THE OPINIONS ON AND USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION AT SOUTH AFRICAN UNIVERSITIES

by

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DECLARATION

I, Adele Naudé, hereby declare that the content of this mini-dissertation is the result of my own independent work and that I have never submitted it at any other institution for the purpose of obtaining a qualification. Where help was sought, it has been acknowledged. I declare that this mini-dissertation has been submitted for the first time at this institution, University of the Free State, towards a Master's degree in Health Professions Education.

I hereby declare that I am aware that copyright of this mini-dissertation is vested in the University of the Free State.

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__________________ 29/01/2016

A Naudé **Date**

DEDICATION

I dedicate this mini-dissertation to my late parents, Koos and Elna Jordaan. You will always be in my heart.

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TABLE OF CONTENTS

Page

CHAPTER 1: ORIENTATION TO THE STUDY

CHAPTER 2: SIMULATION AND PHARMACY EDUCATION: A SOUTH AFRICAN PERSPECTIVE

CHAPTER 5: INTERPRETATION AND DISCUSSION OF RESULTS

CHAPTER 6: CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

LIST OF ACRONYMS

APS	**Academic Achievement Point Score / Admission Point Score**
BBL	**Brain-based Learning**
B.C.E	**Before the Common Era**
C.E	**Common Era**
CHE	**Council on Higher Education**
EC	**Eastern Cape**
EL	**Exit Level**
ELT	**Experiential Learning Theory**
FS	**Free State**
GPES	**Good Pharmacy Education Standards**
GP	**Gauteng Province**
GPP	**Good Pharmacy Practice**
KZN	**Kwa-Zulu Natal**
LP	**Limpopo Province**
MEDUNSA	**University of Limpopo (Medunsa Campus)**
MP	**Mphumalanga Province**
NC	**Northern Cape**
NDP	**National Drug Policy**
NMMU	**Nelson Mandela Metropolitan University**
NQF	**National Qualifications Framework**
NSC	**National Senior Certificate**
NW	**North-West**
NWU	**North-West University**
PBL	**Problem Based Learning**
PU for CHE	**Potchefstroom University for Christian Higher Education**
RU	**Rhodes University**
SAPC	**South African Pharmacy Council**
SA	**South Africa**
SBME	**Simulation Based Medical Education**
SCRIPT	**Strathclyde Computerized Randomized Interactive Prescription Tutor**

SLE	**Simulated Learning Environments**
SAPC	**South African Pharmacy Council**
SAQA	**South African Qualifications Authority**
SP	**Simulated Patient**
UFS	**University of the Free State**
UKZN	**University of Kwazulu-Natal**
UL	**University of Limpopo (Turfloop Campus)**
UWC	**University of the Western Cape**
WC	**Western Cape**
WHO	**World Health Organization**
WITS	**University of the Witwatersrand**

SUMMARY

Key terms: simulation; advantages; disadvantages; questionnaire survey; undergraduate pharmacy education; good education practice standards; competent; eight-star pharmacist; practice-ready pharmacist.

An in-depth study was done to obtain greater insight into the current use of simulation, and the opinions of lecturers regarding simulation, in undergraduate pharmacy education at South African Universities registered with the South African Pharmacy Council as training institutions. The South African Pharmacy Council recently published Good Education Practice Standards (GPES) guidelines to ensure quality pharmacy education across South Africa.

Simulation experiences are specifically addressed in these guidelines including facilities for practice simulations, "in order to provide students with practical and simulated pharmaceutical care experiences". The delivery of competent, eight-star, practice-ready pharmacists to fulfil the needs of the community are paramount.

The research methods consisted of a literature review and an online questionnaire survey sent to lecturers involved in undergraduate pharmacy education. The literature review provided the background for a conceptual framework, as well as information to develop the questionnaire survey.

The study originated from the lack of information regarding the use of simulation in undergraduate pharmacy education in South Africa. To bridge the information gap, the researcher used the results from the questionnaire survey as the foundation for the compilation of recommendations for possible incorporation of simulation to enrich undergraduate pharmacy education at pharmacy schools.

Through the assessment of the current use of simulation, including the opinions of lecturers regarding simulation as well as possible advantage and disadvantages thereof, the results of the study provided a valuable contribution to knowledge. The reliability and validity of the study were ensured through sound research approach and methodology. The research can form the foundation for further research projects.

OPSOMMIMG

Belangrike terme: simulasie; voordele; nadele; opname vraelys; voorgraadse farmasieopleiding; bedrewe; goeie opleidingspraktykstandaarde; agt-stêr apteker; praktyk-gereed apteker.

'n In-diepte studie is gedoen om dieper insig te verkry rondom die gebruik van simulasie, insluitende die opinies van lektore oor simulasie, in voorgraadse farmasie onderrig by Suid-Afrikaanse Universiteite wat as onderrig instellings geregistreer is by die Suid-Afrikaanse Aptekersraad.

Die Suid-Afrikaanse Aptekersraad het onlangs goeie opleidingspraktykstandaard riglyne publiseer ten einde kwaliteit farmasie onderrig regoor Suid-Afrika te verseker. Simulasie word spesifiek geaddresseer in hierdie riglyne, insluitende fasiliteite vir simulasie oefeninge ten einde studente van praktiese en gesimuleerde farmaseutiesesorg ervarings te voorsien. Die lewering van bedrewe, agt-stêr, praktyk-gereed aptekers om aan die behoeftes van die gemeenskap te voldoen is van die uiterste belang.

Die navorsingsmetodes het bestaan uit 'n literatuuroorsig en 'n aanlyn vraelys wat aan lektore wat betrokke is by voorgraade farmasie onderrig gestuur is. Die literatuurstudie het die nodige agtergrond verskaf vir 'n konsepsuele raamwerk, sowel as inligting om die vraelys te ontwikkel.

Die studie het sy oorsprong gevind in die gebrek aan inligting rondom die gebruik van simulasie in voorgraadse farmasie onderrig in Suid-Afrika. Om hierdie gaping te oorbrug het die navorser die resultate van die aanlyn vraelys gebruik as 'n basis vir die formulering van voorstelle vir moontlike gebruik deur farmasieskole om onderrig te verryk.

Deur die assessering van die huidige gebruik van simulasie, insluitende die opinies van lektore en die moontlike voordele en nadele van simulasie, lewer die studie 'n waardevolle bydrae tot kennis.

Die betroubaarheid en geldigheid van die studie is verseker deur die gebruik van grondige navorsingsbenaderings en metodes. Die navorsingsprojek kan die grondslag vorm vir verdere navorsing.

LIST OF DEFINITIONS AND TERMINOLOGY USED IN THE STUDY

Applied competence: "the ability to put into practice in the relevant context, the learning outcomes acquired in the process of obtaining a qualification or part qualification (applied competence encapsulates foundational, reflexive and practical competence)" (NQF 2014:13).

Clinical Pharmacy (unabridged definition): "Clinical pharmacy is a health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention. The practice of clinical pharmacy embraces the philosophy of pharmaceutical care; it blends a caring orientation with specialized therapeutic knowledge, experience, and judgment for the purpose of ensuring optimal patient outcomes. As a discipline, clinical pharmacy also has an obligation to contribute to the generation of new knowledge that advances health and quality of life", American College of Clinical Pharmacy (2008:816).

Community Pharmacy: "means a pharmacy wherein or from which some or all of the services as prescribed in regulation 18 of the Regulations Relating to the Practice of Pharmacy are provided to persons requiring pharmaceutical services, but excludes an institutional pharmacy" (RSA DoH 2000b:1).

Consultant Pharmacy: "means a pharmacy wherein or from which some or all of the services as prescribed in regulation 19 of these regulations are provided to persons requiring pharmaceutical services" (RSA DoH 2000b:2).

Curriculum: A statement of the training structure and expected methods of learning and teaching that underpin a qualification or part qualification to facilitate a more general understanding of its implementation in an education system (NQF 2014:24).

Entry requirements: "means the academic and/or practical, and/or work experience that a learner must have completed to be able to be admitted for a qualification. This may include recognition of other forms of prior learning such as non-formal and informal learning and work experience deemed as comparable for entry. In the South African context, entry requirements also take into account the broad socio-political issue of access" (SAQA 2013:4).

Exit Level Outcomes: "refer to the outcomes which define the level of performance according to which a candidate completing the qualification is assessed (SAQA 2013:4) or the knowledge, skills and attitudes that a learner should have obtained or mastered on completion of a qualification and against which the learner is assessed for competence" (NQF 2014:29).

Institutional Pharmacy: "means a pharmacy situated in –

(a) a public health facility wherein or from which some or all of the services as prescribed in regulation 18 of the Regulations Relating to the Practice of Pharmacy are provided to persons requiring pharmaceutical services, from or at that public health facility; or

(b) a private health facility wherein or from which some or all of the services as prescribed in regulation 18 of the Regulations Relating to the Practice of Pharmacy are provided to persons requiring pharmaceutical services from or at that private health facility" (RSA DoH 2000b:2).

Internship: the practical training undertaken by a pharmacist intern in terms of a contract under the direct personal supervision of a tutor in a pharmacy approved by Council for purposes of such training or at an institution registered as a provider of a qualification in pharmacy (RSA 2000a:2).

Learning outcomes: the "contextually demonstrated end-products of specific learning processes, which include knowledge, skills and values" (NQF 2014:40).

Manufacturing Pharmacy: "means a pharmacy wherein or from which some or all of the services as prescribed in regulation 16 of the Regulations Relating to the Practice of Pharmacy are provided and which shall sell medicine only to a wholesale pharmacy or a community pharmacy or an institutional pharmacy or to persons who are authorised to purchase medicines in terms of the Medicines Act or to an organ of State" (RSA DoH 2000b:2).

Outcomes: "means the contextually demonstrated end-products of specific learning processes, which include knowledge, skills and values. Outcomes could be generic in that they apply across many fields of learning (generic outcomes include aspects such as "ability to problem-solve" or "understanding the world as a set of inter-related systems")" (SAQA 2013:5).

Pharmaceutical Care: "Regulations relating to the Practice of Pharmacy (R.1158 of 2000) were promulgated in terms of Section 35A to give effect to acts pertaining to the scope of practice of the pharmacist. Regulation 3 (1)(a) to (e) represents the pharmaceutical care concept. All these acts revolve around the patient and the inclusion thereof as acts pertaining specially to the pharmacy profession represent a dramatic change of direction in pharmacy practice, compared to the previously prescribed acts, where the word, patient, did not appear at all and where the emphasis was placed on the product, the medicines.

(1) the provision of pharmaceutical care by taking responsibility for the patient's medicine related needs and being accountable for meeting these needs, which shall include but not be limited to the following functions:
(a) evaluation of a patient's medicine related needs by determining the indication, safety and effectiveness of the therapy;
(b) dispensing of any medicine or scheduled substance on the prescription of a person authorised to prescribe medicine;
(c) furnishing of information and advice to any person with regard to the use of medicine;
(d) determining patient compliance with the therapy and follow up to ensure that the patient's medicine related needs are being met; and
(e) the provision of pharmacist initiated therapy" (RSA DoH 2000b:4).

Pharmaceutical Chemistry: "is a core discipline within Pharmaceutical Sciences. It is centrally engaged in the drug discovery process, mainly focusing on lead finding, lead optimisation and structure-activity relationship investigations, using technologies of computer-aided drug design, natural products chemistry, synthetic organic chemistry, and biochemical approaches in a transdisciplinary combination which is generally known by the term "Medicinal Chemistry". Discovery and validation of new drug targets has also been recognised as a complementary research field, as well as state-of-the art methods of pharmaceutical analysis. Moreover, important aspects of drug development and drug production are addressed by Pharmaceutical Chemistry by the development and application of methods in Pharmaceutical/Biopharmaceutical analysis, being absolutely essential in Pharmaceutical quality management" (UWC 2015b:Online).

Pharmaceutics: used in pharmacy and pharmaceutical science to encompass many subject areas, including but not limited to dosage form design and compounding – physical pharmaceutics, biopharmaceutics – how drugs arrive following administration, as well as Pharmaceutical microbiology, Aulton (2007:1).

Pharmacology: a branch of medical science which deals with the properties and characteristics of drugs. It is particularly interested in the actions and effects of these chemicals on the human body (Galbraith, Bullock, Manias, Hunt & Richards 1999:3).

Pharmacy Practice: the discipline which focuses on cultivating the professional attributes of pharmacy students, to take on the roles of committed pharmacists. These attributes are multi-faceted, involving social and administrative sciences, as well as Clinical Sciences and practice experiences. The social and administrative sciences encompass the philosophy and ethos of Pharmacy as a profession, the legal and ethical framework within which Pharmacy is practiced, aspects of Pharmacy Management, Health Psychology and Communication. (UWC 2015c:Online).

Qualification: "a registered national qualification consisting of a planned combination of learning outcomes which has a defined purpose or purposes, intended to provide qualifying learners with applied competence and a basis for further learning and which has been assessed in terms of exit level outcomes, registered on the NQF and certified and awarded by a recognised body" (NQF 2014:55).

Simulated learning: "is learning stimulated through an activity that involves the imitation of the real world in the academy. The act of simulating something entails representing certain key characteristics of the selected workplace and includes such things as laboratories, patient models, mock meetings, flight simulations etc." (CHE 2011).

Wholesale Pharmacy: "means a pharmacy wherein or from which some or all of the services as prescribed in regulation 17 of the Regulations Relating to the Practice of Pharmacy are provided and which shall sell medicine only to a wholesale pharmacy or a community pharmacy or an institutional pharmacy or to persons who are authorised to purchase medicines in terms of the Medicines Act or to an organ of State" (RSA DoH 2000b:4).

LIST OF TABLES

LIST OF FIGURES

THE OPINIONS ON AND USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION AT SOUTH AFRICAN UNIVERSITIES

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

In this research project, an in-depth study was done by the researcher with the view to investigate the current opinions on and use of simulation in undergraduate pharmacy education at South African universities.

Chapter 1 aims to provide the background and context to this study and orientate the reader. The chapter provides background on the changes in pharmacy as a profession, as well as the use of simulation in health professions education. These are followed by the problem statement and research questions, the overall goal, aim and objectives of the study as well as the scope, significance of the study and the research design.

Finally, Chapter 1 concludes by providing an outline of the mini-dissertation and the following chapters.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

The pharmacy education environment has changed remarkably in recent times. The foundations of much of modern Western medicine are found in ancient Greece. Greek medicine moved from the divine and spiritual (in 800 B.C.E) towards scientific observation and logical reasoning (in 200 C.E). The word pharmacy is derived from the ancient Greek word *pharmako*, meaning drug or poison, according to Shah, Gibson and Tex (2013:5). In modern times, graduate pharmacists step into an environment where the scope and complexity of their roles and responsibilities have increased. Accordingly, it is incumbent upon pharmacy educators to prepare graduates for this changed environment by ensuring that they are able to deliver safe and effective healthcare to patients. Graduates must also be technically skilled, have theoretically driven problem-solving and decision-making skills, understand human behaviour at an in-depth level, and work with other professions in diverse circumstances. Educators should be searching for innovative teaching strategies that will optimise learning in an evolving health system, to equip pharmacists to deal with the increased demands they are facing (Elfrink, Kirkpatrick, Nininger & Schubert 2010:97). In addition, according to Prensky (2001:1) in many ways "today's students are no longer the people our educational system was designed to teach".

1.2.1 The South African Pharmacy Council (SAPC) and minimum curriculum for pharmacy education background

The SAPC is responsible for establishing, developing, maintaining and controlling universally acceptable standards in pharmaceutical education and training in terms of the requirements of the Pharmacy Act (RSA 1974:5). The SAPC accomplishes these objectives through the accreditation of providers and courses, as well as quality assurance of these accredited programmes (SAPC 2015a:Online). The SAPC provides minimum curriculum requirements, but remain non-prescriptive regarding the exact content of each curriculum. The SAPC (2010a:22) also provides guidelines concerning key professional competencies and outcomes expected to be achieved through each curriculum to deliver competent, generalist entry-level pharmacists that should be able to work in any pharmacy sector on completion of a one-year internship (or a two year academic internship) and one-year community service.

Although the outcomes are specified by the SAPC, curriculum development is led individually by higher education institutions. It therefore remains the responsibility of each lecturer at these institutions to ensure that the curriculum and teaching and learning methodologies are relevant to the demands of the profession and the community.

The curriculum entails a minimum of four years of full-time study at a university recognised for the purposes of training pharmacists by the SAPC.

The SAPC "Statistics for registered persons and organisations" in 2014 (SAPC 2014a:Online) had eight academic institutions registered as providers of a degree in pharmacy indicated in Table 1.1.

