Africa and it was recognised that they may not be able to return to participate in this research study.

3.4.3 Setting and site

This study was carried out at one of the univerities that offered the course. The semi-structured interviews were conducted in different venues which were convenient to participants since the participants were distributed over a large geographical area. This included a coffee shop in a city , the selected university, the infection prevention and control department of an academic Hospital and the Head Office of an Emergency Services group. The small group discussions were recorded. In order to increase participation teleconference and Skype ® facilities were used

3.4.4 Small groups

Originally a focus group was considered for this study because it gives the selected group of participants the opportunity to provide individual responses to questions posed by the researcher and then debate the options. Once the responses were received it became evident that the participants that were attending the groups were not sufficient to form focus groups and it was changed to small groups.

3.4.5 Semi-structured interviews

According to Van Teijlingen (2014), Brink et al. (2014) and Polit and Beck (2018) semi-structured interviews make use of predetermined questions that need to be asked. They can be modified based upon the interviewer's perception of what seems most appropriate to response by probes. Question wording can be changed and explanations given, inappropriate questions for a particular interviewee can be omitted, or additional ones included. The purpose of a -semi-structured interviews is a face-to-face interaction exploring attitudes, values, beliefs and motives. This method offers insight into behaviour perceptions and the preferences of the participants attending the interviews. It is an in-depth approach to study the feelings of the participants and is a link between what the participants say during the interview and what happened during the IPC course. The semi-structured interviews capture the ways in which the participants interpret events and experiences during the IPC course. Semi- structured qualitative research interviews seek to cover both factual meaningful as well as feelings of the particular experiences. Semi-structured interviews could take the form of face-to-face interviews, telephonically interviews or electronic interviews such as skype.

During the study, it was difficult to get hold of participants to participate in the semi-structured interviews. Reasons given by participants were that they were not allowed

by their employer to take off to participate in the study. If they really wanted to take part in the study they needed to take leave. The students who attended the IPC course were demographically spread over the country and transport was a challenge from the different provinces. Data collection was changed from focus groups to small groups.

Table 3.1: Availability of the Respondents.

GROUP NUMBER	PARTICIPANTS' ATTENDING THE GROUP	TOTAL INVITATIONS TO THE GROUP
1	3	5
2	2	10
3	2	14
4	4	15
5	2	28
6	2	20
Total	15	92

The participants were geographically wide-spread and were employed full time. This made it difficult to meet the participant numbers set out in the proposal resulting in the groups became smaller in number. The students who were available to participate were grouped according to geographical location forming small groups. Open-ended questions were used as the researcher had no preconceived views of the information that was offered. It was anticipated that some of the students might no longer be available thus influencing the sample. Saturation was reached after six groups of two

to four participants were conducted. Fifteen participants attended to group discussions.

3.5 DATA COLLECTION

Data collection according to Grove *et al*. (2015:536) is a "systematic gathering of information relevant to the research purpose or specific objectives of the study".

In the study data collection was done using semi-structured interviews which took place in small groups. Semi structured interviews explored the participant preferences of the evaluations and perceptions of the MCQ type of examinations undertaken. After receiving approval from the institution and appropriate committees (Appendices 1) data were collected from the participants. The data collection plan for this study included planning and conducting interviews, analysing the recordings and reviewing recordings.

3.5.1 Planning the interviews

Doody *et al*. (2013) explained that to plan and organise a group, one needs to reflect on the purpose of the study as good preparation is required before conducting the group discussions.

Discussions were arranged and semi-structured interviews were conducted in small groups. The groups were divided according to the geographic area in which the participants resided or worked.

Before invitations were sent out to the participants, consent from the Head of the Clinical Microbiology Department for access to the database was obtained. Recruitment of the participants for each group was coordinated by the researcher. All of the students who completed the IPC course from 2011-2016 were invited via email to participate in the study.

Attached to the invitation was a letter of consent to take part in the study and consent for recording the meeting.

3.5.2 Conducting the interviews

Between December 2016 and March 2017, fifteen participants took part in six small group interviews. The group discussions were opened with a welcome and an introduction. Each meeting started with the researcher reading the letter of information to ensure that the participants fully understood the purpose of the group. Permission was obtained from all participants for audio recording of the meeting. (Appendices 3-5). The semi-structured questions approved by the ethics committee were put to the groups. Additional probes were used to obtain clarification and greater depth when necessary. Group discussions averaged between 30-45 minutes in time. The questions asked to participants in each group were:

1. What did you feel about the system of examining students using computer based MCQ's?
2. What alternative approaches to assessment would you have preferred?
3. What type of assessment do you think might have improved your marks?

The development of the probe questions was an iterative process between the researcher and her supervisor that included on-going literature review and brainstorming. The probes were designed to clarify the experiences and preferences of the participants who had already performed a summative evaluation.

All interviews were held at sites familiar to participants during the day. Each group was led by the researcher.

Following the introduction, the discussions were recorded with each participant using a number to maintain anonymity and confidentiality as far as possible. The discussions continued with questions about perception and preferences concerning

evaluations and the MCQ method. The participants had the opportunity to explain their preferences and perceptions of the examination and to offer recommendations about writing and preparing for these examinations. Probes were used to obtain greater in-depth understanding of the information. During these interviews, field notes were written for use during analysis.

3.6 DATA ANALYSIS

Brink *et al.* (2012:172) define data analysis "as a scientific and systematic way of organising, categorising, ordering, manipulating, interpreting, summarising, reporting and describing collected data into a meaningful structural form for an easy discussion of research data." The data varies with the method of research data collection. In qualitative research, it is important to be open and non-judgemental about the experience of the participants' thus allowing an unbiased interpretation.

3.6.1 Approach to Analysis

In this study data analysis was done concurrently with the data collection and involved creative conceptual identification, organising, reporting and description of the themes brought about by the collected raw data (Clarke and Braun, 2013; Maguire and Delahunt, 2017). Raw data from the semi-structured interviews were analysed by making use of Clarke and Braun's (2013) thematic analysis methods which consist of six steps including:

Table 3.2 Clarke and Braun (2013) six-step framework for doing a thematic analysis.

STEP	EXPLANATION OF THE STEP FROM BRAUN AND CLARKE (2013)
Step 1: Become familiar with data	The researcher needs to familiarise him or herself with the data collected. The data needs to be read and listened to. The audio records give a broader picture of the information
Step 2: Generate initial codes	Coding is an analytic process to refine data in a systematic manner by labelling important features of relevant data. This process uses the broad research question as a guide to analysis.
Step 3: Search for themes	A theme is a pattern that relate to the research question. Codes form the basis and themes are built from the codes. By grouping the codes, themes are formed that give meaning to the collected data. This step ends by collating the relevant codes into themes.
Step 4: Review themes	The themes need to reflect a relevant story from the full data. Refining of the themes may result in combining themes

	together or discarding a theme if it does not define the nature of the data.
Step 5: Define themes and sub-themes	The researcher needs to evaluate the importance and necessity of each theme by asking questions. They need to identify the role and the story that every theme is telling.
Step 6: Write up	Writing up involves putting together the data with narratives that tell the story and compare it with existing literature.

Step 1: Familiarisation with data

The researcher familiarised herself with the content of the transcription data by listening many times to the audio material collected during the data collection. Transcription of the complete text was done by the researcher and validated by re-reading the transcription whilst listening to the recording. Following this, the transcribed data was read a number of times and the meanings were identified, understood and organised. The researcher needs to be familiar with the data before continuing with the analysis. Maguire and Delahunt (2017) discuss that during familiarising yourself with the transcription, it is useful to make notes from the transcriptions.

Step 2: Generate initial codes

In qualitative research this is the step where the data is organised in a systematic way. Coding reduces data from large parts to smaller meaningful parts of transcriptions. Coding can take place in different ways and will be determined by the

research questions. Passages of text that were linked by similar or common thoughts and ideas were grouped into categories that would become the basis of the themes. This study's research questions were; what method of assessment do the IPC students prefer and what are their perceptions of computer based multiple choice questions?

The researcher identified and grouped the like statements and recurrent issues in each of the transcripts and codes were allocated. Codes were compared and discussed before moving to the next step of data analysis.

Table: 3.3 Examples of coding transcripts according to the research question

RESEARCH QUESTION	EXAMPLES OF CODING
Preferred methods of assessment by the IPC students	• Assignments. • Portfolio of evidence
Perceptions of computer based multiple questions?	• negative marking unfair, • don't understand the questions

Step 3: Search for common themes

Themes are recurrent issues that form a pattern that captures something significant or interesting in data collected. As Clark and Braun (2013) and Maguire and Delahunt (2017) explained there are no hard and fast rules about what make a theme. A theme needs to be significant. Significance is the character of a theme. If there is a small data set, there may be overlapping between coding and identifying pre-limiting themes.