TABLE 1.1: APPROVED HIGHER EDUCATION INSTITUTIONS OFFERING BACHELOR OF PHARMACY EDUCATION IN SOUTH AFRICA (SAPC 2014a:Online)

INSTITUTION	ABBREVIATION
Nelson Mandela Metropolitan University	NMMU
Rhodes University	RU
University of Limpopo (Medunsa Campus) in collaboration with Tshwane University of Technology	MEDUNSA
University of Limpopo (Turfloop Campus)	UL
North-West University (Potchefstroom Campus)	NWU
University of KwaZulu-Natal	KZN
University of the Western Cape	UWC
University of the Witwatersrand	WITS

The SAPC currently have nine providers in their statistics for registered persons and organisations (SAPC 2015a:Online) as providers for a degree in pharmacy as indicated in Table 1.2. Sefako Makgatho Health Sciences University (SMU) was established when the Minister of Higher Education and Training, Dr Blade Nzimande, in terms of section 20 of the Higher Education Act 1997 (Act 101 of 1997) promulgated the SMU in the SA Government Gazette no: 37658 of 16 May 2014.

The promulgation followed the announcement made in 2011, by Minister Nzimande, when he announced the intention to separate the University of Limpopo (UL) and the Medunsa Campus. The university opened its doors in January 2015 after the Medunsa Campus was separated from the University of Limpopo and integrated into SMU (SMU 2015:Online).

TABLE 1.2: APPROVED HIGHER EDUCATION INSTITUTIONS OFFERING BACHELOR OF PHARMACY EDUCATION IN SOUTH AFRICA (SAPC 2015a:Online)

INSTITUTION	ABBREVIATION
Nelson Mandela Metropolitan University	NMMU
Rhodes University	RU
Sefako Makgatho Health Sciences University	SMU
University of Limpopo (Turfloop Campus)	UL
North-West University (Potchefstroom Campus)	NWU
University of KwaZulu-Natal	KZN
Tshwane University of Technology	TUT
University of the Western Cape	UWC
University of the Witwatersrand	WITS

Pharmacy students registered as such with the SAPC are obligated to take part in work-integrated learning activities, known as integrated practical training during their studies. They have to be exposed to a variety of learning activities throughout the integrated practical training period during their formal studies to fulfil the requirements of the

BPharm degree. The practical experience must be completed during the students' second year and their final year of study.

Pharmacy students are exposed to a variety of learning activities throughout their official higher education curriculum and their internship period. Insofar as the internship period is concerned, the SAPC requires the completion of online questionnaires by the pharmacist overseeing the relevant activities, confirming the ambit of the activities that the student participated in (SAPC 2016:3). However, the quality of the internship depends to large extent on the commitment and skill of the pharmacist (tutor) overseeing the activities.

In the SAPC Annual Report (2013:11), recommendations from its 1st National Pharmacy Conference at Sun City, North-West in 2013, regarding pharmacy education include the consideration of a five-year degree where the internship is included in the last academic year and where exposure is controlled in all areas of practice. More prominent experiential learning components need to be included in the training of pharmacists through the promotion of strategic partnerships between pharmacy schools and workplaces to enable experiential learning.

The quality of the learning experience, knowledge retention and skills development during the official higher education curriculum, is dependent on the ability of lecturers to bridge the gap between theory and practice through teaching. Increased workload, time constraints, shortage of pharmacists and other healthcare professionals all play a part in limiting the learning opportunities provided to pharmacy students. While the focus is on the expressed competencies to be obtained by pharmacy students, the implied competencies that they need to acquire are often either lacking in some aspects or completely ignored.

Examples of expressed competencies, in my opinion, is to read and interpret prescriptions according to the South African Qualifications Authority (SAQA) registered qualification document (SAQA 2012:Online), as well as application of legal and ethical requirements and good pharmacy practice, discussion and employment of applicable pharmaceutical and pharmacological principles. The implied competencies in this case include the ability to communicate effectively with the patient or a medical professional, when needed. Another implied competency is the ability of the student, not only to memorise ethical rules relating to the pharmacy profession, but to demonstrate an understanding of the ethical implications of decisions, actions and practices specifically relevant to legalities associated with pharmacy as profession. In addition, the student should demonstrate the skill to implement the legal requirements applicable to the pharmacist in practice in new and unfamiliar situations.

The pharmacy environment needs a more "practice-ready" pharmacist who is able to focus on crucial elements of practice when they enter the pharmacy sector, rather than having to spend time learning skills that can be taught, and learned, within the higher education environment through effective teaching methods.

The ability to overcome the gap between the classroom and the practice setting is an area of concern for students. Pharmacy students at North-West University (NWU) (Potchefstroom Campus) have expressed the need for real-world training to address real-world problems and obtain real-world skills required for pharmacy practice (NWU 2014: class discussion FPKG221).

The use of simulation could address some of the identified needs, as an alternative to experiencing real-life situations. The skills obtained through simulation may contribute to pharmacy students becoming confident healthcare practitioners who will be able to work as custodians of medicine in inter-professional healthcare teams to promote pharmaceutical care effectively. This will be discussed further in Chapter 2.

A registered pharmacist may choose to work within any recognised field (cf. Table 2.1). Table 1.3 gives a representation and comparison of registered organisations within the pharmaceutical sector approved with the SAPC in 2014 (SAPC 2014b:Online) and 2015 (SAPC 2015c:Online).

TABLE 1.3: COMPARISON OF ORGANISATIONS REGISTERED WITH THE SOUTH AFRICAN PHARMACY COUNCIL BY SECTOR AND PROVINCE 2014 & 2015 (SAPC 2014b:Online; 2015c:Online)
[Table continues on next page]

SECTOR	EC	FS	GP	KZN	LP	MP	NW	NC	WC	TOTAL
	PROVINCE									
Academic Institutions										
2014	2	0	2	1	1	0	1	0	1	8
2015	3	0	3	1	1	0	1	0	1	10
Community Pharmacy										
2014	221	142	1048	487	156	212	187	57	444	2954

2015	272	137	1073	498	162	220	195	58	456	3071
Consultant Pharmacy										
2014	0	0	9	2	0	0	0	0	1	12
2015	0	0	8	1	0	0	0	0	2	11
Institutional Private										
2014	23	13	98	41	8	14	23	5	36	261
2015	26	15	100	45	8	13	23	5	39	274
Institutional Public										
2014	93	53	81	101	39	39	54	43	134	637
2015	103	51	82	102	39	39	59	39	131	647
Manufacturing Pharmacy										
2014	6	1	195	8	0	1	8	0	26	245
2015	11	1	199	9	0	1	8	0	27	256
Wholesale Pharmacy										
2014	21	7	124	22	5	3	3	3	36	224
2015	24	7	122	24	5	3	3	3	37	228

Looking at the approved organisations, it is evident that some academic institutions do not have approved organisations within the different sectors in their provinces to provide students the opportunity to visit these sites. It is therefore necessary to investigate other teaching strategies to give students relevant learning opportunities.

1.3 PROBLEM STATEMENT AND RESEARCH QUESTIONS

The problem that was addressed is the lack of information regarding the use of simulation in pharmacy in South Africa.

Each of the pharmacy education institutions have their own unique curriculum design based on exit-level outcomes (ELO's) drafted by the SAPC. However, the methods used to achieve the stated outcomes are unique to each institution.

The NWU Potchefstroom Campus opened its simulation pharmacy in 2011 (NWU 2011:Online) and Nelson Mandela Metropolitan University (NMMU) formally opened a simulated community pharmacy in 2013 according to McCartney (2013:32).

Information for the literature review were sourced from published articles in national and international accredited journals as well as books and various internet search engines. Electronic searches using terms/keywords such as Simulation, Pharmacy, Simulation in

Pharmacy Education, and Pharmacy Education in South Africa were entered alone or in combination. As far as could be ascertained through search engines such as Google Scholar, ScienceDirect and Ebscohost there seemed to be no recent scientific studies in South Africa within the pharmacy context on the use of simulation and limited research projects were available in published format.

The following research questions were addressed by the objectives of this study:

1. What is the current state of simulation use in undergraduate pharmacy education in South Africa?
2. What are lecturers' opinions regarding the use of simulation in pharmacy training institutions in South Africa?

1.4 OVERALL GOAL, AIM AND OBJECTIVES OF THE STUDY

Different terms are used by different researchers to describe what they want to investigate. For the purpose of this study, a goal will be defined as the central thrust of what the researcher would like to achieve with the study (Fouché & Delport 2011:108); the aim is more focused (Aldous, Rheeder & Esterhuizen 2011:15); and the objectives as the specific issues that will contribute to the broader goal (Fouché & Delport 2011:108).

1.4.1 Overall goal

The overall goal of the study was to conduct an investigation into the current state of simulation training in pharmacy education and training at higher education institutions in South Africa, and to give direction for simulation integration into education and training programmes for pharmacists in undergraduate education programmes and possible future research projects.

1.4.2 Aim

The aim of the study was to investigate the opinions on and use of simulation in undergraduate pharmacy education at South African universities.

1.4.3 Objectives

To achieve the aim, the following objectives were pursued:

- To gain a deeper understanding of the current status of simulation use in higher education in the changing arena of teaching and learning. This was done by means of a literature study. This objective addresses research question one.
- To determine the current availability, use and opinions of resources involved in a simulation setting by means of inquiry into technology used; resources available and opinions regarding the use of simulation of lecturers involved in undergraduate pharmacy education. This would provide the necessary data for an assessment of the current status of simulation. This was done using an online questionnaire sent to all undergraduate pharmacy lecturers employed at Higher Education Institutions. This objective addresses research questions one and two.

1.5 DEMARCATION OF THE FIELD AND THE SCOPE OF THE STUDY

Demarcation is the setting of borders within which the research will be done. According to Goddard and Melville (2004:14) the absence of borders will result in a lack of direction in your research and it includes the scope of the study, as well as the methods, the variables in the study and the limitations of the study.

The findings of the study may be of value to pharmacy schools and lecturers involved in pharmacy education at higher education institutions.

This study was performed in the field of Health Professions Education and is interdisciplinary due to the application of the study in die field of pharmacy.

The researcher is registered with the SAPC as a Pharmacist. She has been working in the Pharmacy Practice Department of the School of Pharmacy, NWU since 2011. She obtained her BPharm qualification from the NWU (then, Potchefstroom University for Christian Higher Education) in 1996 and worked in the private sector as retail pharmacist for fifteen years. She is currently involved in management of the new simulation facilities at the NWU as well as implementation of simulation as teaching strategy in training of undergraduate pharmacy students. This stimulated her to investigate the current use of simulation in undergraduate pharmacy education curricula in the South African context as a whole and possibly integrate simulation more successfully into the current undergraduate curriculum at the NWU.

1.6 SIGNIFICANCE AND VALUE OF THE STUDY

The value of the study lies in addressing the current status of pharmacy education about simulation use in South African pharmacy education. The results of this study will be made available to all the other pharmacy schools in South Africa. It will be of value to any Higher Education Institution to use the research output to rethink the possibilities of simulation use in undergraduate pharmacy education. This research study will contribute to the available information regarding simulation in pharmacy education in South Africa.

1.7 RESEARCH DESIGN OF THE STUDY

A brief overview of the research methods used in this study is provided in this section. A detailed discussion on the research design and methodology follows in Chapter 3.

The research project will be an exploratory, descriptive, quantitative study. The literature study was followed by an on-line questionnaire. The study was quantitative because all the data were gathered through closed questions in an online questionnaire. The questionnaire, however, included a few open-ended questions, where lecturers were asked to give opinions. These opinions were coded and arranged into themes. Reporting on these themes was done quantitatively.

A schematic overview of the study is given in Figure 1.1.

Literature study
Protocol development
Presentation of protocol - HPE 703
Peer Review Committee - 20 June 2014
Ethics Committee Application
Consent from School Directors of Pharmacy Schools and final Ethics Approval 125/2014
Consent from participants
Pilot study: Questionnaire survey
Empirical phase: Questionnaires to participants
Data analysis and interpretation
Discussion of the results
Finalisation of the mini-dissertation and submission

FIGURE 1.1 SCHEMATIC OVERVIEW OF THE STUDY

1.8 ARRANGEMENT OF THE MINI-DISSERTATION

This mini-dissertation consists of six chapters. Each chapter addresses a different aspect of the study.

The arrangement of the chapters is as follows:

In this chapter, Chapter 1, ***Orientation to the study***, an introduction and background to the study was provided. The research problem was stated, as well as the research questions. As an overview, the goal, aim and objectives were stated and the research design and methods that were used were described briefly to provide the reader with an overview of the contents of this report.

In Chapter 2, ***Theoretical foundation for the use of simulation in health professions education.*** In this chapter attention will be given to the term simulation and its use in education. This chapter also clarifies the higher education pharmacy environment in South Africa at present.

In Chapter 3, ***Research design and methodology,***, the research methodology will be discussed in detail.

In Chapter 4, ***Results of the questionnaire survey and data analysis,*** an analysis of the results will provide a clear picture of the research findings.

In Chapter 5, ***Discussion and interpretation of the results*** on opinions and use of simulation in undergraduate pharmacy education will be provided. This chapter will include recommendations and examples of simulation modalities for possible curriculum integration.

In Chapter 6, ***Conclusion, recommendations and limitations of the study,*** an overview of the study, conclusion, additional recommendations and the limitations of the study will be provided.

1.9 CONCLUSION

In this first chapter, the background and context of the research projects were layed out. The problem was stated, with the overall goal, aim and objectives and the scope of the study. A brief introduction was given on the research design and methods as well as the arrangement of the chapters of the mini-dissertation. The next chapter will provide the theoretical foundation for the research project.

CHAPTER 2

SIMULATION AND PHARMACY EDUCATION: A SOUTH AFRICAN PERSPECTIVE

2.1 INTRODUCTION

In the previous chapter an overview of the study was provided as well as the motivation for the study. The outline of the study was explained.

In this chapter the literature review provides a foundation for the study. A literature review can be described as an "original story that you write that tells what has been happening in your field of interest" according to Aldous *et al.* (2011:18).

2.2 UNDERGRADUATE PHARMACY EDUCATION IN SOUTH AFRICA

The pharmacy profession, like every other profession, is undergoing major changes. Clearly then, the knowledge and skills base required is affected by external changes, including patient demographics and expectations, technological advancements, emerging disease state priorities, regulatory requirements and advances in other professions.

The *Baccalaureus Pharmaciae* degree is a four-year degree registered at NQF level 8 (SAQA 2012:1). The purpose of this qualification is to deliver pharmacists to the profession with the necessary knowledge, skills and competencies to promote the health of South African citizens, as a member of the healthcare team.

Although the outcomes are specified by the SAPC, curriculum development is led individually by higher education institutions. It therefore remains the responsibility of each lecturer at these institutions to ensure that the curriculum and teaching and learning methodologies are relevant to the demands of the profession and the community.

Pharmacy is described by Van Dyk (2014:56) as "a dynamic, information driven, patient-orientated profession whereby the pharmacist, through his or her competence and skills, is committed to meeting the healthcare needs of the people of South Africa".

To be effective healthcare team members, pharmacists need skills and attitudes enabling them to assume many different functions; it is important as an educator to acquire the necessary skills needed to teach students innovatively to achieve these goals.

The various pharmacy schools in South Africa as well as the SAPC are continually challenged to make significant changes in undergraduate pharmaceutical education and training (cf. Figure 2.2), so that present and prospective graduates can meet current and future expectations of pharmacy practice.

The SAPC has adopted the concept of the eight-star pharmacist (RSA 2014:78). The pharmacist needs to be able to adopt many different functions and therefore needs to be a caregiver, communicator, decision-maker, teacher, life-long learner, leader, manager and researcher.

Figure 2.1 provides a schematic overview of Chapter 2 and familiarises the reader with the content of the chapter.

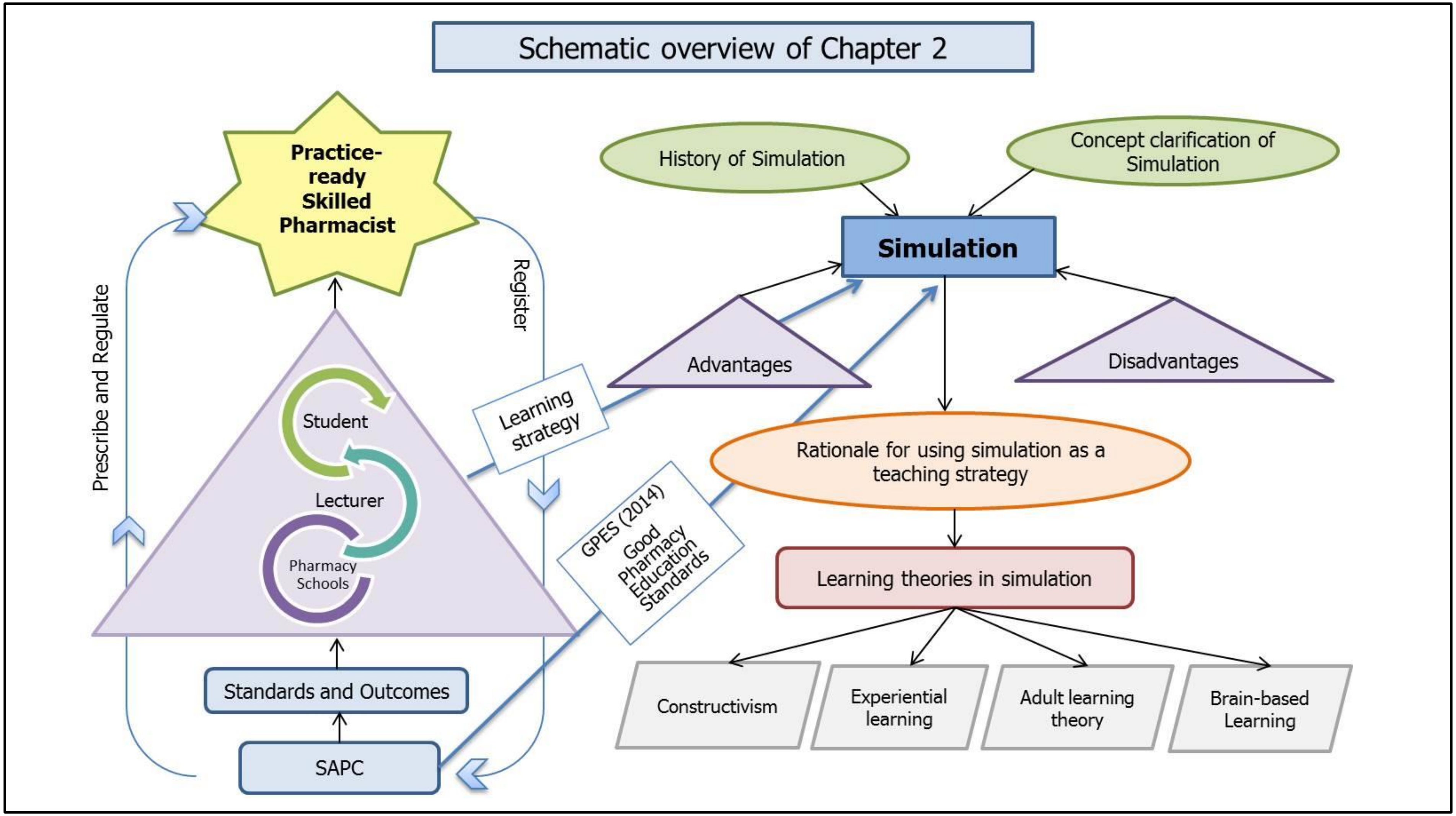

FIGURE 2.1: SCHEMATIC OVERVIEW OF CHAPTER 2
(Compiled by the researcher, A Naude:2015)

2.2.1 Curriculum requirements

The SAPC, the juristic person established in accordance with the Pharmacy Act (Act 53 of 1974) has the following objective: establishing, developing, maintaining and controlling universally acceptable standards in pharmaceutical education and training, as well as to prescribe the scope of practice of the various categories of persons registered in terms of this Act (RSA 1974:5) (cf. Table 2.1).

Anderson (2002:392) states that pharmacists worldwide have shifted their focus of attention from the product and its preparation, to the patients' pharmaceutical needs. These patient-centred activities have developed into the concept of pharmaceutical care.

The minimum curriculum and changes in the curriculum over time are described below (cf. Figure 2.2 and Table 2.1). The current pharmacy curriculum can be described as a patient-orientated curriculum consisting of a combination of the fundamental minimum curriculum requirements, unit standards (phased out, but addressed in the new ELO's) and new exit-level outcomes to produce an eight-star pharmacist.

The SAPC (RSA DoH 1994:1) published "Regulations relating to the minimum requirements of the curriculum for a degree in pharmacy" providing guidelines for the minimum curriculum. The curriculum entails a minimum of four years of full-time study at a university recognised for the purposes training pharmacists by the SAPC. In 2000 the SAPC published new regulations relating to pharmacy education and training by prescribing seven unit standards for pharmacists' minimum curriculum (RSA DoH 2000a:13).

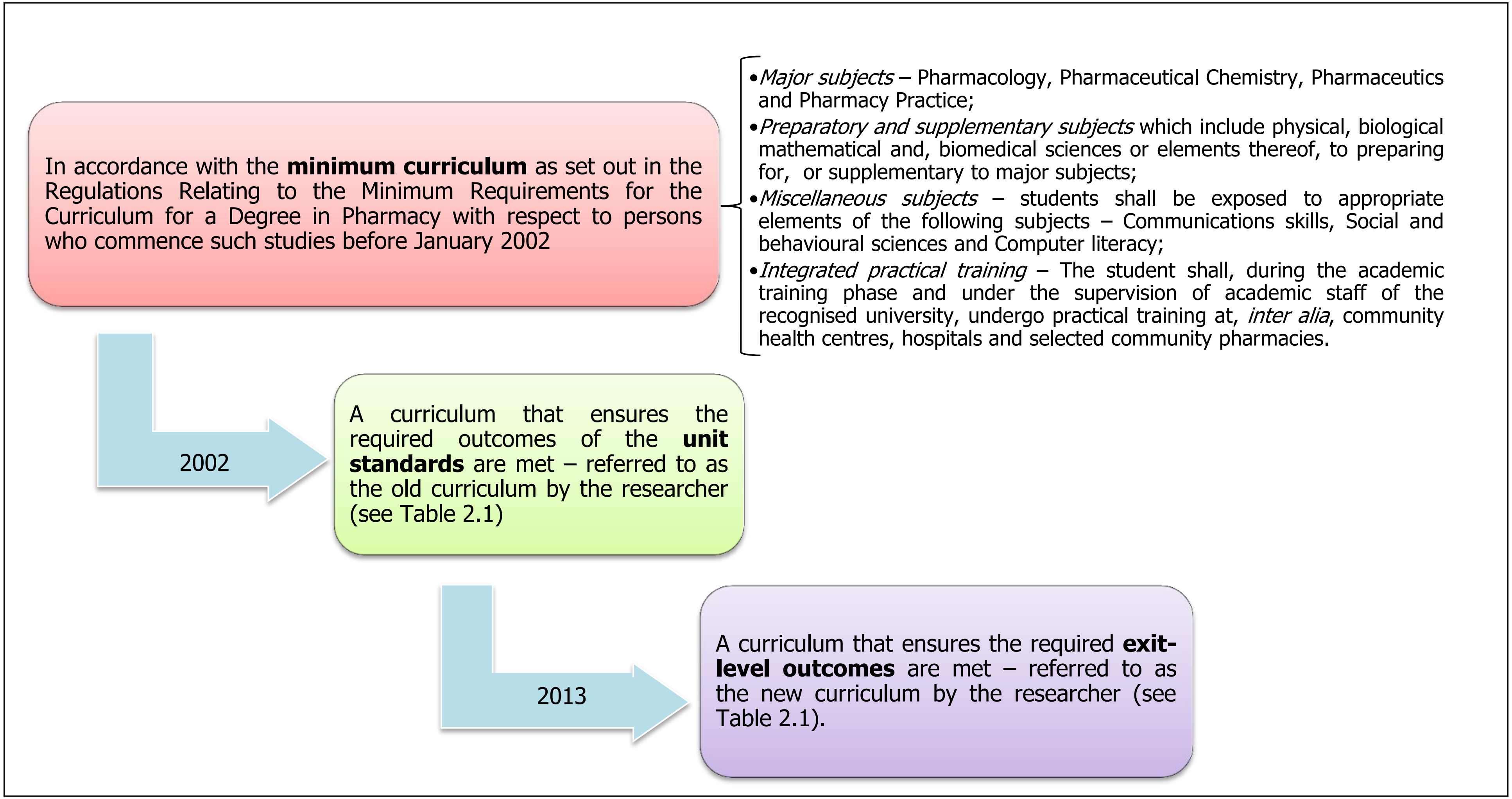

FIGURE 2.2: PHARMACY CURRICULUM CHANGES OVER TIME

It is evident that the original minimum curriculum was more scientific in nature (product-oriented) and the new exit-level outcomes are more patient-oriented (cf. Table 2.1).

The pharmacy curriculum should address the underlying philosophy of pharmacy as a patient-orientated profession, through competency and skills to fulfil the healthcare needs of the South African people (SAPC 2010b:2).

The pharmacist is one of the most accessible providers of healthcare information and should advise patients on the safe, rational and appropriate use of medicine, as well as essential clinical services including screening and referral services. The pharmacist should also be the controller of safe, effective and quality medicine, including formulation, manufacturing and distribution (GPP 2010b:2).

Pharmaceutical care principles should be a focus by taking responsibility for the outcome of therapy and by being actively involved in effective pharmaceutical services (RSA DoH 2000b:4). The pharmacist should be committed to competency and professionalism and co-operation with other members of the healthcare team in the interest of the patient.

While programmes must conform to the qualification standards of the SAPC, some allowance is made in terms of the contextual realities at the various institutions. Matters such as specific assessment tasks, module composition and the choice of elective modules to name just a few could be decided on at the different institutions.

The SAPC has recently published Good Pharmacy Education Standards (RSA 2014:78) to ensure quality pharmaceutical education across South Africa. The purpose of *Good Pharmacy Education Standards* (GPES) in education is to guarantee that pharmacists practising in SA are prepared for the roles they have to take on in practice and that their performance complies with the exit-level outcomes of the qualification. The learner should be enabled by the provider to reach the desired level of competence.

The GPES guidelines require the necessary mix of educational and patient care activities. Work-integrated learning in pharmacy must integrate, apply, strengthen and develop the knowledge, attitudes, skills and values developed through other components of the curriculum.

Simulation experiences are now specifically addressed in the GPES guidelines and the SAPC require the necessary environment – including facilities for practice simulations, "in order to provide students with practical and simulated pharmaceutical care experiences" (RSA 2014:12).

One of the recommendations of the World Health Organization (WHO) is the inclusion of the use of simulation methods by health professionals at education and training institutions (WHO 2013:37). According to the WHO, "simulation methods are useful in helping students to acquire skills and to accelerate learning".

Table 2.1 shows the comparison between the previous unit standards for entry-level pharmacists and the new exit-level outcomes curriculum used by pharmacy schools to develop their curricula. The old curriculum has a teach-out period until 2017 and the exit-level outcomes (ELO) for the new curriculum has already been introduced and approved by the SAPC. The interpretation of these standards and the curriculum planning for each of these standards remain the prerogative of each training institution. The different academic programmes of the individual universities lead to the conferment of an equal qualification, which means that at all the programmes must be consistent with the purpose, rationale, learning outcomes, credit structure and assessment criteria of that qualification to produce capable entry-level pharmacists.

TABLE 2.1 COMPARISON OF THE SOUTH AFRICAN PHARMACY COUNCIL UNIT STANDARDS (OLD CURRICULUM) FOR ENTRY-LEVEL PHARMACISTS (SAPC 2010a:22) AND THE EXIT-LEVEL OUTCOMES FOR THE NEW CURRICULUM

[Table continues on next page]

Unit Standards for the previous (old) pharmacy curriculum		Exit-Level Outcomes for the current (new) pharmacy curriculum
Organise and control the manufacturing, compounding and packaging of pharmaceutical products	**Capability**: A person who has achieved this standard is capable of authorising and controlling personnel, materials and equipment in the manufacturing, compounding and packaging of pharmaceutical products according to good manufacturing practice, and controlling the quality of these, leading the work team and assisting in the training of pharmacists' assistants-in-training.	Manage the manufacture, packaging and registration of pharmaceutical products in compliance with GMP and GCP.
Organise the procurement, storage and distribution of pharmaceutical materials and products	**Capability:** A person who has achieved this standard is capable of controlling the procurement, ordering, receiving, sampling, releasing, storing, preparing for dispatch, controlling transport and keeping records of pharmaceutical materials and products in compliance with legal and technical requirements.	Manage the logistics of the selection, procurement, storage, distribution and disposal of pharmaceutical products.
Dispense and ensure the optimal use of medicines prescribed to the patient	**Capability**: A person who has achieved this standard is capable of supplying medicines to humans and animals on the prescription of an authorised prescriber. This implies the gathering of all information required to assess and prepare a prescription, applying pharmaceutical techniques and principles; providing information and counselling to the patient/caregiver on the optimal use of the prescribed medicine, implementing a care plan and monitoring the therapeutic outcomes thereof.	Dispense medication and ensure optimal pharmaceutical care for the patient in compliance with GPP and, where applicable, GCP.
Provide pharmacist-initiated care to the patient and ensure the optimal use of medicine	**Capability**: A person who has achieved this standard is capable of assessing the medicine and health needs of the patient, identifying the patient's signs and symptoms, devising, documenting and implementing a pharmaceutical care plan and monitoring the outcome	Apply a pharmaceutical care management approach to ensure rational medicine use

Provide education and information on health care and medicine	**Capability**: A person who has achieved this standard is capable of accessing, interpreting, evaluating and supplying information on the nature and use of drugs, disease states and health care to the public, health care providers and patients.	Promote public health.
Promote community health and provide related information and advice	**Capability**: A person who has achieved this standard is capable of identifying community health needs, planning and implementing promotive and preventive programmes, including screening, directly observed therapy and immunisation	Promote public health.
Participate in research and ensure the optimal use of medicine	**Capability**: A person who has achieved this standard is capable of participating in research and applying research findings to health care	Participate in research.
		Integrate and apply foundational scientific principles and knowledge to pharmaceutical sciences
		Apply integrated knowledge of product development and formulation in the compounding, manufacturing, distribution and dispensing of pharmaceutical products.
		Compound, manipulate and prepare medication in compliance with Good Pharmacy Practice (GPP) rules, Good Manufacturing Practice (GMP) and/or Good Clinical Practice (GCP) guidelines.
		Initiate and/or modify therapy, where appropriate, within the scope of practice of a pharmacist and in accordance with GPP and GCP, where applicable.
		Integrate and apply management principles in the practice of pharmacy.

ELO's was developed by the SAPC (RSA 2014:29) for the pharmacy profession. These ELO form the basis for the (new) BPharm curriculum, as registered with the SAQA and contain all the knowledge, skills and attitudes as needed by the entry-level pharmacist.

The SAPC states that "Although it is not always directly evident how the combination of knowledge, skills and attitudes contribute to the demonstration of competence, an extensive knowledge of the principles of pharmacy is essential to enable the pharmacist to apply his/her skills in effectively dealing with the demands of pharmacy practice in the various sectors (cf. 2.2.3) of the profession" (SAPC 2016:8).

Anderson, Brock, Bates, Rouse, Marriot, Manasse, Futter, Bhojraj, Brown and Gal (2011:1) emphasize that the application of knowledge can be an important barrier to achieving health. Health professions education, in this case, pharmacy education, should prepare pharmacists to use their knowledge effectively and be able to engage as competent healthcare team members to address the community needs. They explain that "in most systems, health professionals are the mediators of knowledge between those who generate it (researchers) and those who need it (patients and communities)".

2.2.2 Entry requirements for approved Bachelor of Pharmacy degree providers

Each South African university require prospective applicants to obtain a National Senior Certificate (NSC) as minimum statutory requirement for admission to degree studies. Each university reserves the right to apply a screening model (calculating the Academic Achievement Point Score, APS), on the basis of which consideration will be given to a candidate's application (NWU 2015:Online).

Admission requirements of institutions registered with the South African Pharmacy Council as providers for a qualification as a pharmacist are unique to each institution.

2.2.3 Scope of practice as a registered pharmacist

After completing their pharmacy degree, students need to complete an internship of one year (two years for academic interns) in an approved training facility under personal supervision of a tutor registered with the SAPC.

Completion of a community service year is also compulsory before registration as a pharmacist. Once registered as a pharmacist with the SAPC, the individual may choose the pharmaceutical sector they want to pursue a career in.

Career opportunities with a BPharm degree according to the University of the Western Cape (UWC) website (UWC 2015a:Online) include community pharmacy or more commonly known as retail pharmacy, hospital pharmacy including small-scale manufacturing of specialised patient-specific medication and industrial or manufacturing pharmacy where pharmacists are involved in manufacturing, quality control, packaging, registration and marketing of medication. Qualified pharmacists may also wish to pursue a career in academic pharmacy, which involves teaching of pharmacy students. It is important to understand that a pharmacy graduate should be able to work in any approved sector of pharmacy, regardless from which approved institution they graduated.

The scope of practice of pharmacist in different pharmaceutical sectors is set out in Table 2.2.