In this study the codes were examined and themes extracted. Several codes were identified that related to the research questions regarding the preferred methods of assessment as well as the perceptions of computer based multiple choice questions.

At the end of this step the codes were organised into themes that spoke to the research question.

Table 3.4 Example of the development of a theme identified from the coding

Theme:	Sub-theme:	Code:
Alternative evaluation approaches	Multi-method evaluation	Essays and assignments

Step 4: Reviewing the themes

Reviewing of themes in step four refers to reviewing, modifying and developing the themes that were identified from the codes. Clarke and Braun, (2013) and Maguire and Delahunt, (2017) suggest asking the question: Do the themes make sense?

Data associated with each theme was read and its support for each theme was considered. The next step was to decide whether the themes applied to the context of the data. According to Maguire and Delahunt (2017; 3358) "themes should be coherent and they should be distinct from each other."

Maguire and Delahunt (2017;3358) also asked the following useful questions to evaluate that the chosen themes are correct.

- "Do the themes make sense?"
- "Does the data support the themes?"
- "Am I trying to fit too much in the theme?"
- "If these themes overlap, are they really separate themes?"
- Are there other themes with this data?"

Once this step was completed three themes emerged and were deemed to represent the data. Peer review was sought and consensus was achieved.

Step 5: Defining themes

This step involves on-going analysis to refine the distinctive features of each theme and the overall story each theme tells. These themes were related back to the objectives of the study as well as the research question. A detailed analysis of each theme was written down. Questions identified by Clark and Braun (2013:10) such as "what story does this theme tell?" and "How does this theme fit into the overall story about the data?" were asked while defining and naming themes. The importance of each theme was identified and an informative name for each theme was compiled.

Step 6: Writing up the report

The full data set was compiled where the themes and sub-themes were put together to form a flow or a sequence of data analysis of the project. Codes, sub-themes and themes were presented to the supervisor of the study and peers to confirm the accuracy and make modifications. The final step in the process was writing up of all the themes and sub-themes obtained from the interviews regarding the preferences and perceptions of the examinations put forward by the participants.

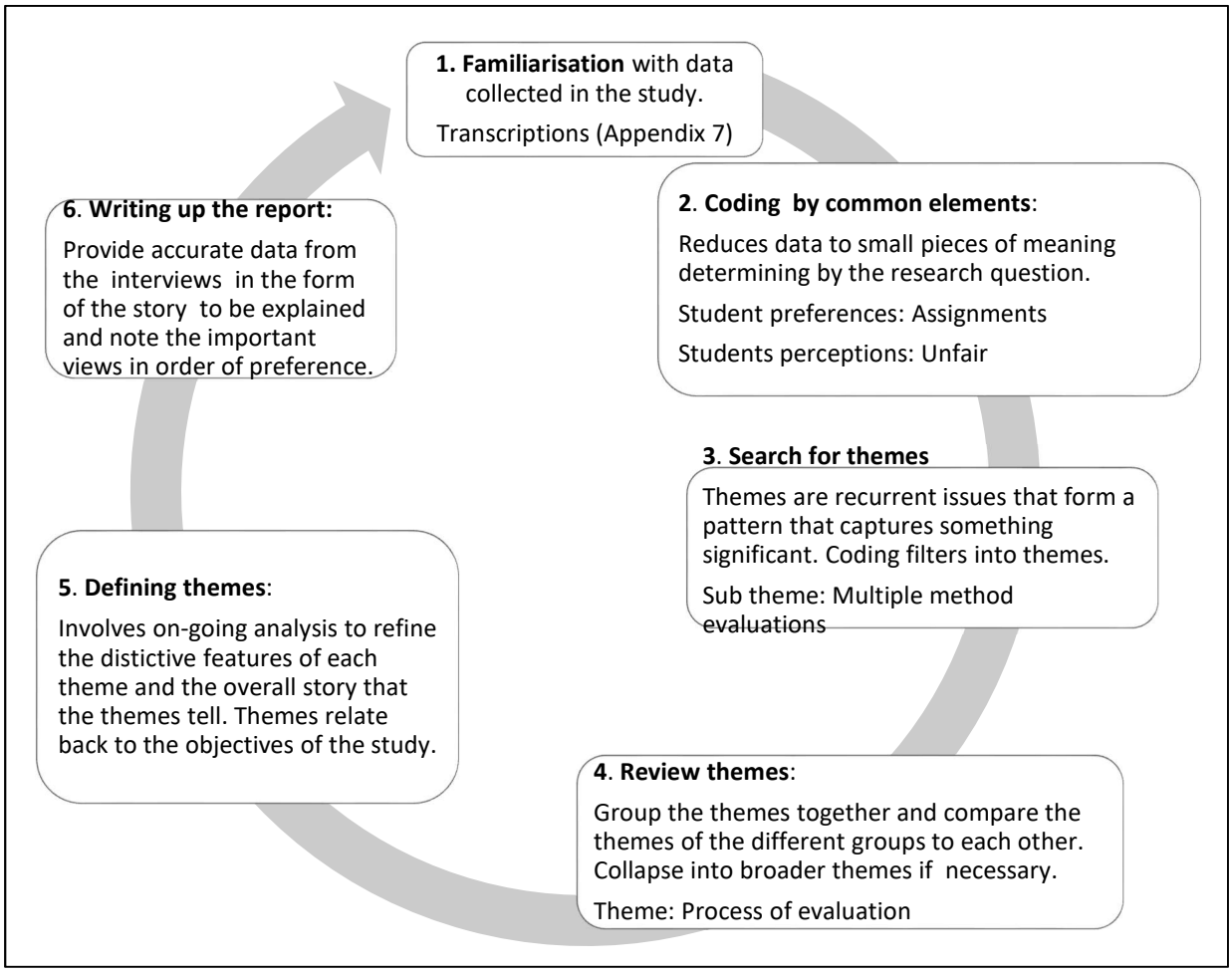

Figure: 3.1: Application of Clarke and Braun's (2013) Thematic Analysis Methods

3.7 MEASURES TO ENSURE TRUSTWORTHINESS

The trustworthiness of the qualitative information was based on the model of Lincoln and Guba (1985) who proposed criteria for assessing trustworthiness. These included credibility, dependability, confirmability and transferability. These criteria informed research results with an aim to support exploratory qualitative research findings.

3.7.1 Credibility

Loh (2013: 5), explained what needed to be present with credibility as one of the criteria of trustworthiness when conducting a qualitative research study. “Credibility (internal validity) included prolonged engagement, persistent observation, triangulation (sources, methods, investigators), peer debriefing, negative case analysis and referential adequacy.” Grassian and Lemire (2018) explained credibility as “how well the analysis process was followed during the research and how applicable the chosen themes are in covering the research findings with all the relevant inclusions and exclusions to judge the similarities within and differences between the categories.”

The credibility of the study was achieved through prolonged engagement until data saturation has been reached during the interviews. It also used member checking which involves getting concordance between the recorded data and the transcribed data from the participants’ perspectives.

3.7.2 Dependability

According to Brink *et al.* (2014), the enquiry auditor, generally a peer follows the process of the researcher in the study and determines if the process followed in the study is dependable. Padilla-Diaz (2015 and Grassian and Lemire (2018) discuss the importance of dependability as it is important to take into account both the factors of instability and factors inducing changes.

In order for dependability to be achieved each step of the process was fully documented so that in future researchers would be able to conduct the research again using a similar sample as recommended by Loh (2013). In this study data collection was described and data analysis conformed to the well-known data analysis methods

of Clarke and Braun (2013). In addition, some members of the Nursing Department were asked for opinions on the selected themes.

3.7.3 Confirmability

Polit and Beck (2017:585) describe confirmability as a "congruency between two or more independent people about the data accuracy." In this study the audio material transcribed by the researcher was confirmed as an accurate replica as the researcher repeatedly reviewed the audiotapes. The supervisor had also attended the interviews and was able to confirm the content. Both the recordings and the transcriptions were locked in a secure place requiring a security code known only to the researcher. Confirmability includes describing and verbatim transcribing of the group's discussions backed up by audio material and notes made in the group discussions. Loh (2013:5) confirms that confirmability "guarantees that the findings, conclusions and recommendations are supported by data and that there is an internal agreement between the investigator's interpretations and the actual evidence."

3.7.4 Transferability

Burns *et al*. (2013) explains that text can be transferred from one context to another. Transferability was ensured in this study as there was a clear and distinct description of context, selection of participants, the data collection and the analysis processes. These steps were recorded and transparent. To demonstrate transferability in this study a rich and vigorous presentation of findings with appropriate quotations are presented in Chapter 4.