TABLE 2.2 PHARMACISTS' CAREER OPTIONS IN THE PHARMACEUTICAL SECTOR WITH REGISTRATION AS A PHARMACIST WITH THE SOUTH AFRICAN PHARMACY COUNCIL AND THEIR SCOPE OF PRACTICE IN EACH SECTOR (RSA DoH 2000:8)
[Table continues on next few pages]

Scope of practice	Community & Institutional /	Wholesale Pharmacy	Manufacturing /	Consultant Pharmacy
(1) the provision of pharmaceutical care by taking responsibility for the patient's medicine-related needs and being accountable for and meeting these needs, which shall include, but not be limited to the following functions:	X			
(a) evaluation of a patient's medicine related needs by determining the indication, safety and effectiveness of the therapy;	X			X
(b) dispensing of any medicine or scheduled substance on the prescription of an authorised prescriber;	X			
(c) furnishing of information and advice to any person with regard to medicine;	X	X[1]	X[2]	
(d) determining patient compliance with the therapy and follow up to ensure that the patient's needs are being met; and	X			X
(e) provision of pharmacist-initiated therapy;	X			X
(2) the compounding, manipulation or preparation of any medicine or scheduled substance;	X			
(3) the purchasing, acquiring, keeping, possessing, using, supplying or selling of any medicine or scheduled substance;	X	X	X	
(4) the application for the registration of a medicine or medical device;	X	X	X	X
(5) the re-packaging of medicine;	X			

Community and Institutional Pharmacy (Regulation 18), Wholesale Pharmacy (Regulation 17), Manufacturing Pharmacy (Regulation 16) & Consultant pharmacy (Regulation 19)
X[1] – with regard to medicine distributed by him, her or it; X[2] – with regard to medicine manufactured by him, her or it;

Scope of practice	Community & Institutional / Wholesale Pharmacy		Manufacturing / Consultant Pharmacy	
(6) the promotion of public health in accordance with guidelines and standards as determined by a competent authority, which includes but shall not be limited to:	X			
(a) the provision of information and education regarding the promotion of human health;	X			X
(b) the provision of immunisation, mother and childcare, blood pressure monitoring; health education; blood-glucose monitoring; screening tests for pregnancy; family planning; cholesterol screening tests; HIV screening tests; urine analysis; and visiometric and audiometric screening tests;	X			
(c) the provision of animal health-care services, which includes:	X			
(i) the compounding and dispensing of prescriptions written by veterinarians and ensuring the optimal use of veterinary medicines;	X			
(ii) the immunisation of animals;	X			
(iii) the handling of minor and/ or self-limiting ailments in animals; and	X			
(iv) the provision of information and education regarding the promotion of animal health;	X			
(7) the initiation and conducting of pharmaceutical research and development;	X	X	X	X
(8) the provision of primary care drug therapy with prior authorisation from council; and	X			
(9) any other health service as may be approved by council from time to time;	X	X	X	X
(10) the manufacturing of any medicine or scheduled substance;			X	

Community and Institutional Pharmacy (Regulation 18), Wholesale Pharmacy (Regulation 17), Manufacturing Pharmacy (Regulation 16) & Consultant pharmacy (Regulation 19)

Scope of practice	Community & Institutional / Wholesale Pharmacy	Manufacturing / Consultant Pharmacy
(11) the formulation of medicine for the purpose of registration as a medicine;		**X**
(12) the distribution of medicine or scheduled substances; and		**X**
(13) the repackaging of medicine in accordance with the Medicines Act;		**X**

Community and Institutional Pharmacy (Regulation 18), Wholesale Pharmacy (Regulation 17), Manufacturing Pharmacy (Regulation 16) & Consultant pharmacy (Regulation 19)

The National Department of Health introduced the National Drug Policy (NDP) in 1996 to transform the pharmaceutical sector of South Africa. Some of the transformational aims included "transforming training institutions so that they produce health care professionals who function effectively and efficiently in meeting the country's health care needs" (RSA DoH 1996:3).

The NDP's intentions are clear. They include modification of the curricula and syllabi of training institutions to produce appropriately qualified and motivated health workers.

"A slow-burning crisis is emerging in the mismatch of professional competencies to patient and population priorities because of fragmentary, outdated, and static curricula producing ill-equipped graduates from underfinanced institutions" (Frenk, Chen, Bhutta, Cohen, Crisp, Evans, Fineberg, Garcia, Ke, Kelly, Kistnasamy, Meleis, Naylor, Pablos-Mendez, Reddy, Scrimshaw, Sepulveda, Serwadda & Zurayk 2010:7). The SAPC therefore needed to align the ELO's of the pharmacy curriculum with the aims of NDP.

Simulation as a part of any teaching-learning strategy is now legislatively addressed by the SAPC to achieve GPES (Good Pharmacy Education Standards). It is, therefore, important to clarify simulation and its related concepts. Understanding of these principles may benefit the implementation of simulation activities into undergraduate pharmacy curricula.

2.3 OVERVIEW OF SIMULATION HISTORY

According to Bradley (2006:254), the use of simulation in its many forms is now widespread in many fields of human endeavour. Simulation has a history stretching back over centuries. The military has been a long-term user of simulation. Examples of this include chess (which constitute an early attempt at war gaming), jousting (aimed at honing the battlefield skills of knights), and the 18th century Kriegspeil (which developed into current-day, complex, computerised warfare simulations). In addition, high-fidelity flight simulations are generally found in the modern aviation industry, and this is also mirrored in the space programme and in the nuclear power industry.

What all these groups have in common, is that the cost and risk associated with real-life testing are prohibitive, rendering such testing unfeasible. As these same conditions are applicable to the medical industry, it is then no surprise that simulation is gaining prominence in the medical profession.

Simulation in healthcare education has been evolving at an ever-accelerating rate over the past 20 years (Khan, Pattison & Sherwood 2011:1). This new movement has necessitated the introduction of new and innovative methods of teaching, to be used in conjunction with traditional methodologies.

Shilkofski (2012:Online) states that simulation-based medical education (SBME) encompasses any educational methodology that replicates, creates, or imitates the real clinical environment. "SBME is a method of medical education that integrates with, and complements other traditional and non-traditional training approaches, such as lectures, problem-based learning (PBL) and bedside teaching" (Ziv, Ben-David & Ziv 2005:193).

Careful integration of simulated events and simulator practice with other educational events and curriculum features, including clinical experience, lectures, reading, laboratory work, problem-based learning (PBL) and many others, is the premise of SBME (McGaghie, Issenberg, Petrusa & Scalese 2010:50). This concept is further supported by Scerbo and Dawson (2007:225) who formulated that "teaching and learning using simulation can occur using all levels of simulation technology as long as it is used with appropriate curricula".

2.4 DEFINITION OF SIMULATION

Simulation has been defined by a number of authors over the years:

Gaba (2004:i2) states that "Simulation is a technique – not a technology – to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner".

Flanagan, Nestel and Joseph (2004:57) state that "simulation is a generic term that refers to the artificial representation of a real-world process to achieve educational goals via experiential learning".

Leigh and Spindler (2004:54) explain that simulation refers to activities designed to assist participants in acquiring insight into "the complex relationships and interconnected structures within a particular context" which are at the heart of simulation, and that this is a way for participants to prepare for (or review) action in the real world.

The Council on Higher Education (CHE) (CHE 2011:76) defines simulated learning as "learning simulated through an activity that involves the imitation of the real world in academy. The act of simulating something entails representing certain key characteristics of the selected workplace and includes such things as laboratories, mock meetings, flight simulations etc."

Based on these descriptions of simulation, SBME could form the bridge between classroom learning and real-life experience that could help graduates with the transition from the classroom to the workplace of a pharmacist.

2.5 THE RATIONALE FOR USING SIMULATION IN TEACHING

Issenberg (2006:203) suggests that we move past the potential role of simulation in comparison to other more traditional methods of training and, instead, focus on the most effective use of simulation for healthcare education. According to Rodgers (2007:25), the use of simulation in the learning environment is being promoted by numerous drivers. The author describes the following drivers:

- The growth of medical knowledge. Curriculum developers and educators are faced with the challenge of finding novel ways to accommodate the exponential growth of medical knowledge in the curriculum.
- Changes in medical education: The demand for accountability and outcomes measurement in allied health, medical, nursing and pharmacy education continues to increase. To meet the demand for improved learner outcomes, the evolution of existing education practices and curricula is essential.
- Patient safety: The use of patients as learning models for students is inherently risky and continued implementation of these models is prohibited by the risk factors. Simulation shows tremendous potential as a suitable, safe and patient-free alternative to allow student learning and demonstrations of competence.
- Realism: Advances in technology are increasing the affordability of simulation at fairly high levels of fidelity. This results in increased accessibility of simulation to healthcare education organisations.

- Patient availability: Improvements in medical care have reduced the prevalence of many types of patient cases in modern society. Accordingly, the teaching platform for these increasingly rare diseases is reduced. Murphy, Hartigan, Walshe, Flynn and O'Brien (2011:143) add that lecturers cannot ensure student exposure to commonly occurring critical situations while on rotations. The case mix that students are exposed to in clinical training is also changing. Simulation could provide replacement training to amplify students' clinical experience.
- Student availability: Simulation could play a significant role in increasing efficiencies in student learning activities. It could assist in reducing the impact of the severe limitations on the time available to students to master new skills caused by the combination of increased learning demands and schedule restrictions.
- Standardisation and replication: In the context of intensifying pressure for improved learner outcome measurements, simulation could provide consistent replication of patient cases. This could, in turn, facilitate the achievement of standardisation in evaluation.

In conclusion, the level and type of simulation will need to be adapted to the educational needs of the learner and the design and intended outcomes of the programme.

2.6 THE ADVANTAGES AND DISADVANTAGES OF SIMULATION IN HEALTHCARE

Lin, Travlos, Wadelin and Vlasses (2011:5) identified several advantages and disadvantages of the use of simulation in healthcare:

The advantages include:

- Patient safety and quality: A key advantage of simulation is the absence of risk or harm to live patients.
- Simulation could assist in filling the need for faculty / clinical site resources. The potential risks of allowing learners to apply their knowledge independently in a clinical practice setting (such as disruption of the practice, providing misinformation to patients or harming patients) are negated in a simulation environment.
- Faster time to competence: Simulation could fill gaps in clinical exposure by allowing learners the opportunity to participate in a wide variety of exercises that would not necessarily form part of real-life training experiences in all instances. The possibility

of repetition in a simulation environment could also decrease the time it would otherwise have taken to master a clinical skill in a real-life clinical setting.

- Ability to practice skills and build confidence: Repeated simulation exercises could reduce real-life errors in clinical practice.
- Structured feedback: Learners are provided with immediate and structured feedback.
- Controlled environment: Learners are exposed to exactly the same situations in the same settings. Evaluation is also consistent.
- Safe learning environment. Learners have the assurance that it is not dangerous to make mistakes in a simulation environment. This builds confidence and provides an opportunity to practice skills repeatedly.
- Addresses the gap in clinical conditions / settings: Simulation exercises could reduce the variability in the types of patients and conditions encountered in real-life settings.

The disadvantages or possible limitations include:

- Unrealistic: Simulation is not "real", no matter how advanced the technology or simulation environment. There will always be differences between working with real patients and simulated settings.
- Faculty time: Successful simulation experiences require faculty time and resources to plan conduct and assess the exercises.
- Faculty proficiency with simulation equipment: Faculty members with adequate clinical knowledge must be trained in conducting simulation exercises and the use of simulation equipment. It may be challenging to allocate adequate resources in this regard.
- Focuses on specific competencies: Simulation exercises are aimed at developing specific skills, such as taking a patient's blood pressure. However, in this example communication skills and emotional awareness are not developed.
- Requires full participation / engagement of the learner: If learners approach simulation with the attitude that simulation is unrealistic, it could limit not only their engagement, but also the potential learning experience.
- Financial and spatial resources: The cost of sophisticated simulation equipment could be prohibitive. In addition, there must be adequate space to house the equipment and conduct the simulation exercises.
- Questionable return on investment: It is not possible to determine return on investment with absolute certainty.

The conclusion can be reached that the advantages of simulation outweigh the possible limitations / disadvantages to such an extent that the use of simulation seems to be appropriate as a teaching strategy to achieve mastery of skills.

2.7 LEARNING THEORIES IN SIMULATION

A variety of educational theories are presented in support of the use of simulation as a teaching strategy. However, to date there has been no single theory that describes the entire field of simulation. It is warranted to undertake an exploration of the reasons why patient simulation is effective as a learning strategy if one considers the confidence that is built on simulation as a "learning strategy for improving healthcare providers' learning, while at the same time increasing patient safety" (Rodgers 2007:71).

According to Kneebone (2006:160) there is a need to elaborate on the supporting 'theory of simulation' in order for simulation to be customised, or fit for purpose. According to the author, such a theory will establish the scientific basis of simulation, provide insight into the theoretical frameworks of related disciplines, and assist learners and teachers in identifying and choosing the type of simulation that best meet their needs at any point in time. The author is also of the view that it is easy to get lost in a confusion of deceptively charming, but essentially different fields, if there is no coherent underpinning theory. It is, therefore, concluded that the simulation design needs to be a carefully planned and executed undertaking.

It appears as if the emergence of new learning technologies has overlapped with an increased recognition and awareness of alternative theories for learning. Oliver (2000:1) states that these theories suggest numerous problems and inefficiencies with conventional forms of teaching.

Dunn (2004:15) reviewed simulation literature and lists five leading educational theoretical viewpoints, namely constructivist, cognitivist, behaviourist, social learning and humanist. According to the author, there must be recognition of two underlying hypotheses when education theory relevant to critical care instruction is reviewed in context. Firstly, improved teaching techniques are associated with better learning. Secondly, education as a discipline (similar to the areas of research and practice) has its own tool set (i.e. the knowledge-of-education theory). If this tool set is applied well and studied adequately, learner (and even patient) outcomes could be facilitated.

Bradley and Postlethwaite (2003:1-3) stated that the field itself is theory-rich. In their view, the abundance of conceptualisation of learning could assist in creating an understanding of how learning is taking place and how simulation can support this learning.

Grabinger (1996:667) provides a meaningful comparison of the assumptions of learning that were typical of older views and those new assumptions that are aligned more with contemporary constructivist views; see Table 2.3.

TABLE 2.3: OLD VERSUS NEW ASSUMPTIONS ABOUT LEARNING
(Adapted from Grabinger 1996:667)

OLD ASSUMPTIONS	NEW ASSUMPTIONS
"People transfer learning with ease by learning abstract and decontextualized concepts	**People transfer learning with difficulty, needing both content and context learning**
Learners are receivers of knowledge	**Learners are active constructors of knowledge**
Learning is behaviouristic and involves the strengthening of stimulus and response	**Learning is cognitive and in a constant state of growth and evolution**
Learners are blank slates ready to be filled with knowledge	**Learners bring their own needs and experiences to learning situations**
Skills and knowledge are best acquired independent of context	**Skills and knowledge are best acquired within realistic contexts. Assessment must take more realistic forms"**

These new assumptions about learning may support the use of simulation to achieve the learning outcomes. Rao (2011:1) states that the desired learning outcomes can be achieved if the learning activities focus on engaging students by providing opportunities and support for students to build on their knowledge, participate actively and practice.

2.8 THEORETICAL FOUNDATION FOR SIMULATION AS PEDAGOGY

Rodgers (2007:71) investigates modern-day thinking in respect of learning theories, with the aim of providing a possible basis for the effective use of simulation. There is a wide spectrum of learning theories that could potentially influence the creation of an integrated simulation learning theory. Learning theories, whether clear or implied, and whether informed by study or teacher intuition, play a role in the choices the teacher makes concerning his/her teaching methodology.

2.8.1 Constructivism

Origin and premise: Originated from the works of John Dewey, the basic premise of constructivism is that learners each have a distinctive knowledge base and frame of reference, and they rebuild that knowledge based on new information, Rodgers (2007:107).

Relevance to simulation:

The three elements of constructivism that have relevance to simulation are:

- The unique experiences, skill and knowledge of each learner shape their simulation experience. As such, each learner has opportunity to access and build on their own values, concepts, customs and views when they perform simulation activities.
- There is potential for each learner to approach simulation activities from a different vantage point. Where existing knowledge is absent or inadequate, learning occurs through exploration. In this context, simulation could break through existing knowledge barriers when learners are pushed to discover new areas of knowledge.
- In order to learn, learners must interact within a social context. In this regard, a team approach to patient care is a fundamental premise of mannequin-based simulation and, in order to obtain success, there must be selective interaction between team members irrespective of the nature of the team.

2.8.2 Experiential learning

Experiential learning theory (ELT) is often mentioned in the simulation literature as a prominent learning theory that supports simulation learning (Rodgers 2007:107). This is based on concepts presented by Kurt Lewin and David Kolb. For ELT to be effective, two primary components must be present. The first component (cf. Figure 2.3) is an active, concrete experience in which the learner interacts with the learning environment.

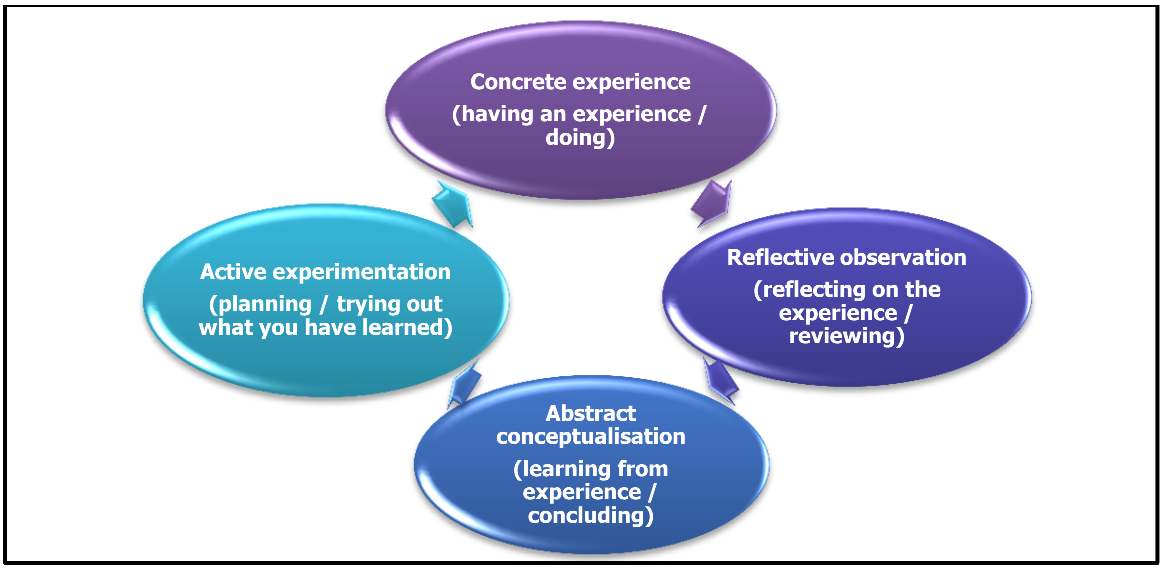

FIGURE 2.3: KOLB'S LEARNING CYCLE FOR EXPERIENTIAL LEARNING (Adapted from Davies 2013:6)

The second component is a reflective process where the actions of the experience are reviewed and areas for improvement identified. This is where leaning happens. The process then continues in a cycle that builds on each experience and continues with reflective action or observation on the simulation or experience and their own performance through debriefing. In contrast to experience and reflection, allowing the learner to make sense of what happened, abstract conceptualisation facilitates bridging to future experiences. Active experimentation follows once the learner has developed a new mental model and the opportunity to test this in actual practice arise, according to Zigmont, Kappus and Sudikoff (2011:50).

Relevance to simulation:

Simulation provides immersive experiences based on the conceptualisation of learning very well. However, the learning does not occur in the experience itself. Steinaker and Bell (1979:7) point out that experiential learning is an on-going and deepening involvement with an experience. Experiential learning is about the total experience, bringing together knowledge, skill and attitudes as well as the idea that the experience happens at different and progressive levels. According to Steinaker and Bell (1979:2) this complements the cognitive work of Dewey and Bloom in that the simulation experience can vary according the veracity of the experience. High-order thinking skills are achieved when one has mastered each level of Bloom's taxonomy. Bloom's taxonomy encompasses all facets of learning, which include the cognitive, affective, and psychomotor domains. Of these, the cognitive domain seems to receive the most attention and educators strive to provide didactic experiences that touch on knowledge, comprehension, application, analysis, synthesis and evaluation (Vyas, Ottis & Caligiuri 2011:1).

Leinster (2009:19) states that although Bloom recognised all three domains, he did not produce a taxonomy for all three domains, in contrast to popular belief. However, a similar grid or triangle, referred to as Miller's triangle can be produced that can define the learning outcomes in relation to the skills that the learner must acquire.

Cruess, Cruess and Steinert (2015:1) amended Miller's pyramid to include a new top tier of professional identity formation namely "is", which represents the embodiment of professional identity (cf. Figure 2.4).

Cruses, Cruses, Boudreau, Snell and Steiner (2014:1450) argue that the main focus of medical education should be to ensure that each individual gains both knowledge and skills, as well as a professional identity to ensure they think, act and feel like a medical professional.

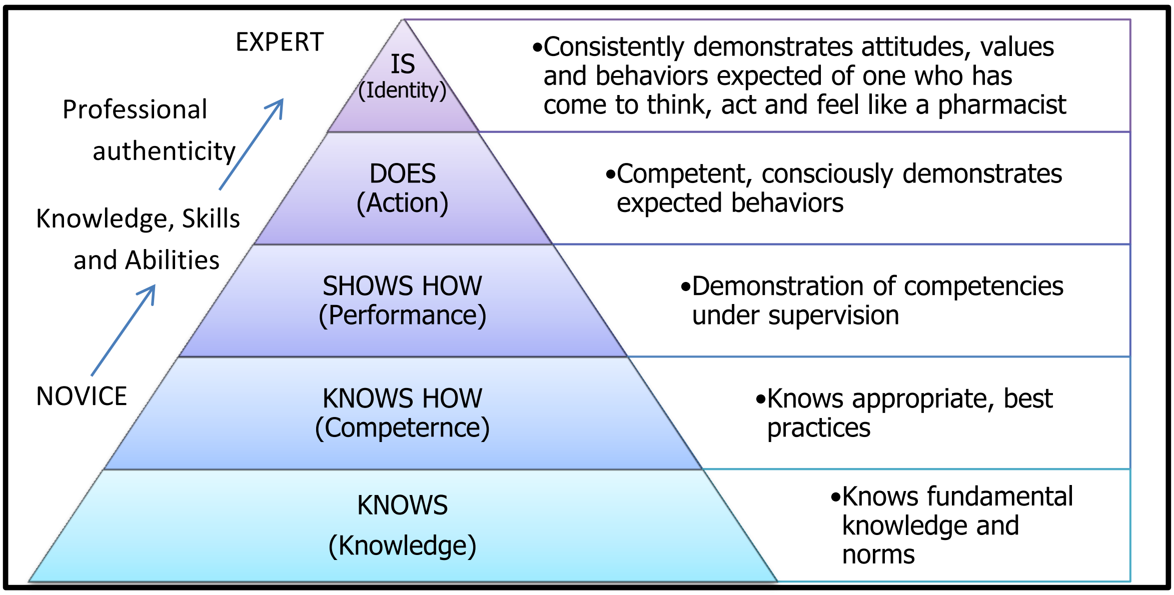

FIGURE 2.4: MILLER'S PYRAMID
(Adapted by Cruess *et al.* 2015:Online)

Traditional teaching methodologies (lectures) are able to provide excellent cognitive learning opportunities. However, while traditional teaching and assessments are good measures of a student’s cognitive learning, they do not necessarily reflect student performance in practice.

Fowler (2008:430) explains that the mere existence of experience and reflection on their own is not enough: there has to be meaningful interaction or overlap of the two. Factors that assist the interaction will increase learning.

For experiential learning to occur, both experience and reflection must be present. Experiential learning will be limited where the experience and the reflection are of limited quality.

Fowler (2008:429) quotes Dewey stating that “there should be brief intervals of quiet reflection provided for even the young. But they are periods of genuine reflection only when they follow times of more overt action and are used to organise what has been gained in the periods of activity”.

2.8.3 Adult Learning Theory

Rodgers (2007:71) states that the “Adult Learning Theory, developed from concepts presented by Eduard Lindemann and Malcolm Knowles, centres on six assumptions that make andragogy (the teaching of adults) different from pedagogy (the teaching of children)”.

Relevance to simulation:

These assumptions can be seen in patient simulation. These assumptions are explained by Zigmont *et al.* (2011:47):

- Adults have an intrinsic need to know: Adults must believe that the learning outcome is usable, concrete and practical.
- Adults have self-responsibility: The self-efficacy of adults are enhanced if they feel competent, are given autonomy, and feel as if they are part of an environment in which they are respected and connected to one another.
- Adults have a lifetime of experiences: The prior knowledge of adult learners constitute ever-increasing resources for learning.

- Adults have an innate readiness to learn: A need to know how to perform more effectively in some aspects of one's life usually triggers an eagerness to learn.
- Adults have a life-centred orientation to learning and they are driven by internal motivating prompts. Adults control their learning and therefore end up providing their own motivation.

Ziv (2009:219) describes simulation as a "hands-on" (experiential learning) learning modality, acknowledged by adult learning theories to be more effective".

2.8.4 Brain-Based Learning

Brain-based learning (BBL) is a fairly new learning theory that has received limited attention in simulation literature. BBL examines how the brain learns and a number of theorists are active in their efforts to contribute towards building this learning theory.

Relevance to simulation:

Caine and Caine (1995:46) identify three essential elements for BBL pertinent to patient simulation:

- Learners must be in a state of relaxed alertness. In other words, learners must be attentive to new challenges, but not to the extent that fear (including fear of failure) could negatively impact the education process. Simulation represents a safe environment for learners to face new encounters without the fear of patient harm.
- There must be orchestrated immersion in complex experiences. It is incumbent on the instructor to create a planned, well-designed immersive simulation experience with specific objectives.
- Learners must actively process the experience. Comparable to the reflective thought process found in experiential learning, learners must process the experience to identify improvement areas.

2.9 SIMULATION DESIGN

2.9.1 Potential simulation design guides

Simulation design, according to Jeffries (2005:100), must be suitable and support course objectives, skill competencies and learning outcomes. It is possible, using the 11 dimensions defined by Gaba (2004:i2), to look at potential strategies for how simulation techniques may be further utilised in the training and education in the pharmacy profession, according to Health Workforce Australia (2011:40).

Dimension 1 (the purpose and aims of the simulation activity)

A simulated environment could provide an ideal opportunity to take 'dry runs' at real patient experiences. An example of this is where a pharmacist is required to demonstrate the use of an asthma device and provide suitable counselling to the patient. Simulation could also be used to measure competency level of the students and monitor their performance.

Dimension 2 (the unit of participation in the simulation)

Pharmacists are required to work individually, or as members of healthcare teams which could be comprised of any number of other healthcare professionals. These team environments could vary in size and could be small, such as a small retail pharmacy; medium, such as hospital pharmacies; or large, such as government bodies. Pharmacy students' skills, including communication, teamwork and work-readiness skills, could be enhanced through the use of varied simulation environments.

Dimension 3 (the experience level of simulation participants)

The experience level of the participants will determine the difficulty level of each simulation exercise, and adjustments could be made as and when required.

Dimension 4 (the healthcare domain in which simulation is applied)

Technical and non-technical skills development could be enhanced through the use of simulation within the pharmacy profession.

Dimension 5 (the healthcare discipline of personnel participating in the simulation)

The training of pharmacists may be the focus of simulation. However, similar simulation methods could be used to train pharmacist assistants, pharmacy technicians and pharmacy or dispensary managers.

Dimension 6 (the type of knowledge, skill, attitudes and behaviour addressed in simulation)

Participants in simulated learning environments (SLEs) are required to respond as they would have in real life, in various situations that imitate reality. This could, as a starting point, be used to build a theoretical understanding before presenting increasingly difficult technical skills, and, ultimately, to implementing more intricate scenarios that require higher non-technical cognitive and social skills.

A student could, for example, participate in a simulated activity where they are asked to show a patient how to use an asthma inhaler. At the onset they would require a theoretical understanding of the equipment used. Thereafter, they could be given various devices (placebo inhaler-devices) to handle and demonstrate.

The learning experience could be intensified if a human-simulated patient with diminished cognitive abilities or poor dexterity is used, as the student not only learns how to counsel a patient, but also develops problem-solving; decision-making and professionalism skills.

Dimension 7 (the age of the patient being simulated)

Simulated activities may include neonates, toddlers, adults and elderly patients.

Dimension 8 (the technology applicable or required for simulations)

The equipment and technology necessary for simulations could cover a wide spectrum. It could, for example, be as modest as doing a role-play exercise or using an orange to mimic a muscle and demonstrate an intramuscular injection. At the other end of the scale, demonstration of clinical tasks such as the blood pressure measurement could be achieved through the use of high-fidelity computerised mannequins.

Cannon-Diehl (2009:129) conducted research, which indicates that students' expectations of their course content have increased. Students also require their learning and development opportunities to be more practical and "hands-on". Cannon-Diehl concludes that today's students should find simulation (where the participants are involved) appealing.

Dimension 9 (the site of simulation participation)

Different locations could be used for simulation activities. However, dedicated sites, which are set up to replicate the environment where pharmacists practice; such as a dispensary fitted out with computers, printers and medications would be ideal.

Dimension 10 (the extent of direct participation in the simulation)

It is not always necessary to be directly involved in a simulation activity to derive benefit from it. While one or more students participate in the simulation activity, such as a patient-pharmacist discussion, the remaining students could learn through observing and evaluating the activity.

Dimension 11 (the feedback method accompanying simulation)

Giving feedback could enhance a student's learning experience. This was confirmed in a review by McGaghie *et al.* (2010) in which they emphasise the importance of feedback in simulation-based medical education. Feedback may occur in many ways. For example, where a virtual reality computer system or mannequin is used, the simulator may provide feedback.

To conclude, the 11 dimensions of Gaba (2004:i2) can be a useful tool in the simulation design, particularly when combined with the Simulation Model, see Figure 2.5, designed by Jeffries (2005:97). Effective learning through the use of simulation requires proper simulation design and the suitable organisation of students in the simulation according to Jeffries (2005:97).

Jeffries (2005:98) explains that unlike traditional classroom settings where instruction is more teacher-centred, teaching using simulation is student-centred, with the teacher taking the role of facilitator in the learning process of the student. The students in the model are expected to be accountable for their own learning to some degree, and this is more likely to happen if they are aware of the rules of the simulation activity.

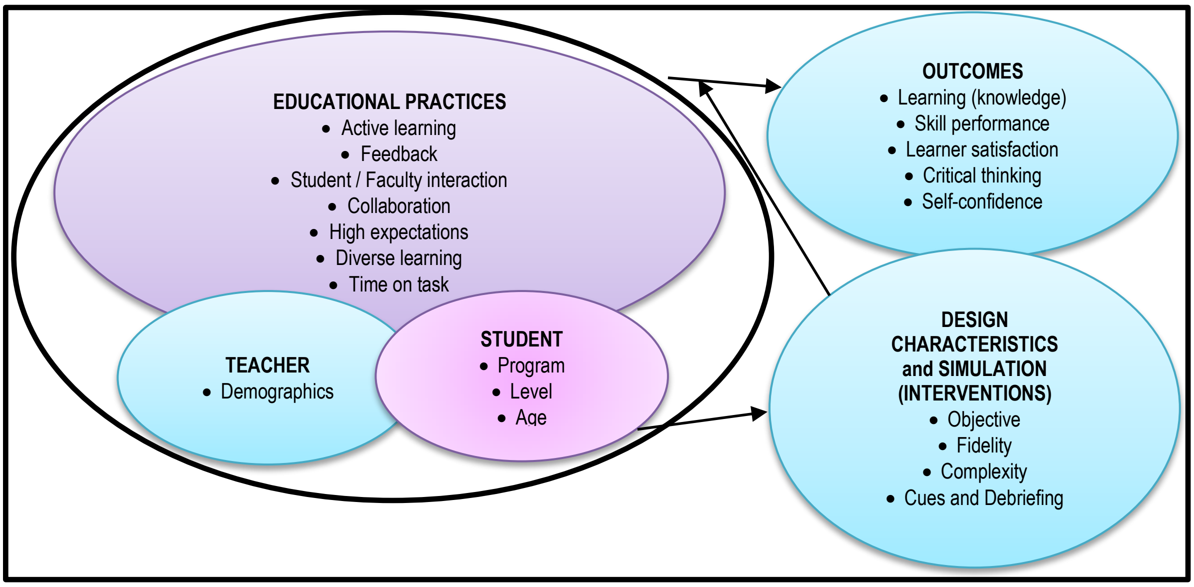

FIGURE 2.5: SIMULATION MODEL
(From Jeffries 2005:97)

Jeffries (2005:98) highlighted the importance of combining educational practices with certain pedagogical principles which, when used consistently, results in students learning and satisfaction. The simulation model identifies seven principles that can be used to guide simulation design and implementation: active learning, feedback, student-faculty interaction, collaborative learning, high expectations, diverse learning and time on task.

2.9.2 Design characteristic of simulation for optimal learning

Issenberg, McGaghie, Petrusa, Gordon and Scalese (2005:10) state that the weight of the best available evidence suggests that high-fidelity medical simulation enable learning under the right conditions. Table 2.4 gives a summary of their BEME (Best-evidence medical education) findings.

TABLE 2.4: SUMMARY OF BEME SYSTEMATIC REVIEW
(Issenberg *et al.* 2005:10)

Simulation feature for optimal learning	Explanation of the feature in journal articles
Providing feedback	Educational feedback is the most important feature of simulation-based medical education and should be provided before, during and after the learning experience
Repetitive practice	Repetitive practice identified as a key feature in simulation
Curriculum integration	Overall curriculum integration identified as an essential feature of its effective use
Range of difficulty levels	Identified as an important factor in educational effectiveness
Multiple learning strategies	Identified the adaptability of high-fidelity simulations to multiple learning strategies as an important factor in their educational effectiveness
Controlled environment	Learners can make, detect and correct errors without adverse consequence
Individualized learning	Highlights the importance of having reproducible, standardized educational experiences where learners are active participants, not passive bystanders
Defined outcomes	The importance of having clearly stated goals with tangible outcomes measured that will likely lead to learners mastering skills

McGaghie *et al.* (2010:53) identified well-established knowledge for "best practices" and tabulate the following "best practices" for medical simulation (cf. Table 2.5).