Transferability was ensured by including a detailed explanation of data collection and analysis affording other researchers the opportunity to apply this method to similar situations.

3.8 ETHICAL CONSIDERATIONS

The term ethics is clearly explained by Geyer *et al*., (2013: 143). "... ethics refers to the well-founded standards of right and wrong that prescribe what humans ought to do, usually in terms of rights, obligations, benefits to society, fairness or specific virtues. They are standards imposed on us by society." Furthermore, Geyer *et al*. (2013) also discussed that the ethics refer to standards as a basis to shape life and behaviour. Ethics permission is necessary in a research to protect the participants as well as the researcher from harm. The following ethical principles were taken into consideration in this study to protect the participants

- permission to conduct the study,
- informed consent,
- confidentiality and anonymity.

3.8.1 Permission to Conduct the Study

Prior to obtaining the approval to conduct the study, the study protocol was written, submitted and presented to the Department of Nursing for peer review then to the school of Therapeutics Sciences Assessors Group. After that process, it was submitted to the Medical Research Ethics Committee (Human) where ethical clearance was obtained (M160511- Appendix 1). Permission to conduct the study was also obtained from the Infection Prevention and Control and Clinical Microbiology Department to access the contact details of previous students.

3.8.2 Informed consent

According to Brink *et al*. (2014), the World Medical Association's *Declaration of Helsinki* reiterates parts of the Nuremberg Code and emphasises the importance of written consent. Brink *et al*. (2014:33) also note that "The Nuremberg Code and the Declaration of Helsinki provide the foundation for numerous ethical research

guidelines developed by government and professional organisations involved in the conduct of research on human participants all over the world."

In this study, participation was voluntary. The participants signed informed consent forms (Appendix 4) to take part in the small group discussions and to allow recording of the group activity (Appendix 5).

Participants were briefed about the study and an information letter was developed and provided to each participant by email. (Appendix 3). Participants were informed about their rights to withdraw from the study at any time without victimisation or penalty.

3.8.3 Confidentiality and Anonymity

Brink *et al.* (2014: 37) clearly explain that "a participant who agrees to participate in research has the right to expect that the information collected from or about him/her will remain anonymous and confidential. Anonymity literally means namelessness. The process of ensuring anonymity refers to the researcher's act of keeping the participants' identities a secret with regard to their participation in the research study." Furthermore, the authors Brink *et al*. (2014:37) note that "it is preferable that even the researcher should not be able to link a participant with his or her data…..by distributing questionnaires and requiring that they are returned without any identifying details, the researcher ensures that the participants' responses remain anonymous." Anonymity between the researcher and the participants and between participants within the group was not always possible since some of the participants were known to the researcher and to each other. There was however no form of identification linked to the verbatim transcription since each participant was given a number to use during the interviews.

Confidentiality was maintained at all times as was explained in the letters to each participant (Appendix 3). Hard copies of all the data collected were locked in a safe place which had an electronic code known only to the researcher. No names or any form of identification that could link with any of the focus group participants were used and the results of the study were published anonymously in the research report. Participation was on a voluntary basis and participants had the right to withdraw at any stage of the study.

3.9 SUMMARY

This chapter described the research design that was chosen to address the purpose of the study and research objectives appropriately. Included in this chapter were the following headings: the research design, study population, study sample, data collection as well as the questions asked in the group interviews, the analysis of data, measures to ensure trustworthiness and ethical considerations. In Chapter four, the analysis of the findings of the semi-structured interviews which took place in small groups will be discussed.

CHAPTER FOUR

FINDINGS

4.1 INTRODUCTION

Chapter three described the research design and included the study population, study sample, data collection as well as the open-ended questions asked in the small group interviews, measures to ensure trustworthiness and ethical considerations. The purpose of this study was to gain insight into students' preferences of assessment methods and their perceptions of computer-based MCQ examinations. Small groups and semi-structured interviews were used because there was a challenge to arrange groups big enough for focus groups. Probe questions were used as the interviews played out. Each interview continued until no new evidence was forthcoming. Clarke and Braun's (2013) method of analysis as described in chapter three was followed. This chapter describes findings and the interpretation of the data obtained from the small group discussions in this study.

4.2 DISCUSSION OF FINDINGS

Demographic data as specified in appendix 6 which included age, experience and study background was collected from each interview participant in order to examine whether any trend in this data might have influenced the findings. This will be presented before the themes and subthemes. This data was collected and analysed to determine if there was any relevance regarding the age, experience or study background on the results of the study.

4.2.1 Demographic Data

The IPC students came from all parts of South Africa as well as from other parts of Africa including Nigeria, Botswana, Uganda and Zimbabwe.

When considering the age group of the participants who attended the semi-structured interviews fifty-three percent (53%) of the participants were between 31-40 years of age, twenty percent (20%) of participants were between 41-50 years of age, seven percent (7%) were older than 50 years of age while 20% of the participants' ages were not recorded. Nearly a third (27%) of the participants were over the age of 40.

Table 4.1: Age of Participants

AGE GROUP	TOTAL	%
No age recorded	3	20
20-30 Years	0	0
31-40 years	8	53
41-50 Years	3	20
51 and above	1	7
Total	15	

When considering qualifications, (Table 4.3) the majority of the participants (53.3%) held nursing degrees. It must be noted that some of these degrees may have been post graduate degrees and not have included IPC content but might have contained MCQ's as an evaluation method. Thirty-three percent (33.3%) of participants held nursing diplomas while thirteen percent (13.3%) held other qualifications.

Table 4.2 Qualifications of the Participants

QUALIFICATIONS	TOTAL	%
Nursing degree.	8	53.3
Diploma in nursing (General, Psychiatric, Community) and Midwifery.	3	20.1
Diploma in General Nursing.	2	13.3
Diploma in Emergency Services.	0	0
Other: state which course.	2	13.3
Total	15	

Table 4.3 shows the IPC experience of the participants that attended the semi-structured interviews. Eight (53.4%) had between 1-10 years' experience in IPC, one (6.7%) had more than 10 years' experience, one (6.7%) had less than 1-year experience while five (33.3%) had no previous experience in IPC. Thus six had little or no experience.

Table 4.3 IPC Experience of the Participants

YEARS' EXPERIENCE AS IPC NURSE	TOTAL	%
No experience	5	33.3
Less than one year	1	6.7
1-5 years	7	46.7
5-10 Years	1	6.7
Longer than 10 years	1	6.7

Total	15	

4.2.2 Emerging Themes and Sub Themes

The six steps of Clark and Braun (2013) were used to analyse the transcriptions. Once the researcher had become familiar with the data in the transcriptions, grouping took place according to similarities and codes were allocated. These codes served to reduce the data into smaller portions and sub-themes and were guided by the research questions. Three themes with eight sub-themes emerged (Table 4.4).

Table 4.4: Emerging Themes and Sub-Themes

Theme	Sub Theme
The evaluation process	• Timing of testing • Content of examinations • Preparation for examinations
The use of computer based MCQ's	• Unfamiliarity with format • Negative marking • Influence of language
Alternative methods of assessment	• Rationale for alternative forms of evaluation. • Recommendations for alternative types of testing

4.2.3 Themes

To facilitate readability, excerpts will be quoted in each theme and sub-theme. They will then be discussed and re-contextualised later by reference to relevant literature.

Students are not always in agreement with each other however, this is natural and discussion on these points are encouraged in the groups.

Theme one: Evaluation Process

The evaluation process used by the Clinical Microbiology Department of Infection Prevention and Control (IPC) is multiple choice questions (MCQ's) with negative marking (N-type questions) as explained in Bauer *et al.* (2010).

When asked what they felt about the type of evaluation that has been used a participant replied:

> *G4P5: "For me, it was very difficult… It was a shock to me... the negative marking..."*

On exploring further, three sub themes emerged from this theme and are discussed below.

- **Timing of testing**

The IPC course ran on a block release system. From 2011 to 2013 the scheduling of the tests (formative evaluation) were held on the last the Friday of the same block. This was changed to the Monday of the following block in 2014.

The participant group were therefore a mix of participants, some who wrote the tests at the end of the block and some who wrote on the Monday of the following block. The resulting discussion gave additional depth to the topic. When the effect of the changed formative evaluation was discussed, many participants agreed that writing the test in the next block was more convenient and preferable. They had this to say:

> *G5P3: "We were told that the students would have been attending the week block and then at the end of the week they write the examination. That is tough."*

G5P2: "You need to remember we wrote the tests immediately after the block was completed. So, it is better to do the test if [when] *you are coming back to the next block."*

Only one participant felt differently.

G4P5: *"Maybe we can write the test before we leave the institution."*

- **Content of examinations**

The participants complained about the amount of content that they were required to master for each evaluation.

G3P1: "This course is too much. The content is bulky."