TABLE 2.5: MEDICAL SIMULATION FEATURES AND BEST PRACTICES (McGaghie *et al.* 2010:53)

Simulation feature for optimal learning	Well-established knowledge, "best practices"
Providing feedback	Essential role in simulation-based medical education. Core elements: varieties, sources, impact and debriefing
Deliberate practice	Learner-centred with highly motivated learners. Learners should be actively engaged in a well-defined learning objective or task
Curriculum integration	Integrate with other learning events and focus on educational objectives
Outcome measurement	Reliable data → valid actions and decisions about the learners. Reliable data are also important for accurate feedback
Simulation fidelity	Outcomes / goals to match the tool used in the simulation. Attention focussed on the learning outcomes to define the fidelity of the learning activity
Skill acquisition and maintenance	Variable skill
Mastery learning	Time needed to achieve "mastery" and learning varies. Rigorous approach to competency-based education; all learners master educational goals at a high achievement rate with little or no outcome variation
Transfer to practice	Stretch measurement endpoint from simulation to practice
Team training	Patient care [can be] a 'team sport'
High-stakes testing	Highly reliable data → valid decisions
Instructor training	Effective simulation-based medical education is not easy or intuitive. Clinical experience is not a proxy for simulation instructor effectiveness. Instructor and learner need not be from the same healthcare profession
Educational and professional context	Context authenticity is critical for simulation-based medical education teaching and evaluation

2.10 ELEMENTS OF SIMULATIONS

Based on the simulation model by Jeffries (2005:97), the design characteristics and simulation (the intervention) will be considered in more detail. Figure 2.6 illustrates the design and intervention characteristics of simulation; namely objectives, fidelity, complexity, cues and debriefing. These characteristics will be discussed in subsequent paragraphs.

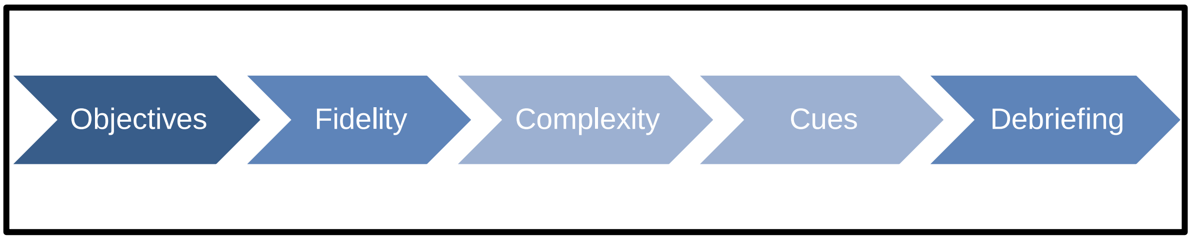

FIGURE 2.6: DESIGN CHARACTERISTICS AND SIMULATION (INTERVENTION)

2.10.1 Objectives

Simulation exercises should start with clearly communicated objectives to guide students' learning and achievement of the outcomes. According to Shearer and Davidhizar (2003:274) this involves careful preparation, objective identifying for the experience, identification of a time frame, stipulating roles for the learning activity and distributing information to the students before the simulation.

2.10.2 Fidelity

The term "fidelity" is also referred to as "realism". Labuschagne (2012:206) states that the trustworthiness or fidelity of simulation is defined by the degree to which the reality is replicated by the simulation. He adds that fidelity in simulation is multidimensional and is determined by the appearance and feel of the equipment used, environmental aspects and psychological fidelity.

Schaumberg (2015:23) agrees that simulated clinical cases should be realistic enough for students to have a meaningful experience and also learn. That begs the question: "How much realism must be sought to achieve a particular learning outcome?"

Using this definition, fidelity becomes a sliding scale, where the given objectives, a piece of equipment for example, may be able to provide "high-fidelity" experience for one outcome but be "low-fidelity" for another outcome or objective (Rodgers 2007:13).

2.10.3 Complexity

Simulation activities can vary from basic to intricate. Basic simulations involve low levels of uncertainty. It is important to understand that the complexity of the simulation should be based on the students' knowledge and the learning outcomes to be achieved.

2.10.4 Cues

Facilitators may provide students with cues throughout the simulation activity to achieve the desired outcomes. "Simulators don't teach" (Schaumberg 2015:22); equipment alone does not guarantee optimal learning. The teacher or facilitator remains vital in the learning process.

2.10.5 Debriefing

Rall, Manser and Howard (2009:517) found that debriefing, a specific form of feedback, was the most significant part of learning through the use of simulation. Rall *et al.* furthermore refer to debriefing as the "heart and soul" of simulation-based education.

Van de Ridder, Stokking, McGaghie and Ten Cate (2008:193) describe feedback in clinical education as: "Specific information about the comparison between a student's observed performance and a standard, given with the intent to improve the student's performance". Van de Ridder *et al.* (2008:192) compiled the following list of characteristics of feedback:

- the **content** of the information (feedback) that should be conveyed is important;
- the **aim** of the feedback should be clearly defined (improvement of performance, promotion of reflection or motivation);
- **feedback recipient** – the feedback should be directed to the learner to acquire knowledge, skills and/or attitudes to become a competent professional;
- the **form of the information** to be communicated - specific, non-evaluative preparation before the information can be conveyed;
- the **source of the information** – internal or external feedback;
- **feedback provider** – the provider needs to measure the performance against the standards or outcomes;
- **communication conditions** – timeline and the directness of the feedback;
- **contextual factors** – the place where the feedback is given.

These factors form a clear and central point of departure for planning a simulation model or scenario successfully.

The following framework (cf. Figure 2.7) was designed by Labuschagne (2012:99) to explore the simulated experience and enhance the learning experience. The framework should be used in a flexible way (as indicated by the arrow).

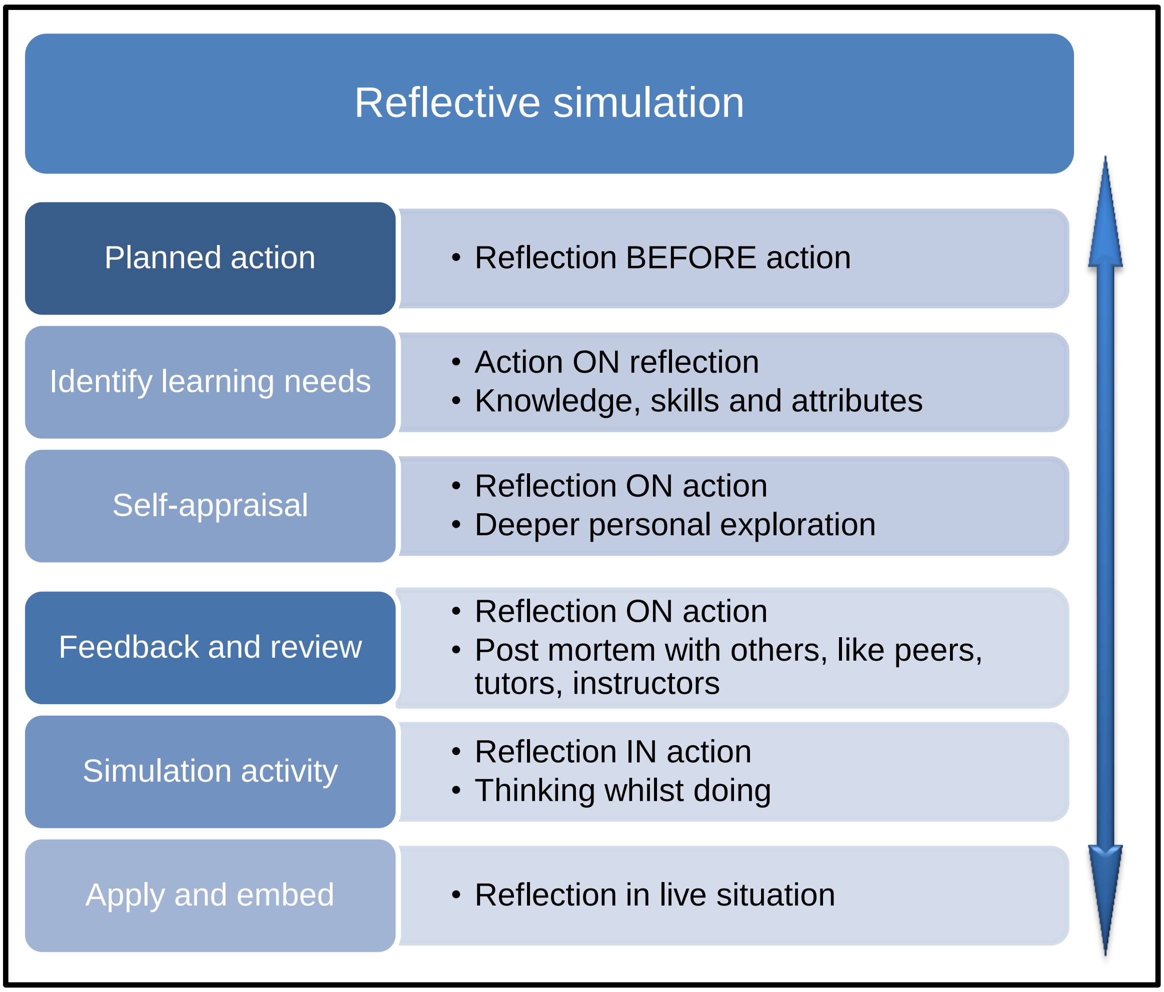

FIGURE 2.7: REFLECTIVE SIMULATION FRAMEWORK
(Adapted by Labuschagne 2012:9)

2.11 CLASSIFICATION OF SIMULATORS USED FOR SIMULATION IN HEALTHCARE EDUCATION

Labuschagne (2012:23) explains that there is much confusion in the literature regarding simulation taxonomy. Terms like "high-fidelity mannequin-based simulation", "clinical simulation", "human patient simulation", "full-scale simulation", "high-technology patient simulation", and several other terms are used haphazardly in the literature.

Labuschagne (2012:209) produced a classification of simulators used for simulation modalities:

- **procedural simulation:**
  - task-trainers,
  - virtual reality,

- patient simulators, and
- organic cadaver or animal material

- **computer-based simulation:**
  - flat screen simulated patients,
  - computer application, web application and virtual world

- **simulation in clinical emersion:**
  - actor, patient and patient-simulator

- **simulated patients (SP's):**
  - actor, patient and patient simulator

These simulators can all be of value in pharmacy education depending on the module or course.

2.12 SIMULATION RESEARCH IN DIFFERENT HEALTH PROFESSIONS

Little is known about the impact of simulation in pharmacy education in the South African context, but international studies have been found. Simulation research in medical and allied health professions is widely available nationally and internationally.

Chen, Kiersma, Yehle and Plake (2015:1) investigated the impact of an ageing simulation game on pharmacy students' empathy for older adults. The results of the study show significant improvement in the students' attitude and empathy towards older adults.

Mesquita, Lyra Jr., Brito, Balisa-Rocha, Aguiar and De Almeida Neto (2010:143) completed a systematic review in relation to the use of simulated patients in developing communication skills in pharmacy. The researchers concluded that literature provides evidence that simulated patient simulations, as educational tool, are able to transfer communication skills from the didactic to the practice settings. Effective communication by pharmacists can provide potential improvements in health outcomes for patients (Mesquita, *et al.*, 2010:147).

Douglass, Casale, Skirvin and DiVall (2013:1) studied the impact of a virtual patient software program to improve pharmacy student learning in a comprehensive disease management course. The researchers reported improvement in students' clinical competence skills (Douglass *et al.* 2013:6) as well as improvements in drug-therapy, critical thinking and problem-solving skills.

E-learning at the University of Strathclyde Institute of Pharmacy and Biomedical Sciences, Glasgow, Scotland includes a simulated prescription analysis tool, namely Strathclyde Computerized Randomized Interactive Prescription Tutor (SCRIPT). According to Zlotos, Thompson and Boyter (2015:2) a number of factors support the need for e-learning, including increased student numbers, space restrictions and the availability of appropriately qualified teaching staff (cf. 2.5). The tool was designed to assist students in achieving competencies required for safe and accurate dispensing (one of the core responsibilities of dispensing pharmacists in South Africa). Zlotos *et al.* (2015:7) conclude that institutions may consider a replacement model (replace some in-class activities with online activities that align with in-class activities) to reduce staffing time and increase flexibility of learning methods.

Mesquita, Souza, Boaventura, Barros, Antoniolli, Silva and Lyra Júnior (2015:13) conclude that incorporation of active learning (including simulation) in a Brazilian Pharmaceutical course significantly improved students' competencies, as well as their satisfaction with the course.

The effect of simulation use in training pharmacy students was investigated by Basheti (2014:1). Correct device (asthma inhaler) technique simulation and engaging pharmacy students with asthma patients in a simulated environment resulted in better device technique demonstration skills among students at the Faculty of Pharmacy, Applied Sciences University, Amman, Jordan.

Labuschagne (2013:157) describes the use of simulation in ophthalmology education for the training of healthcare students as well as undergraduate medical students. Labuschagne (2013:159) concludes that the use of simulation as a necessary element of a curriculum improves clinical skills and competence.

Murray (2011:528) reviewed the current trends in simulation training in anaesthesiology. He states that many of the practice skills required needs to be acquired in experiential rather than traditional lecture or didactic settings. Simulations should be planned in such a way that performance expectations are set in advance and to assess the skills that are relevant to the learning outcomes.

Technology-driven simulators for medical students were reviewed by Michael, Abboudi, Ker, Khan, Dasgupta and Ahmed (2014:531). They propose that adoption of simulators into medical school education programs has the potential to revolutionise modern undergraduate medical education. The potential of 3-D virtual worlds in medical and health education through Second Life® has been investigated by Boulos, Hetherington and Wheeler (2007:233). The application of avatars in this virtual platform is vast, but needs to be explored further to document best practice guidelines.

The use of simulation in dental education, nursing education and related fields are extensive and the possibilities endless.

2.13 SUMMARY OF THE CHAPTER

In Chapter 2, the researcher completed the literature review, focusing firstly on undergraduate pharmacy education in South Africa and the scope of practice of a qualified pharmacist. Simulation and concept clarification followed, including the advantages and disadvantages of simulation.

The researcher discussed the use of simulation in education as well as learning theories underpinning simulation. The chapter concluded with a look at the use of simulation in various health professions.

After conducting the literature review, the questionnaire survey was designed.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

Leedy and Ormrod (2014:2) define research as a methodical process of collecting, analysing and interpreting data or information to increase our understanding of a phenomenon that we are interested in, or is of concern to us.

In this chapter, the researcher will explain the context of the study and then give an in-depth description of the research approach used.

The aim of the study was to investigate the opinions on and use of simulation currently in undergraduate pharmacy education at South African universities. Descriptive research examines a situation in its current state according to Leedy and Ormrod (2014:190) and includes questionnaire survey research, which produces quantitative information that can be summarised through statistical analysis.

The description will explain the theoretical grounding of the research approach, the strategies and tools used for data collection, methods of data analysis and steps followed to ensure a quality study. Ethical issues will be discussed before the conclusion.

3.2 RESEARCH DESIGN

Mouton (2001:49) stated that the research design refers to the particular data collection procedures and depends on the type of research chosen to provide satisfactory answers to the research questions.

Fouché and De Vos (2011:96) explain that exploratory and descriptive research may have some similarities, but also differ in other respects. It is stated that it might blend in practice, as descriptive research presents a picture of the specific details of a situation and focuses on "how" and "why" questions, whereas with exploratory research the researcher aims to become knowledgeable with regard to basic facts to create a general picture of current conditions.

The research project is an exploratory, descriptive, quantitative study. The researcher needed to examine the current situation regarding the use of simulation in pharmacy education to create a general picture of pharmacy education in South Africa. The study is quantitative because all the data were gathered through an online questionnaire comprising of closed questions and the findings will be expressed as statistical data. The questionnaire did, however, include an open-ended question where lecturers were asked to give opinions. These opinions were arranged into themes and reporting on these themes were done quantitatively.

3.3 RESEARCH METHODOLOGY

3.3.1 Literature study

The aim of a literature study is to gain a clear understanding of the research problem and putting the research into perspective; positioning it in a larger body of theory. Mouton (2001:87) defines a literature review as "interest in the most recent, credible and relevant scholarship in your area of interest" – therefore a *scholarship review*. The literature review creates the foundation constructed on existing, related knowledge (Fouché & Delport 2011:134).

According to Mouton (2001:86) the purpose of a literature study is to help the researcher delimit the research problem and define it better. The literature study also provides the researcher with an overview of the research that has already been conducted, as well as ideas on methods and instruments to use in one's own research. Leedy and Ormrod (2014:51) conclude that the literature study provides the necessary background and context for a well-formulated research problem statement as well as complementary hypothesis and research questions.

In this study, the literature review has the specific aim of describing the history and current status of the use of simulation in teaching and learning in health professions education, locally and internationally. The literature study was used to compile the questionnaire survey, and even though the use and opinions on the use of simulation in pharmacy education in South Africa is unclear, the possible advantages, disadvantages and factors influencing the use of simulation as an educational tool can be drawn from other health professions in South Africa, as well as internationally (cf. 2.12).

3.3.2 Empirical study

3.3.2.1 *Questionnaire survey*

Questionnaire surveys are quantitative research instruments with a basic objective to obtain facts and opinions about a particular phenomenon from people who are informed on a particular issue, according to Delport and Roestenburg (2011:186).

Stone (1993:1264) describes the characteristics of a well-designed questionnaire; including appropriate, intelligible, unbiased, piloted and ethical. Stone (1993:1264) reasons that a good and appropriate questionnaire is one that works and is capable of providing answers to the questions being asked.

Baruch and Holtom (2008:1140) caution that questionnaire research depends on the willingness of the participants to answer the questionnaire. The aim of the researcher is a response rate as high as possible to assess the value of the research results.