G4P1:" To me, it was too much work and the time was too short."

G4P2:" If it was spread across the year the load will be a little bit better."

Participants in some of the interviews differ in opinion when asked about their perceptions of content evaluated by the method of MCQ's. Some agreed that the chosen MCQ method did, in fact, evaluate a broader curriculum:

G3P5: "Yes, it covered all the necessary topics that were covered in the course. There were questions out of every week's [work….]. *It covered everything."*

G4P5: "Yes, the examination was balanced."

One of the concerns of the participants in this study was apparent inconsistency between the content covered in class and the content evaluated. Some participants perceived that there was no correlation.

G1P2: "I would say the volume of work covered versus the examination questions. I don't think there was a correlation in time. Some topics spent a lot of time being learned about or being lectured on, but when the paper comes it wasn't there".

G1P4: "there was no correlation between what was covered in the lectures and that covered in the papers. No correlation!"

G1P2: "I don't think that it was correlated [to] *the course content. It is amazing stuff to learn and then comes the test and that* [section] *wasn't even asked."*

G2P4:" We knew from the beginning the microbiology is a big part of that, but I did think that there was not a big balance between the questions. All the topics were covered, but there was not a balance between them. I think there should be more balance between the different topics in the exam."

Two participants did however feel that the summative evaluation was a fair balance between microbiology and Infection prevention and control

G4P1: "Final examination was balanced but not the tests."

G4P6:" The final examination was balanced."

There was a strong belief that there were questions in the evaluations that were not taught in the class. That made completing the examination very difficult.

G6P3: "There were things we were tested on that were not taught. I even lost my voice due to stress. The examination really needs to be looked into. It is unnecessarily complicated."

- **Preparation for examinations**

When study methods for evaluations were considered the participants discussed whether it was necessary to change their study methods for this N-type of evaluation method. They shared their perceptions of the appropriateness of either in-depth or superficial learning as the best study method for this type of evaluation. Students disagree and some feel that good preparation is necessary for MCQ's.

G2P3:" ...need to prepare thoroughly and in detail..."

Some of the students disagreed and thought it was not necessary to study in detail for MCQ examinations.

> *G1P2: "If I prepared for the more essay type of question, [I] spend more time memorising on list and content, on specific detail at length …. if I think you prepare for multiple choices you are focusing more on the volume than the detail."*

In the different interview groups, the participants discussed many ways to study. Some of them changed their study methods whilst others learned to read the questions more carefully.

> *G2P4 "One thing I have learned through the program is to read your questions very carefully……. Actually, the way you read if you prepared for the MCQ exam is different to when you prepare for a written examination or an oral examination."*
>
> *G4P2: "I used different study methods."*

There were participants who did not change their study method.

> *G1P3: "I mean the way I prepared for examinations is the same way I prepared for any other examinations. I don't think there was too many differences…. just in your head the concept of change a bit."*

Some uncertain students changed their study method, searched for clarity and formed groups:

> *G2P4: "Definitely I am going to study differently. There is a huge difference between the two. MCQ you get much more details. Finer points that you need to look into. With the longer questions, you need to have the knowledge, but*

you can at least explain yourself. [These are] *totally different ways of studying."*

G4P6: "Some of us used different types of study. Some of us use mind maps. We do different types of study. For me, I study on my own and then attend a group discussion. I need to search for clarity."

When considering revision for the summative evaluation, the participants emphasised that they needed revision before the examinations as part of the preparation.

G5P3 "Now it is the final of the year.... going through all the work. I think we need to do a bit more revision."

Summary of theme one:

For many of the participants, the content in the IPC course is overwhelming Evaluation at the end of the block week increased their stress. They felt there was insufficient time allowed for studying. It was therefore suggested that the tests should be written when students return to Block 2, 3 and 4, as there would have been a longer period to study.

There were complaints from the participants that there was inconsistently in the content inclusion in the evaluations with regards to both what had been covered in class as well as the volume of the content.

The participants felt the MCQ examinations required a study method that included knowing the work really well to eliminate guessing. The participants discussed many different studying methods. Some of them changed their study methods whilst others learned to read the questions more carefully. During the discussions, it was clear that the study methods differ from person to person.

Theme two: The use of computer based MCQ's

Whilst computer based evaluation methods are seen as one of the future trends for evaluating students, this is only happening at present for some of the degree nursing evaluations. Forty-seven percent of the participants held diplomas and not degrees and had either not been exposed to MCQ's or had minimal experience of this method of evaluation. Considering that many (27%) of the participants were over the age of 40 and they have expressed that they were not exposed to MCQ's negative marking as an examination method (Byrd et al, 2018).

- **Unfamiliarity with format**

All the participants agreed that they were not accustomed to negative marking and regarded it as a challenge.

> *G1P3: "I think there is a different concept to bear in mind. You need to be conscious that it is negative marking because if you have something wrong, you will get a minus mark on it."*

Nursing participants particularly are not used to multiple choice questions (MCQ's).

> *G6P1: "I have never had a multiple choice question paper* [before]."
>
> *G6P2: "The test, multiple choice questions are not a type of examination I do well in. I had never had a multiple choice in my life."*

They added that they were not exposed to writing N-type examinations during their undergraduate studies.

> *G1P3: "It was quite tricky because it was not a system we are used to. Our papers are long question papers in the examinations and then also multiple-choice papers but not with negative marking. So, it is not something we are used to."*

G1P2:" I am more used to single multiple choice ... I was used to longer questions [essay type] ..."

One of the participants had previously undergone evaluations with negative marking and during the discussion expressed that it was not challenge.

G1P4: "It is not the first time I was being exposed to negative marking..."

According to the participants, the examination with multiple choice negative marking increased their anxiety and resulted in them feeling demotivated. They also complained that there were 'trick' questions and were of the opinion that the examination was set to catch one out.

G1P3: ".....set up to catch you out."

G5P3: "Especially if it is the final examinations... they have trick questions"

Some of the participants agreed that they became more used to this method of examination by the end of the year after writing the test in the same format throughout the blocks.

G4P2: "It is a matter of wording. Need to do the test on different occasions so that you can be used to the negative marking."

Although the examination method was new, the students acknowledged that the method of examination was explained to them before writing the formative and summative evaluations.

G1P3: "Yes, it was explained, but it was a new concept to get used to."

G2P3: "Information was given to me about the negative marking of the questions."

G3P5: "The whole process of negative marking was explained."

Although the examination method was explained to all students, it took a while to get used to this method of examination.

G1P2: "I agree. At the end of the year we understood but the first exam [test]…. *it was a challenge."*

- **Negative Marking**

The use of MCQ's with negative marking is not uncommon in many Health Care Faculties, however it is not commonly used in the Nursing subjects and certainly not common in the diploma courses which accounted for the majority of the participants. Negative marking if correctly understood, is believed to discourage guessing of the responses and therefore students' marks should be more credible. During the Infection Prevention and Control course, the students completed three formative evaluations (tests in block 2, 3 and 4) as well as an examination at the end of the study year. The formative and summative evaluations were written making use of the same examination method consisting of N-type multiple choice questions.

Although there were strong feelings about the challenges of the examination method, there was not only negative feedback regarding the MCQ's marking evaluations. Some of the positive comments included:

G3P1: "MCQ in terms of the other [aspects] *is best because it makes someone think."*

G3P2: "So it makes someone read."

Reading and understanding of questions is very important if one wishes to prevent the impact of negative marking. The students realized very quickly during the year that they needed to read the questions carefully to understand the meaning clearly.

G2P4: "I had to read the questions more than once."

G2P4: "One thing I have learned through the program is to read your questions very carefully, it can be one word or one sentence in between that can make a difference in what you understand."

G3P1: "Multiple choice questions are the best, it makes someone think. So, it makes someone read."

Negative marking as a method of setting tests and examinations preventing guessing amongst students in multiple choice question examinations may be considered by students as 'unfair'. Many participants from the study shared the same perception as the following participant.

G6P3: "Negative marking is unfair and not a good reflection of the learner's knowledge and performance."

The participants admitted that they sometimes guessed the answers. Negative marking made this more difficult.

G6P3: "Multiple choice questions, especially negative marking is good for spotting."

G6P2: "I was guessing most of the time."

The evaluation by MCQ's with negative marking increased the anxiety levels of the participants. One described it as follows:

G5P3: "…especially if it is the final examinations there have to be trick questions, but for me, it felt outrageous. I feel I couldn't breathe. I was under water. I felt what is going on …."

- **Influence of language**

Many of the participants in this study believed there was a possibility that the language used in setting the multiple-choice question (MCQ) examination could have been the reason for the poor performance of the students who participated in the IPC course. They complained that English was not their first language and thus is a barrier to understanding questions. The use of scientific vocabulary was a challenge.

> *G1P4: "…I do think that the English language was not the first language of many of the students... that is probably why some of the students find it so extremely difficult…me included"*
>
> *G2P4: "Not always our first language. Yes, I think some of the questions, I think, might be a language barrier. Some of the words and the sentences were put in the academic language of microbiology and made it a bit difficult for me."*
>
> *G3P1: "Number one, English is not the first language."*

There were however some participants who believed language were not a barrier.

> *G4P5: "The questions were clear.... The English is fine. We understand English……."*

Summary of theme two

In summary the participants felt that MCQ's were new to most participants and the fact that they were coupled to negative marking created an even greater challenge. This left the participants feeling concerned and confused about the fairness of the evaluations. They agreed that this might have increased the guessing of the answers. The perception amongst the participants was that negative marking increased anxiety and was set to catch one out.

The participants did believe that their results were low as English was not their first language.

There were some participants that did not experience challenges in understanding the way the questions were set however the answers were very similar to each other and that made it difficult to choose the correct answer. Participants agreed that questions needed to be read very carefully as marks could be lost because of misreading a question and choosing the incorrect answer.

Theme three: Alternative methods of assessment

There are different types of adult evaluation already discussed in chapter two. The different types of evaluation evaluate different aspects of cognitive thinking (Verenna *et al*., 2018)

- **Rationale for alternative forms of evaluation**

The participants felt strongly about the method of examination All of them had completed some form of qualification since leaving school and so had experienced different forms of evaluation and competency assessment. Various methods were mentioned in the discussions but most had experienced short essay type questions requiring paragraphs and longer essay type questions. They were not used to the MCQ N-type setup. One participant believed:

> *G1P2: "It is a limitation in terms of ...can you really articulate and apply understanding in situations with multiple* [choice] *questions? I don't know if it is possible."*

The structure of the questions in the exams seems to be very important to the participants in order to give the opportunity to think and apply their coursework and

not only recall the information learned. Application as this participant pointed out is very important.

> *G1P2: "In real life, unfortunately, you need to take what you learned and apply it in your particulate situation - staff, budget, people and organizational culture whatever it is. It is a limitation if you cannot really articulate and apply understanding of a situation within multiple questions."*

In this study, the participants felt strongly that they were not good at writing MCQ's. The participants are used to explaining themselves in an examination:

> *G2P4: "...I agree with a little bit of longer questions. You will be able to explain yourself."*
>
> *G3P5: "If you have an examination where you can explain yourself you get more marks."*
>
> *G4P5: "Our nurses are used to applying most of the time."*

Participants thus tended to favour multi-method examinations.

> *G1P4: "I think a mix* [of] *multiple choice questions (MCQ), short questions and long questions. Then you can test whenever a person can think through a situation and can apply their mind."*

- **Recommendations for alternative types of testing**

The participants are used to explaining themselves in an examination and prefer multi-method examinations.

> *G4P6: "They need to mix the questions like open questions and multiple choice questions not only multiple questions. One needs to explain like in depth".*
>
> *G1P4: "I think a mix, a MCQ, short questions and long questions…."*

G3P1: "If you mix questions…oral with essay type of questions to help students to get more marks. I think it is a good idea."

During the group discussions course work, oral examinations, essay type and short questions, problem based scenarios and assignments were considered.

Assignments were introduced into IPC course together with the tests in 2014. The participants agreed that this kind of evaluation method could assist in increasing the marks. A number of evaluation methods were considered positively. When considering use of the alternative evaluation methods, the participants commented as follows:

G1P3: "The assessment was good and it helps boost your marks."

G1P3: "I think the assessment mark counting towards your final mark… it is fair."

G2P4: "I like the idea of scenarios."

G4P5: "I think scenarios can work."

G1P4: "…. You are used to orals."

G1P2: "I prefer oral by a panel…."

The participants suggested that it might be helpful if a clinical facilitator could assess or assist the IPC students clinically especially if it is a new field for the student. They suggested that the IPC lecturers could work with the student in practical sessions, advising and assessing the students.

G1P1: "With nursing, it is both theory and practice for the nurses."

G4P2: "There needs to be more practical [exposure]*."*

Summary of theme three

The alternative methods of assessment were examined in this theme as well as the concerns with the present form of evaluation.

The participants agreed that they were used to explaining themselves in previous studies and preferred multi-method examination approaches. They recommended examination approaches such as combinations of short questions, long essay questions, assignments, more practical sessions and orals.

4.3 SUMMARY

In chapter four, the detailed analysis of the findings of three themes and eight sub-themes that emerged was given. These themes were extracted using the thematic analysis approach developed by Clark and Braun (2013).

Three sub-themes emerged from theme one. This theme discussed the participants' perception of the way the examination was compiled as well as the method of evaluation presently used in the infection control course.

The second theme describes the experiences of the use of computer based Multiple-Choice Question (MCQ) examinations. Three sub-themes provided more clarity on the participants' unfamiliarity with the format of questions, negative marking and the influence of language proficiency of the students writing the examinations.

Theme three focused more on the exploration of the preference of examination methods of the students completing the IPC course. The participants' discussions focused on the rationale for alternative forms of evaluation and recommendations for alternative evaluation processes.

Chapter five will conclude the report with the discussion of findings supported by literature, limitations and recommendations for future nursing research.

CHAPTER FIVE

DISCUSSION, RECOMMENDATIONS LIMITATIONS AND CONCLUSIONS,

5.1 INTRODUCTION

In this final chapter a summary of the research report is described. This chapter connects chapter two and the findings in chapter four. The discussion focuses on the main findings, recommendations and limitations for future nursing research. A conclusion is reached from the findings. In addition, this chapter reflects on the lessons learned and identifies the preferences and perceptions of the infection prevention and control course. The research methodology followed the qualitative manner of semi-structured interviews. These took place in small group discussions and captured real-life information in a social setting. Themes and sub-themes were revealed. Literature was used to compare and support the interpretation of the participants' comments.

5.2 SUMMARY OF FINDINGS

The purpose of the study was to gain more insight into students' actual preferences of assessment methods and their perceptions of computer based multiple choice question examinations. Consideration of these preferences and perceptions may help future students improve their understanding and competency in a field of patient care which remains desperately short of nursing expertise.

The objectives of the study were:

- To explore the preference of the IPC students of assessment methods used in the IPC course.
- To explore the perception of the IPC students of the computer based MCQ method of assessment used in the IPC course.

5.3 DISCUSSION OF FINDINGS

Infection prevention and control is a new nursing discipline in South Africa in spite of being studied for many years in the United States of America and Europe (Dixon, 2011). Students registering for the IPC course come from many different hospitals. There is a large range in age as well as their experience in IPC.

5.3.1 Discussion of Demographic Data

In this study, 73% of participants were between 31-50 years of age confirming that these nurses had considerable nursing experience generally and represented an older generation of nurses. Some may not have been exposed to infection prevention as a formal discipline during their training. These experienced participants' did not struggled to understand new terminology. At the start of the course the participants found it difficult to get used to studying but as the year progressed experience gave them a great advantage. Van de Watering *et al.* (2008) posit that inexperience can create a barrier to studying and understanding of new terminology. Fifty-three percent of participants were university graduates. Exposure to the academic environment may have fostered an interest in participating in research and may be the reason for the larger number of degreed participants in the group discussions. These participants may have been previously exposed to MCQ's since this is a

method of evaluation frequently used at universities. This could have influenced their perceptions of MCQ examinations and the preparation for such an examination. The experience in infection prevention of nine participants that attended the semi-structured interviews was between one and more than 10 years. This gave these participants some advantage particularly with skills however they still felt that multi method assessments were preferable. Rose *et al.*, 2018 confirm that nurses in the age group 40-60 year with experience do have an advantage over students without experience when answering examinations.

Five participants had no experience. The inexperienced participants were required to learn a new subject without practical experience. This, they said made studying much more difficult. Byrd (2018) confirms that inexperienced participants required to learn a new subject without practical experience find the subject more difficult.

The bulk of the participants were employed in government hospitals (46.7%) whereas only 20% came from the private institutions. The reason for the low representation of private sector students was thought to be that the private sector hospitals offer their own infection control courses and only the students that have the need to specialise further in an advanced diploma or postgraduate degree attend the course at the university. The success or lack of competency could not be linked to the institution sector and so this was not considered to play a roll.

In general, the demographic data played no role in influencing the perceptions of this group of participants.

5.3.2 Discussion of Small Group Data.

Three themes and eight subthemes emerged from the data. This section will discuss these themes.