The response rate by distribution methods for e-mail questionnaires as reported by Baruch and Holtom (2008:1153) is 54.7% (mean) with a standard deviation of 23.9%. The study reflected response rate by industry sector, see Table 3.1

TABLE 3.1: RESPONSE RATE BY INDUSTRY SECTOR (BARUCH AND HOLTOM 2008:1153)

Sector	N	Min	Max	Mean	SD
Education	15	10.0	84.0	49.0	24.1
Financial Services	23	16.0	90.0	57.0	21.7
Healthcare	21	17.4	94.0	53.8	20.0
Production	48	14.4	91.2	50.3	22.2
Public/State	21	27.0	82.8	54.5	16.7
Service	10	19.6	89.0	62.1	24.8
Various or unspecified	325	3.0	93.0	46.2	21.4

The results from the industry sector response rate study conducted by Baruch and Holtom (2008:1153) indicated a low response rate in the education sector and in the healthcare sector. The participants in the present study were health professionals in the education sector (cf. 4.3.2).

Nulty (2008:302) concludes that the average response rate for online surveys are much lower than for paper-based surveys. More specifically, on average a 33% response rate is typical for online surveys, which is 23% lower than for paper-based surveys. The response rate for this study was 38.8%.

The questionnaire survey was designed based on the objectives of the research project. The questionnaire was grouped in a number of sections:

Section 1 (question 1 – 10) contains personal information regarding the participant's gender, registration as a pharmacist with the SAPC and work environment.

Section 2 (question 11 – 17) contains questions regarding simulation, and possible factors influencing the use of simulation; the current use of simulation including types of simulation used, its location as well as opinions regarding possible benefits of the use of simulation in undergraduate pharmacy education.

Section 3 (question 18) gives the participant the opportunity to give an opinion regarding the use of simulation in undergraduate pharmacy education.

The questionnaire was completed by consenting lecturers involved in undergraduate pharmacy education from pharmacy schools registered with the SAPC as training institutions (cf. Appendix A).

3.3.2.2 *Target population*

A target population represents a group of individuals who share certain specific characteristics (Strydom 2011:223). In this study, the target population included all the lecturers involved in undergraduate pharmacy education from pharmacy schools in South Africa registered with the SAPC as training institutions.

3.3.2.3 *Description of sample and sample size*

The sample size included the total number of consenting academic staff members (≈141) involved in pharmacy education at Universities registered with the SAPC as training institutions. The number of academic staff members at each institution was obtained by the researcher through personal telephone conversations with the School Directors of each Pharmacy School. In Table 3.2, a breakdown of training institutions and the number of academic staff members is presented.

TABLE 3.2: INSTITUTIONS AND THE NUMBER OF ACADEMIC STAFF

INSTITUTIONS REGISTERED WITH THE SAPC	NUMBER OF ACADEMIC STAFF MEMBERS
Nelson Mandela Metropolitan University (NMMU)	12
North-West University (NWU)	35
Rhodes University	17
University of Kwazulu-Natal	25
University of Limpopo – Medunsa Campus	15
University of Limpopo – Turfloop Campus	13
University of the Western Cape	16
University of the Witwatersrand (WITS)	20
	141

3.3.2.4 *The pilot study*

Delport and Roestenburg (2011:195) suggest that two objectives can be achieved through a pilot study. First of all, the pilot study improves the content and face validity of the questionnaire; and secondly, it gives an estimation of the time needed to complete the questionnaire.

A pilot study was done to ensure that the questions are clear and unbiased; that the questionnaire was well-structured; and to determine the amount of time needed for completion. To achieve this, the questionnaire (cf. Appendix A) was given to two academic staff members of the NWU, who are employed as full-time lecturers and involved in undergraduate pharmacy education. The pilot study participants included the School Director of the North-West University's School of Pharmacy to ensure the questionnaire is of high quality, relevant and adequate to achieve the objectives of the study.

3.3.2.5 *Data gathering*

Data collection was done by means of an online questionnaire (which was available in English) in Appendix A. The link to the questionnaire was e-mailed to the participants. The e-mail addresses of the participants for the survey were obtained through the Directors of the various Pharmacy Schools.

The researcher consulted the EvaSys Online survey-team once the following information was available:

- An approved research proposal with a questionnaire;

- Proof of ethical clearance from The Faculty of Health Sciences Ethics Committee of the University of the Free State (UFS); and
- A list, in Excel format, of the 135 e-mail addresses of participants, as received in writing from the various Pharmacy Schools.

The UFS EvaSys procedure manual of February 2014 (UFS 2014:Online) states that an online survey using the e-mail collection method will proceed as follows. The EvaSys officer will open the online survey collector and distribute the questionnaire via e-mail.

<u>E-mail method</u>

An e-mail was sent to each participant containing a personalised link to access and complete the questionnaire. Results were available on the EvaSys system immediately after a respondent submitted the questionnaire. It was possible for a respondent to complete a questionnaire partly and save it temporarily. The questionnaire could then be accessed again by clicking on the link in the e-mail. Once a questionnaire had been submitted, the link deactivated and could not be used again to access the questionnaire.

Reminders were sent to non-responders by EvaSys at regular requested intervals.

3.3.2.6 *Data analysis*

Data analyses were done by a senior biostatitian, Dr J Raubenheimer of the Department of Biostatistics of the Faculty of Health Sciences at the UFS.

Quantitative data analysis can be described as the process whereby data are interpreted and then presented as numbers in order to describe distributions, similarities, relationships and comparisons among the data.

The following steps (cf. Figure 3.1) need to be followed for effective quantitative data analysis according to Pietersen and Maree (2007:183):

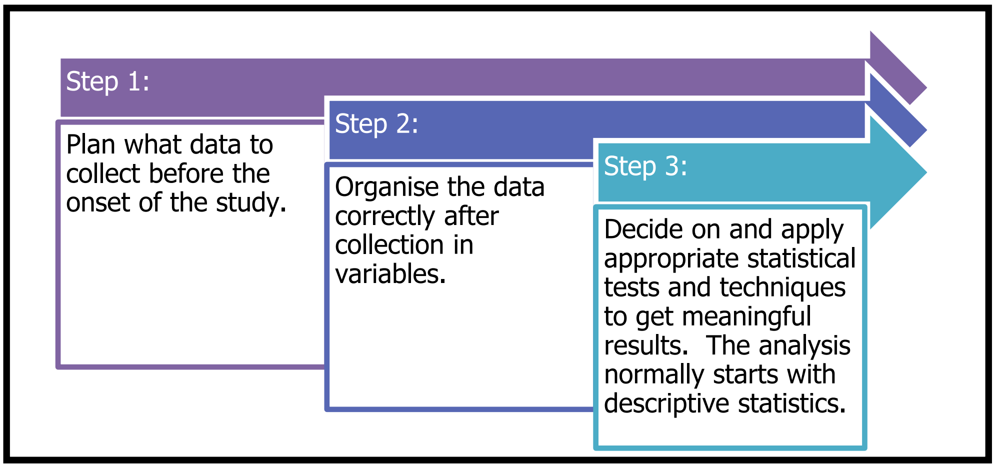

FIGURE 3.1: STEPS FOR EFFECTIVE QUANTITATIVE DATA ANALYSIS

In this study, descriptive statistics were used to organize and describe the characteristics of the collected data. The following statistical tests were done: cross tabulations with chi-square tests and Fischer's exact tests for categorical data and ANOVA for continuous data.

3.4. ENSURING VALIDITY AND RELIABILITY OF THE STUDY

3.4.1 Validity

According to Leedy and Ormrod (2002:31), validity is defined as the extent to which the instrument measures what it is supposed to measure. The questionnaire was based on a literature review and was piloted before it was sent to research participants to ensure that it was clear and concise. This enhanced the validity of the research instrument.

To further ensure the validity of the research instrument, the questionnaire was well-structured after conducting the literature study and in consultation with a statistician. The promoter also checked the questionnaire to ensure validity.

3.4.2 Reliability

The reliability of an instrument is defined as the extent to which the instrument (questionnaire) measures something consistently (Salkind 2014:109). The questionnaire was developed through the literature review. The pilot study served as a tool to enhance the reliability of the study as adjustments to the questionnaire were made before data collection.

3.5 ETHICAL CONSIDERATIONS

The following ethical aspects were considered:

3.5.1 Approval

Approval for the research project was obtained from the Ethics Committee of the Faculty of Health Sciences (cf. Appendix C) at the UFS (ECUFS 125/2014). Permission was sought from the North-West University School of Pharmacy, as well as the School Directors of the Pharmacy Schools included in the study (cf. Appendix B).

3.5.2 Informed consent

A short overview of the study and its purpose was provided to the participants with an explanation of what was required from them. In this study, informed consent was given by completing the online questionnaire.

3.5.3 Right to privacy

The introduction to the questionnaire informed the participants that all the information will be handled confidentially. The data from the online questionnaire, as well as any personal information gathered, will remain confidential. The e-mail addresses used to distribute the questionnaire will be managed in a confidential manner.

The participants will have the option to contact the researcher for the results of the study. The list of e-mail addresses will not be used for any other purpose or given to any other entity.

3.6 SUMMARY OF THE CHAPTER

This chapter discussed the methodology used to achieve the objectives of the study. After conducting a literature review, a questionnaire survey was designed.

After approval for the study was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 125/2014), the online questionnaire was sent to 135 participants.

In Chapter 4, the results of the online questionnaire will be presented.

CHAPTER 4

RESULTS OF THE QUESTIONNAIRE SURVEY

4.1 INTRODUCTION

In Chapter 3, the theoretical aspects of the research methodology used were explained in the context of the study. In this chapter, the results of the study will be presented.

4.2 QUESTIONNAIRE SURVEY RESULTS

The empirical investigation consisted of an electronic questionnaire survey designed to determine lecturers' opinions on simulation and the use of simulation in undergraduate pharmacy education at South African Universities.

An electronic link was sent to each participant's e-mail address received from the various heads of Pharmacy Schools currently registered with the SAPC. As was pointed out in Chapter 3, a total of 135 e-mail addresses were received and the questionnaire was sent to those 135 participants.

A pilot study formed part of the research project. The pilot study questionnaires were completed by two undergraduate lecturers, after which minor amendments were made to clarify the questionnaire where appropriate.

After distribution of the first e-mail link to participants, only 11 initial responses were received. Regular reminders were subsequently sent out to non-responders. The researcher personally contacted the Heads of Pharmacy Schools to remind them of the value of the study and to improve the response rate from the undergraduate lecturers. The questionnaire survey was closed at the end of May 2015 after sending five reminders. A total number of 52 participants responded to the questionnaire, giving a response rate of ≈39%.

4.3 DEMOGRAPHY OF THE PARTICIPANTS

In this section, the demographic information of the participants will be represented.

General information including gender, registration with the SAPC as a pharmacist, work environment and simulation workshop attendance was recorded.

4.3.1 Gender of the participants

The gender summary, in Figure 4.1, indicates that 34 female participants (65%) and 18 male participants (35%) completed the survey.

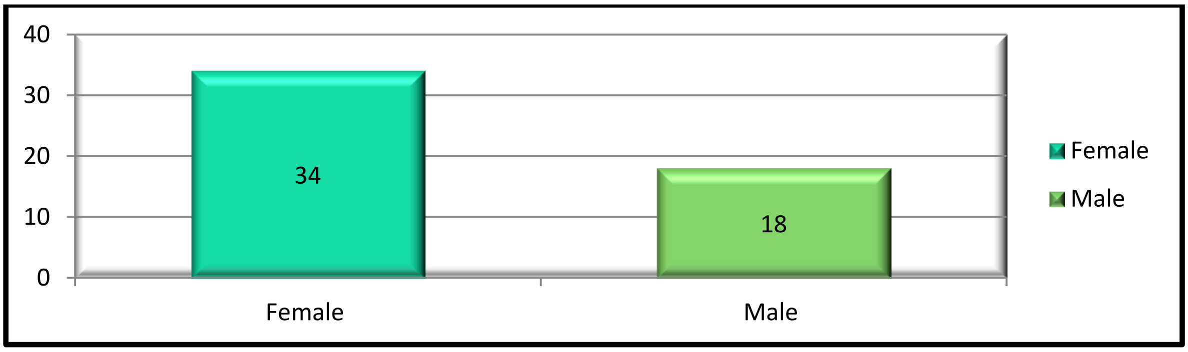

FIGURE 4.1: GENDER OF THE PARTICIPANTS (n=52)

4.3.2 Pharmacists registered with the South African Pharmacy Council

Figure 4.2 represents the number of registered pharmacists with the SAPC involved in the study.

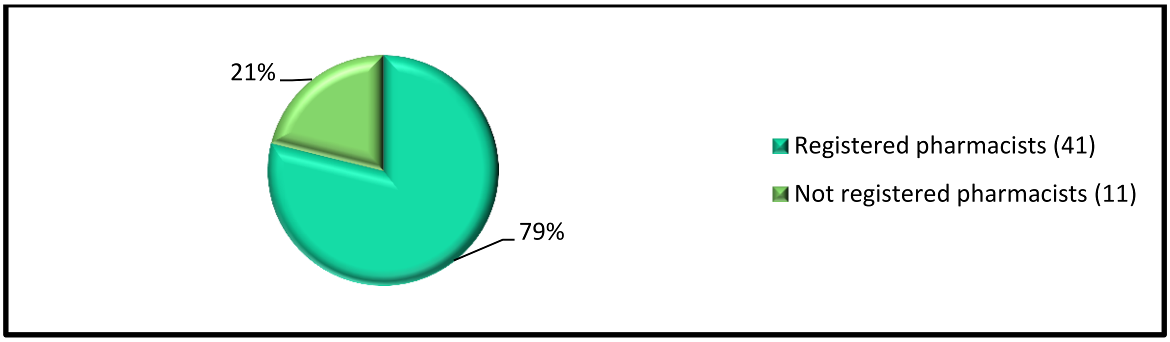

FIGURE 4.2: PHARMACISTS REGISTERED WITH THE SOUTH AFRICAN PHARMACY COUNCIL (n=52)

The responders included 41 registered pharmacists and 11 participants that are not registered as pharmacists.

4.3.3 Current employment of the participants

Figure 4.3 depicts nine institutions currently registered with the SAPC as training institutions for pharmacists, with a summary of the number of participants from each of these institutions.

The graph also shows the number of responders and non-responders for each training institution in relation to the number of e-mail addresses received from each pharmacy school head.

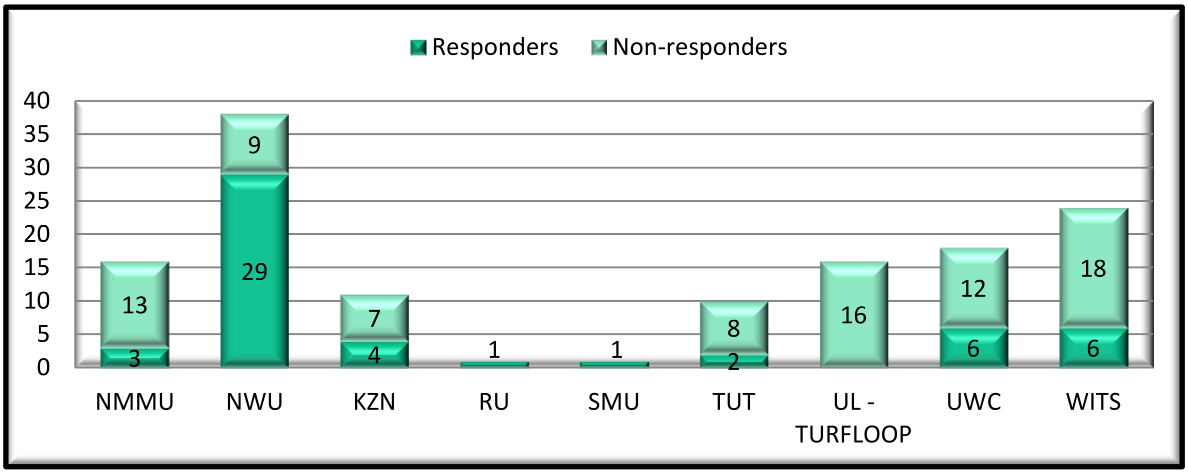

FIGURE 4.3: CURRENT EMPLOYMENT OF PARTICIPANTS AT TRAINING INSTITUTIONS REGISTERED WITH THE SOUTH AFRICAN PHARMACY COUNCIL (n=52)

4.3.4 Student numbers in each module or unit

Table 4.1 represents the student numbers in each year group of the four-year pharmacy degree, as indicated by the number of participants from the various training institutions.

TABLE 4.1 STUDENT NUMBERS IN EACH YEAR OF STUDY

YEAR OF STUDY	N	MIN	MAX	MEDIAN	MEAN	SD
1ST YEAR	12	40	220	130	132	63.90
2ND YEAR	23	60	250	200	171	63.20
3RD YEAR	28	20	236	140	146	66.42
4TH YEAR	31	6	250	120	135	73.54

4.3.5 Curriculum models in undergraduate pharmacy education

The majority of the participants (84.6%) indicated that they use an outcomes-based curriculum approach, while 13.5% of the participants used a problem-based curriculum approach. One participant did not answer the question. The presentation of the curriculum also varied between the different institutions and 43 participants (82.7%) indicated that they had semester modules; 7 participants (13.5%) had one-year modules and 2 participants (3.8%) indicated that they follow a systems-based block approach.