- **The evaluation process**

Perceptions are assessed making use of formative and summative assessment approaches. These assessments have different goals and different methods of evaluation are commonly used (Bruce et al., 2011). The participants in the semi-structured interviews considered the evaluation process for competency as difficult since only one method of examination was used. They perceived that this method limited their ability to explain or express themselves. Sharma and Mutalik (2014) also stated that to focus on only one examination method such as MCQ's hindered the ability of the students to express themselves and resulted in failure to achieve competency

Three subthemes emerge from this theme.

During the period under investigation changes were made to the day on which the block test would be written and it was moved to the Monday of the following block in 2014. The participants agreed that writing tests in the following blocks gives the students the opportunity to spend more time to master the difficult concepts and they find the evaluation less of a challenge. Literature (Helmien et al., 2016, O'Dwyer, 2012 and Bruce *et al*., 2011) focuses on other aspects of formative and summative evaluation such as open or closed book evaluation and whether it is preferable to write evaluations in the morning or in the afternoon to increase marks of students. When asked about this many of the participants in this study felt that the time of day of testing was of less concern than the method of the testing. They did however agree that writing the test in the next block was better since the volume of work covered in each block was excessive.

The participants stated that the IPC course covered a broad section of knowledge and they understood the reason for choosing MCQ's as the method of evaluation since it

can cover a broad curriculum. Some participants believed that the curriculum was fully covered in the examination however the majority of participants felt that there were aspects of the content that was not fully evaluated.

No consensus was reached on the manner in which to prepare for these evaluations. Generally scientific subjects require critical thinking and students need to apply their knowledge to practice. Stanger-Hall (2012) commented that the style of examination could influence how much students learned as well as their ability to become critical thinkers however they do not comment on the method or type of preparation for this to take place.

The use of computer based MCQ's

Byrd (2018), Madwela et al (2018), Delaram and Sharifi (2017) and Stanger-hall (2012) highlighted an important advantage of multiple choice questions (MCQ's) as the student's reading skills and understanding were tested. Participants learn from the start to read the questions carefully.

Under the theme of using computer based MCQ's, three subthemes emerged. These were unfamiliarity with format, negative marking and the influence of language.

Historically from 2011 both the formative and summative evaluations of the IPC course were multiple choice questions with negative marking. O'Dwyer (2012), Stanger-Hall (2012) and Bauer *et al.* (2010) explained the complexities of setting MCQ's. When using N-type MCQ's any incorrect option that is selected incurs a negative mark. This type of question is used to prevent the guessing of answers. Multiple choice questions (MCQ's) as a sole evaluation method in formative and summative evaluations was a challenge for most of the students because they were not used to the evaluation method. These challenges identified by the participants in this study are controversial. Bond *et al.* (2013) disagree with this study. According

to them, nurses are used to writing MCQ examinations. The IPC course also made use of negative marking and the participants' perception was that this made it even more difficult to master this method of evaluation. The participants in this study felt very strongly that they prefer writing essay type examinations because they could explain themselves. The participants felt that MCQ's were "unfair". Bond *et al*. (2013) confirmed the feelings of the participants of unfairness when referring to negative marking or N-type MCQ's as a method to prevent guessing amongst students. On the other hand, Bond *et al.* (2013) felt that using discrimination levels to develop negatively marked questions might improve the critical thinking of the students and increase their performance. Stanger-Hall (2012) disagrees with Bond *et al.* (2013) and agrees with the participants in this study. Stanger-Hall (2012) believed that mixed examination methods tests critical thinking to a maximum. Stanger-Hall (2012) also referred to students with high anxiety levels preferring MCQ examinations in their study. In this study the participants disagreed. They suggested that those with higher anxiety levels preferred writing an essay type of an examination.

There are eleven languages spoken in South Africa. This makes teaching and learning a challenge in the South African context. There were participants who agree that language was a barrier as it was not their first language. Translation of questions from one language to another often changes the meaning of the sentence and the vocabulary also differs from language to language. In non-English speaking homes, children master their mother tongue first and second languages such as English are taught at a later stage. Mastering another language later in life can be very challenging (Dale, 2013). Students participating in this course experienced similar challenges. Most of the participants in the interviews were of the opinion that there

was a possibility that the language difficulty used in setting the MCQ exam could have been be the reason for the poor competency of the students who participated in the IPC course. There were participants that complained that the way the exam was set and the English language that was used made the examination extremely challenging. The participants who really struggled to understand the questions asked in the examination might not have known the meaning of the words used in the questions. Kurdi *et al.* (2016) suggest that if a question is misinterpreted in MCQ's, the loss in scores are minimal whereas if an essay question assessment is misread, the student may lose considerably more marks. Because IPC is a fairly new discipline some terminology is unfamiliar in the clinical setting. If the students had not read their examination paper carefully they would have lost marks. For the English speaking participants, it was not difficult to understand the questions.

The participants were forced to read the questions carefully from the onset of the course and to make sure that they understand what was asked before selecting the correct answer. The negative marking posed a challenge for even the participants who did speak and understand the English. They felt uncertain of committing to an answer. The allocation of negative marking increased the risk of failing the question. Mahjabeen (2017) explains that allocation of marks to N-type of questions could be fair if the allocation is correct and influences marks of the students positively. Alternative methods of evaluation are not necessarily easier to set or to understand.

- **Alternative methods of assessment**

Most of the participants agree strongly that they are not used to the type of questions asked in the IPC examinations and this can have an influence in their marks. More recently assignments were included as formative assessments. The participants were

very positive towards assignments and agree that it gave them the opportunity to explain their knowledge.

The participants in the groups have not referred to the use of a portfolio of evidence but felt a strong need for different evaluation methods that have not yet been used in the IPC course as yet.

All the participants in the interviews would prefer the inclusion of oral examinations conducted according to a rubric and questions that would incorporate scenarios as an evaluation method as they are more familiar with such an evaluation than multiple choice questions with negative marking. Alenezi (2018) confirms that the advantage of oral examinations is to improve talkative skill, enhance communication and restore confidence but it could be very stressful for the person that is being evaluated whereas scenarios as an evaluation method enhance the students' ability to apply their knowledge. It could therefore enhance the IPC students' competency and application if used in the course.

The participants in the difference interviews agreed that it would be of value if a clinical facilitator could assess or assist the IPC students in the clinical setting particularly if it is a new field for the student. IPC educators could work with the student in practice and by doing so would provide an opportunity to advise the student on the job. Methar *et al*. (2011) confirm that IPC is a clinical field of training and competency is built in the clinical environment where educators could support the students.

5.3.3 Summary of the Discussion

To the best of the researcher's knowledge, this study is the first nursing study to examine the educational success of the IPC course of its kind to be conducted in the

IPC department of the university from the nursing perspective. It addresses education in a very new and scarce skill in South Africa. This study answers the set objectives.

- Exploring the preferences of IPC students of assessment methods used in the IPC course.
- Exploring perceptions of the IPC students of the computer based MCQ method of assessment used in the IPC course.

The participants' opinions of successful evaluations lay in choosing the best time to write the formative evaluations. More time was needed to master new terminology as well as the opportunity to broaden their practical skills in the workplace from block to block. The extra time would give the opportunity to familiarise themselves with the content of the work.

Effective communication and understanding is also an important challenge for the participants in order to find success in the course and master the curriculum. There were participants who believed that their marks were very low as English was not their first language. Understanding the way, the questions were set because English was not their first language and finding that the answers were very similar made it difficult to choose the correct answer. The participants however confirmed that the invigilators were on hand to assist with clarification of questions if necessary. Questions needed to be read very carefully because marks would be lost as a result of misreading a question and choosing the incorrect answer. The negative marking exacerbated this. The participants continuously questioned the need for the negative marking. It was a difficult system to get used to. All the participants agreed that they were not accustomed to negative marking. The perception amongst the students was that the method of evaluation was set to catch them out. The student's feelings towards the N-type of questions remained negative. It is perceived to be a method to

prevent guessing but was unfamiliar and unfair. It was a difficult system to get used to. Their preference for long essay type questions where they could express themselves more easily was repeated frequently. The participants were not totally negative about the MCQ form of examination. They felt that this kind of evaluation did teach the students to think before answering the questions. They also realised that they needed to read the questions carefully in order to understand the meaning of the question.

The participants preferred flexibility of evaluation methods rather than one method. Their preference for long essay type questions where they could express themselves more easily was repeated frequently. They believed that assignments assisted them to improve their marks.

They would like to see a summative examination that contains a number of different methods from all the different approaches of evaluation. They suggested making use of a continuous evaluation approach under the supervision of a clinical facilitator who would be responsible for ensuring compliance in the clinical skills. The participants who have had the opportunity to write an essay also enjoyed the integrated approach where they were able to explain themselves through completing an assessment during the IPC course.

The experience of MCQ evaluations makes the participants anxious and they realised that they need to choose the correct study method to increase the possibly of obtaining competency. The participants also realised that the final preparation for different evaluation approaches needs to be managed differently.

This, added to the fact that they were learning in a second or third language made it difficult to understand the questions asked thus increasing the difficulty of the

MCQ's. Generally mixed type of questions were preferred rather than tests and examinations using only one type of method.

The participants found the class work challenging as it sometimes felt as though they received excessive information. They referred to it as "information overload". They believed that they needed more contact time to bridge the gaps in their knowledge deficit.

In each of the interviews the participants discussed many ways to study. Some of them had changed their study methods whilst, others learned to read the questions more carefully. Some of the participants had not realised the need for an in-depth study approach for an N-type of examination as describes in a study by Mingo *et al.* (2018). The method of study they most often used was superficial learning.

The participants found the class work challenging as it sometimes felt as though it was excessive information. They referred to it as "information overload". They believed that they needed more contact time to bridge the gaps in their knowledge deficit. They realised that they needed to make appointments with educators to assist them with content that they hadn't mastered.

The participants discussed many ways to study. Some of them had changed their study methods whilst, others learned to read the questions more carefully. Some of the participants had not realised the need for an in-depth study approach for an N-type of examination as also describes in a study by Mingo *et al.* (2018). The method of study they most often used was superficial learning.

5.4 RECOMMENDATIONS

Recommendations are based on the findings of the study. This research examined the preferences and perceptions of examination methods of the students completing the IPC course and the perceptions of IPC students with regard to the way the examination is compiled and their opinions of completing this examination.

The recommendations have been grouped into three parts, those that will influence direct nursing care, those that require decisions of nursing management or require insertion into a training programme and lastly those that need more research.

5.4.1 Recommendation for the Nursing Practice

The IPC nurse practitioner needs to incorporate management skills, education skills and infection control skills in their clinical environments. The IPC course equips the nurse in practice to sustain surveillance programs which identify and enable one to manage outbreaks early and needs to be incorporated in the curriculum of the IPC students. Evaluation of the IPC student need to be in a way that the IPC student could explain themselves by using multi method examination methods.

IPC staffing according to Stone (2014) regarding bed occupancy needs to be taken into consideration when the scope of an IPC program, the complexity of the health care facility, the characteristics of the patient population and the unique or urgent needs of the facility and community is planned. Examination questions need to take all these aspects into account. Students could be skilled in the way to read and answer a multiple choice negative marking question. A mock test could be given to the students to give them the opportunity to exercise before writing an exam that counts for marks. Students also could complete a portfolio of evidence that gives them guidance and direction to use in their position as IPC practitioner.

5.4.2 Recommendation for the nursing management

Exposure to an IPC environment will assist the student to apply theory in practice. Exposure enhance experience of the student that has been trained. More practical examination methods is recommended in the IPC curriculum to give the students the ability to critical analyse and think creatively by using scenario's as assignments in the IPC curriculum. It will evaluate critical thinking and application of that what was studied during the course of the study. The management of the healthcare facility could involve IPC students working in other departments in containing outbreak situations and develop teaching, learning and assessment activities as a coherent process. (SAQA, 2005).

5.4.3 Recommendation for the nursing research

Further research is required on the infection prevention and control course regarding incorporating mini point prevalence studies into the IPC course to equip the students with practical knowledge in identifying hospital acquired infections.

More research could be done to identify if a portfolio of evidence could make a difference in improving competency of the IPC students while they are on the course.

Multiple choice questions being used in the question bank should be rated for cognitive levels according to Blooms' taxonomy. Evaluate which questions have application values and which questions are recall questions.

Examination methods could be changed so that evaluation start in the beginning of the year with equal mix methods questions to accommodate all students' preferences and then move to more multiple choice questions as used in the current evaluation method.

5.4.4 What does this study add?

This study added knowledge regarding the infection prevention and control students' preferences and perceptions after completing their course examinations. Some minor amendments regarding the way the examinations were structured could make a difference in the performance of the students.

One of these amendments, without changing the examination method, includes a detailed explanation to the students of what N-type MCQ examination questions entail and how the N-type MCQ needs to be answered. One needs to provide examples of such questions to the students when the course commences. Providing a "mock test" in the first block will provide valuable exposure to the questions being asked and how to answer them appropriately.

From the onset, the students need to know that they should make use of an in-depth study method and need to know the content of the curriculum as guessing incorrect answers will result in even lower marks than would have been the case if they did not answer the question at all.

The use of other evaluation approaches such as assignments and portfolio of evidence could assist the students in achieving competency.

5.5 LIMITATIONS

The study was a small sample (n=15) carried out in a university setting using post graduate students that work full time. Some of the participants who did not live in Gauteng were not able to participate while others were able to take leave to participate in the semi-structured interviews which took place in small groups discussions.

Participant selection was based on a census sample. Due to the small sample the findings cannot be generalised to all students. However, the purpose of this exploratory study was to discover the preferences and perceptions of the students towards MCQ negative marking. Saturation was achieved in spite of the small numbers.

The researcher accepts that there may be different interpretations and thus different themes extracted from the narratives in other contextual settings. This is possible because the method used in the analysis of the data is subjective.

5.6 CONCLUSION

In order to fulfil the purpose of this study two objectives were set and achieved. The study's purpose was to gain more insight into students' actual perception and preferences of assessment methods and their perceptions of multiple choice questions examinations in the IPC course at a selected university.

The findings of the study showed that the participants who attend the semi-structured interviews which took place in small groups discussions were overwhelmed and found the method used for the examination very difficult to understand. For many it was the first time in their lives that they were exposed to a multiple choice negative marking method of examination. They prefer a multi method questions to be able to explain or express themselves.

The participant's perception regarding the way the examination was compiled was that it was an unfair method and selected to catch them out. This created a challenge for the students. The participants learned to read their questions carefully before choosing any answer that might be incorrect.

The participants agree that the way forward to increase the competency of the IPC students included development of study guides, a varied method approach to evaluation and if MCQ's are to be used, the students need to be taught how to understand and complete that type of evaluation. They appreciated assignments as an add-on to assist with increasing the marks.

There was also representation (5%) of participants from other institutions including laboratories, Emergency Services and Department of Correctional Services. This confirms that IPC is useful in more than one field of interest and the application of IPC principles could be used in preventing transmission of infectious diseases in communal settings such as the police cells. Other medical and non-medical fields are also interested and infection prevention and control should be included into the training of these personnel. This includes laboratory personnel. Training must also be extended to include these fields.

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APPENDIX 1: ETHICAL CLEARANCE FROM: HUMAN ETHICS COMMITTEE (MEDICAL)

R14/49 Ms Antoinette Moolman

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160511

NAME: (Principal Investigator)	Ms Antoinette Moolman
DEPARTMENT:	Nursing Education
PROJECT TITLE:	Students' Perceptions and Preferences of Computer Based Multiple Choice Question Examinations during the Infection Prevention and Control Course
DATE CONSIDERED:	27/05/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Andrea Hayward
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	20/07/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office, Secretary in Room [redacted]

I/We fully understand the the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated,from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially review in May and will therefore be due in the month May each year.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 2: LETTER OF PERMISSION TO CONDUCT THE STUDY

The Head of Microbiology Department

Room 3T11, Level 3

[redacted]

7 York Road

PARK TOWN, Gauteng

RSA

Request permission to conduct a research study using IPC students 'examination results from 2011- 2016.

Dear Prof. A Duse

My name is Antoinette Moolman; I am a Masters student, studying Infection Prevention and control- Nursing Science at [redacted] As part of the requirement to fulfil the course I have to conduct a research study.

The aim of this study is to gain more insight into students' perceptions and actual preferences of computer based marking multiple questions examination method, into the effect of these on writing multiple choice questions. This study consists of a qualitative design and will include four semi-structured interviews which took place in small groups of five participants who attended the Infection Prevention and Control course from 2011 to 2016 and have experience of multiple choice questions.

In order to obtain historical evidence on scores obtained by students, I will examine the final examination of students for the years 2011 – 2016.

Participation will be voluntary and a written informed consent will be obtained from participants. Confidentiality will be maintained at all times and anonymity will be assured during reporting and publication of research results.

I therefore request permission to access the electronic records of the students' performance.

The result of the study will be made available in the form of a report.

Regards

A Moolman

Phone no: 0834165977

E-mail address: Antoinette.moolman[redacted]

APPENDIX 3: INFORMATION LETTER AND CONSENT OF PARTICIPANT

INFORMATION LETTER: RESEARCH PARTICIPANT

Dear Participants

My name is Antoinette Moolman. I am a postgraduate student at university of [redacted], in the Department of Nursing Education for the degree of Master of Science in Nursing (Infection Prevention and Control). I am conducting a research on preferences and perceptions of students who attended the IPC course at [redacted] University from 2011 to 2016. The title of my study is:

STUDENTS' PERCEPTIONS AND PREFERENCES OF EDUCATIONAL ASSESSMENTS DURING THE INFECTION PREVENTION AND CONTROL COURSE

You will form part of a group. Participants will be asked to share their perceptions and preferences for examinations. The group will then discuss these perceptions and preferences. The discussions will be recorded with each participant using a number to maintain anonymity and confidentiality. These discussions will then be transcribed and analysed.

The semi-structured interviews which took place in small groups discussion will take a proximal 45-60 minutes to complete. Each of the participants in the group will get a number on a card to ensure confidentiality of each group member (No names will be used). When a group member answers a question, this group member must begin his or her answer with the number of his or her card and then express his or her feelings towards the open ended question.

Participation is voluntary, you may choose to participate or withdraw from the study at any time. Please note that I will do everything in my power to adhere to confidentiality but unfortunately confidentiality cannot be guaranteed in a semi-structured interviews which took place in small groups discussion despite the use of study numbers instead of names.

Findings from the study will be communicated to you on written request and any appropriate authority for planning and implementation of educational programs.

Thank you for taking time to read the information letter. Should you require any further information regarding the study or your right as a participant, you are welcome to contact the ethical committee of the University of the [redacted] using the following details:

- Protocol Ref No: M160511
- Chairperson: peter.cleaton-jones1[redacted]
- Administrators:

  Ms Zanele Ndlovu/ Mr Rhulani Mkansi/ Mr Lebo Moeng Tel: 011 [redacted]

  Email: HREC[redacted]

Or myself at the Department of Microbiology Infection Prevention and Control or email me using the following address: Antoinette.moolman@[redacted]

Yours Faithfully,

Antoinette Moolman

MSc Nursing Student

APPENDIX 4: PERMISSION FROM THE PARTICIPANT SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS

I agreed to participate in this study. I have read and understood the content of information sheet and I have been given the opportunity to ask questions, where deemed necessary, about the study and its procedures.

All information will remain confidential and my name will not appear anywhere on the report written.

I hereby agree to participate in the study.

.....

Name of participant

....

Signature Date

If you have any questions or concerns about this study, please contact Mrs Antoinette Moolman by email: antoinette.moolman@[redacted].

APPENDIX 5: CONSENT FORM FOR THE RECORDING

OF SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS.

I, the undersigned understand that the discussion will be recorded. There will be no consequences for me if I do not want to participate in the semi-structured interviews which took place in small groups.

I understand that the information from the recording will be transcribed and transcripts will be given codes and my name will not be mentioned. I was also informed that the recording device will be locked in a safe which has an electronic code and will be destroyed after two years following publication of five years if there is no publication.

I therefore consent to the recording of the semi-structured interviews in small groups during the course of this study.

Participant's signature: _____ Date: _____

APPENDIX 6: INFECTION PREVENTION AND CONTROL (IPC)

SEMI-STRUCTURED INTERVIEWS

QUESTIONS THAT WILL BE USED DURING

EVERY GROUP INTERVIEW

Demographic information from the group members:

Item	**Answer**
Age	
Registration: • Nursing degree	
• Diploma in Nursing: (General, Psychiatric& Community) and Midwife	
• Diploma in General Nursing	
• Diploma in Emergency Services	
• Other: State which course	
Did you hold an IPC position when you did the IPC training course?	
Do you hold an IPC position at the moment?	
How long have you worked in an IPC post? (Mark the applicable years) • Less than 1 year	
• 1-5 years	
• 5-10 years	
• Longer than 10 years	
You are employed at: • Private Clinic	
• Private Hospital	
• Government Clinic	
• Government Hospital	
• Other: (e.g. Laboratories or Emergency Services)	

Examples of open ended leading questions that encourage participation in the group are:

Think of your final IPC examination and then tell me about:

1. What did you feel about the system of examining students using computer based MCQ's?
2. What alternative approaches to assessment would you have preferred?
3. What type of assessment do you think might have improved your marks?

APPENDIX 7: EXAMPLES OF TYPO TRANSCRIPTIONS OF THE SEMI-STRUCTURED INTERVIEWS IN SMALL GROUPS:

Linking Themes, Subthemes and coding to the research Question

RESEARCH QUESTION	THEMES	SUB THEMES	CODING
Preferred method of assessment	The evaluation process	Timing of testing	*"..it is writing on the Monday as writing on the Friday."*
Perception of the method of assessment	The evaluation process	Content of examination	*"Final exam was balance but not the tests.."*
Perception of computer based multiple questions	The evaluation process	Preparation for the exam	*"I prepared for exams in the same way.."*
Preferred method of assessment	The use of computer based MCQ's	Unfamiliarity with the format	*"..they didn't give negative marking at all.."*
Perception of computer based multiple questions	The use of computer based MCQ's	Influence of language	*"English language was not the first language."*
Preferred method of assessment	The use of computer based MCQ's	Rationale for alternative forms of evaluation	*"..longer questions you will be able to explain yourself."*
Preferred method of assessment	Alternative methods of assessment	Recommendation for alternative types of testing	*"The assignment was good and it helps bust your marks."*

Group1:

3(G1P3): "It was quite tricky because it was not a system we are not use to. In our training they didn't give negative marking at all. (Unfamiliarly with the format) *So the concept was something new that you have to get used to. I must say the exams were quite tricky sort of set up to catch you out. But we managed it."*

3(G1P3): "Our papers normally are I am talking of short course paramedics. Our papers are long question paper in the exams and then also multiple choice papers but not worth negative marking. So it is not something we are used to."

2(G1P2): "The way the multiple choice questions were set up. I am more using to a single multiple choice you have the question and only one right answer. Where true [or] *false and the answer you know that is choose the rightest…… …. I was use to lot more longer open ended questions and explain way ….*

4(G1P4): "It is not the first time I was been exposed to negative marking but I do think that because English language was not the first language (Influence of language) *of many of the students that's probably why some of the students find it so extremely difficult."*

3(G1P3) "…. I think there is a different concept to bear in mind. You need to be conscious that it is negative marking because if you have something wrong will get a minus mark on it. It happened in the beginning but we get used to it……..... I mean the way I prepared for exams in the same way (Preparation for examinations)

2(G1P2): "If you prepare for the more essay type of question spend more time memorising on list and content on specific detail at length. There if I think you prepared for multiple choices you are focussing more on the volume than the detail."

3(G1P3): "The assignment was good and it helps bust your marks." (Recommendation for alternative types of testing)

3(G1P3): ……I find the orals very stressful but there is place for it. I suppose."

Group 2:

3(G2P3) "……My experience with the exams with regards to the MCQ was [a] *big challenge. Sometimes the answers look similar…….*

4(G2P4): "…….is to read your questions very carefully as she said it can be one word or one sentence in between that can make a difference …. longer questions you will be able to explain yourself. (Rational for alternative forms of evaluation) *Not always our first language it might be difficult to express yourself.*

4(G2P4): "……. assignments are a very good thing because it gives you change to really prepare a proper document to really enhance your year-end score….

4(G2P4): "Definitely I am going to study differently. There is huge difference between the two. MCQ you got much more details. Finer points that you need to look into. With the longer questions you need to have the knowledge but you can at least explain yourself. [There are] total different ways of studying."

3(G2P3): "……._essay type of questions, ……. needs to prepare thoroughly in detail……..

4(G2P4): "……..I think it might be a language barrier. Some of the words and the sentences was put in the academic language of microbiology make it a bit difficult to me. I had to read the questions more than once to start going on in the question…."

4(G2P4):" …… there should be more than a balance between the short and the longer questions…". the short question isn't that big problem but the negative marking was for me very stressful…"

Group 4:

5(G4P5): "It was a shock to me the negative marking……

2(G4P2): "……. the majority of the questions they were interlink because it in a sentence that was change and whether you get the answer is correct. It is a matter of wording…."

(G4P3): "Although it was challenging it gives you a change to know all the work that has done. Through the course of the year not doing guess work."

1(G4P1): "Agree with the tests as it is writing on the Monday as writing on the Friday. Rather do practical on a Friday. If the curriculum changes that you get scenarios and questions to do between block…. So students in future, need to do something between the blocks, to force you as student to read theory on the subject."

5(G4P5): "Yes it will work (All agree)."

6 (G4P6): "Some of us used a different type of study. Some of us use mind maps, some of us use. We do different types of study. For me I study on my own and then attend a group discussion. I need to search for clarity"

6(G4P6): …. "They need to mix the questions like open questions and multiple questions not only multiple questions. One needs to explain like in dept."

1 (G4P1): "I agree with explanation you need to explain."

1(G4P1): "Final exam was balance but not the tests." (Content of examinations)