4.3.6 Number of years lecturing undergraduate pharmacy students

Table 4.2 represents the participants' (n = 52) cumulative results of number of teaching years' experience. The participant with the least amount of experience had only been teaching for six months. One participant had been teaching undergraduate pharmacy students for 38 years.

TABLE 4.2 RESULTS OF NUMBER OF YEARS TEACHING EXPERIENCE

YEARS TEACHING	N	MIN	MAX	MEDIAN	MEAN	SD
	52	0.500	38.000	9.000	11.742	9.772

4.3.7 Primary teaching strategies

The participants identified a number of teaching strategies used in their undergraduate teaching. These strategies are shown in Figure 4.4.

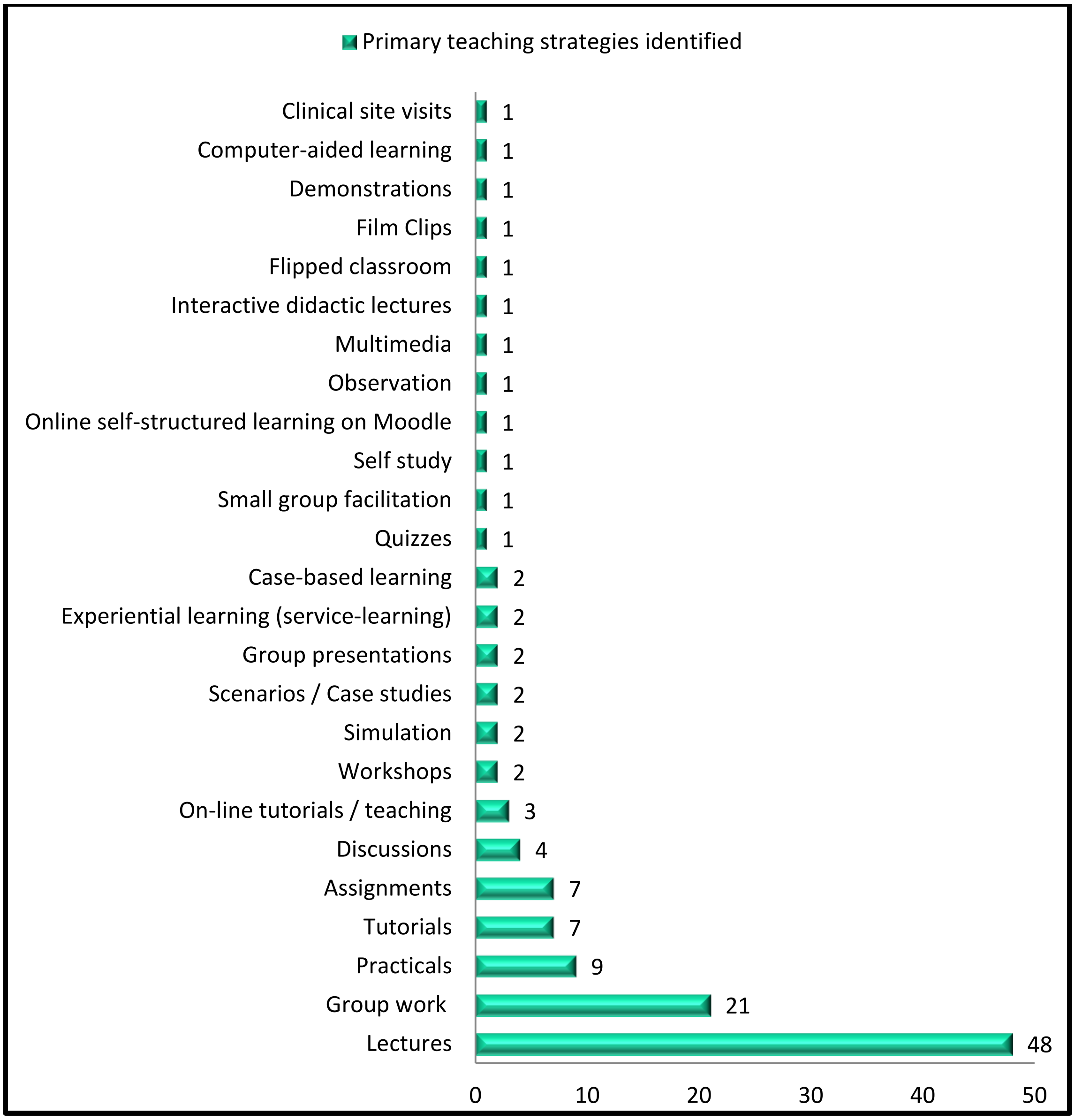

FIGURE 4.4: PRIMARY TEACHING METHODS USED BY PARTICIPANTS

The primary two methods identified were lectures and group work.

4.3.8 Lecturers' subject area

All of the participants (n = 52) identified the broad subject area they are involved in as undergraduate lecturers. Figure 4.5 represents the broad distribution of these lecturers into the main subject areas within pharmacy education, they are responsible for.

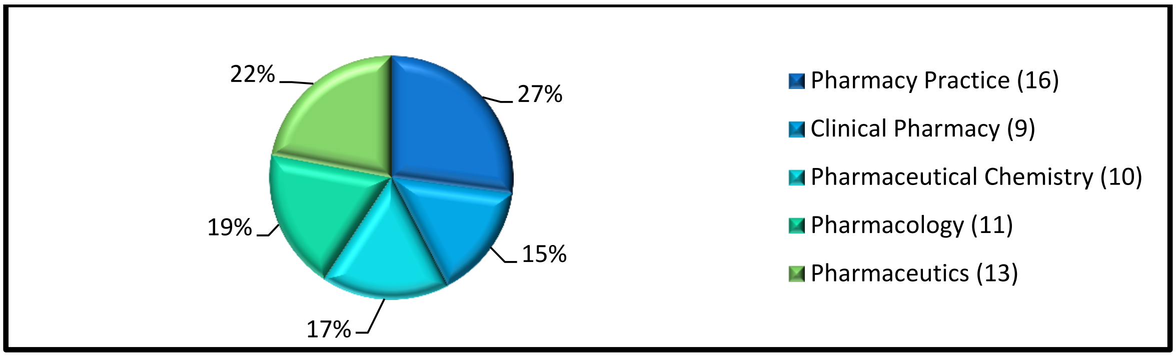

FIGURE 4.5: BROAD DISTRIBUTION OF PARTICIPANTS' (n=52) INTO SUBJECT AREAS

4.3.9 Simulation training or workshops

The majority of the participants (76.9%) indicated that they have never had any simulation training or attended any workshops relating to the use of simulation in education. Only 12 participants (23.1%) have had training or attended a simulation workshop.

The gender distribution of the 12 participants who had attended simulation training were as follows: 66.7% (8 participants) female and 33.3% (4 participants) male. This is very similar to the overall gender distribution of the total group.

4.3.10 Frequency of simulation use

Figure 4.6 displays the participants' (n=51) frequency of simulation use. The participants were asked to provide their opinion using a five-response category scale that included "not at all", "very little", "somewhat", "a bit" and "a great deal".

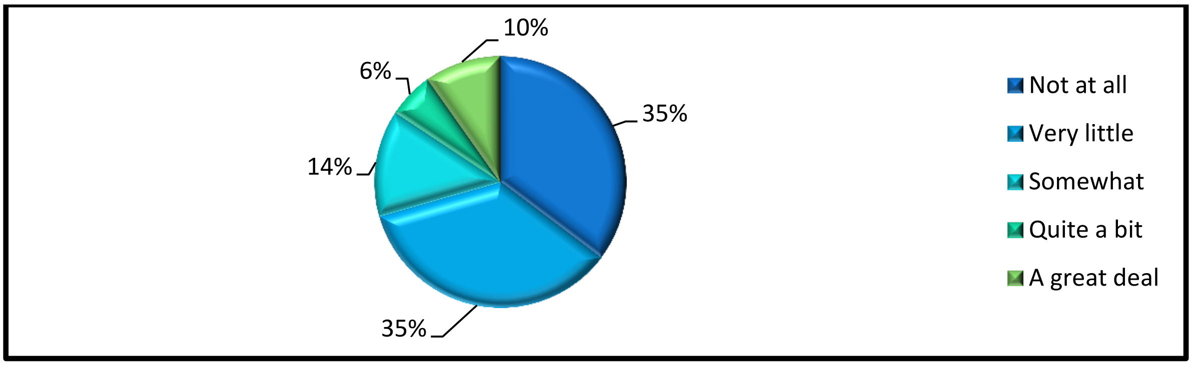

FIGURE 4.6: PARTICIPANTS' USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION

Figure 4.6 shows that 70% of the participants of the study do not use simulation, or use simulation very little in their undergraduate pharmacy teaching. Results show that 6% of the participants indicated that they use simulation quite a bit and 10% indicated that they use simulation to a great deal.

4.3.11 Types of simulation

The participants were asked to indicate the type of simulation used (if any) using a four-response category scale which included never, rarely, often and always. Figure 4.7 represents the participants' responses visually. One participant added a comment that they use simulation of a manufacturing setup in Pharmaceutics. One participant commented that simulation is not needed in the course that they are currently teaching and one comment referred to the use of case studies.

The participants' responses in Figure 4.7 show that a number of simulation types are never or rarely used in undergraduate pharmacy education.

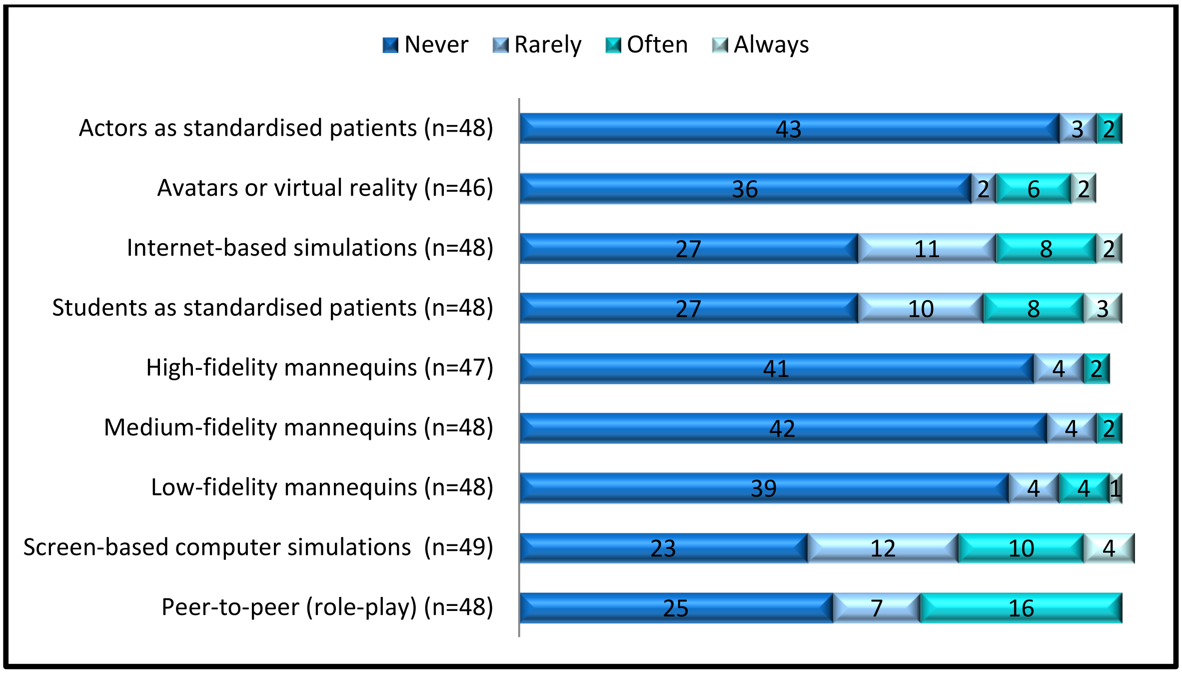

FIGURE 4.7: PARTICIPANTS' TYPES OF SIMULATION USED (IF ANY) IN UNDERGRADUATE PHARMACY EDUCATION

Figure 4.7 shows that more than 50% of the participants never use any type of simulation and that the use of certain types of simulations is limited. If the participants' responses in Figure 4.7 are consolidated into two categories, by combining "never" and "rarely" into one category, and "often" and "always" into another category, one can clearly see that the use of simulation is limited to ≤33.33%.

4.4 OPINIONS REGARDING THE FACTORS INFLUENCING THE USE OF SIMULATION

In this section, the participants' opinions regarding the factors influencing the use of simulation will be represented.

The participants were asked to provide their opinions using a four-response category scale that included "mildly disagree", "disagree", "mildly agree" and "agree". The responses in Figure 4.8 were grouped for visual representation into two categories, namely disagree and agree.

The factors were used as a guide to measure the participants' opinions including set-up costs, space requirements, the lack of necessary facilities, the running costs of the simulation facilities and many more, as represented in Figure 4.8.

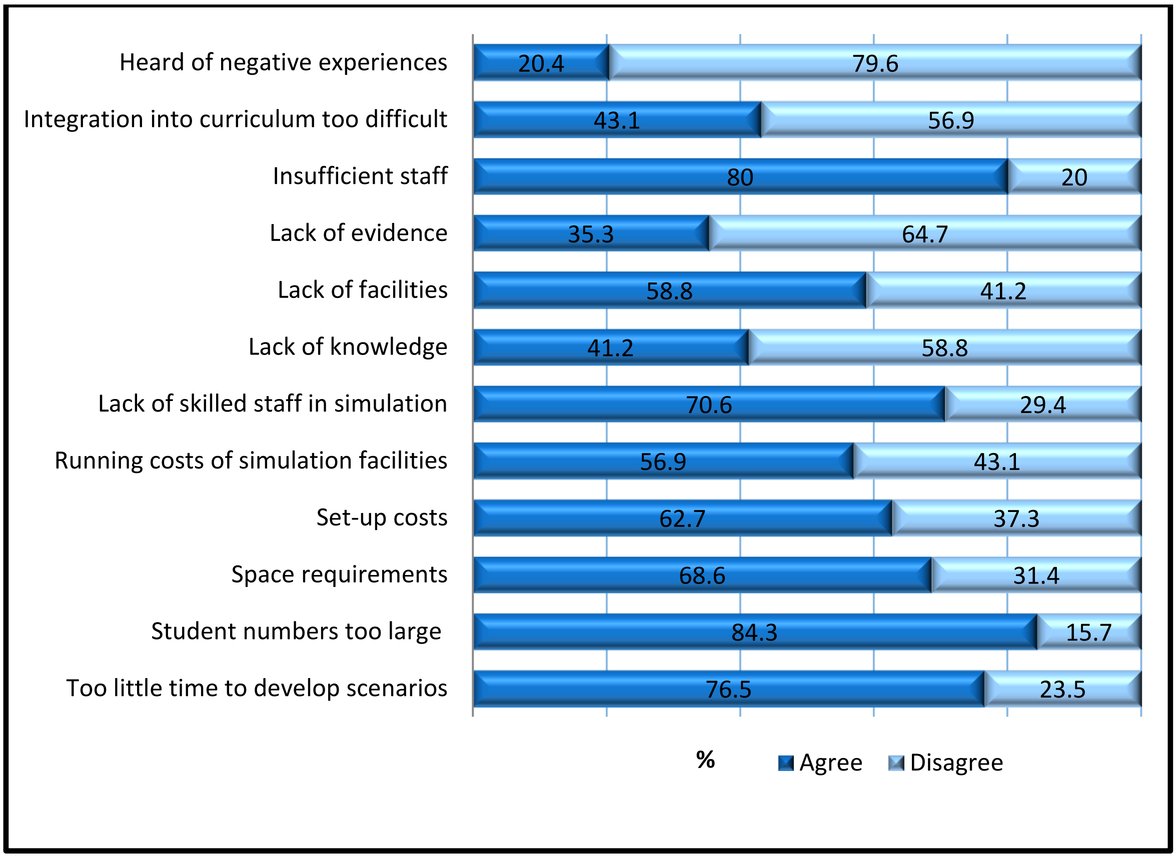

FIGURE 4.8: PARTICIPANTS' OPINIONS REGARDING FACTORS INFLUENCING THE USE OF SIMULATION

The factors influencing the use of simulation can be summarised as follows:

One participant indicated they "*don't know where to start*" as a factor that influenced the use of simulation negatively.

Ten participants had heard of negative experiences of others (n=49) and viewed it as an influencing factor in the use of simulation. Integration of simulation into the curriculum (n=51) was regarded by 29 participants (56.9%) as not too difficult and 80% of the participants (n=50) agreed that insufficient staff members was an influencing factor in the use of simulation.

The lack of sufficient available staff members may have an influence on the number of lecturers available for training in simulation to address the possible lack of knowledge. The limited number of available staff may also limit their available time to spend on the development of simulation and simulation activities.

The majority (64.7%) of the participants (n=51) did not feel that there is a lack of evidence regarding simulation and 30 participants (58.8%) regarded the lack of simulation facilities as a factor in the use of simulation. Twenty-one (41.2%) participants (n=51) agreed that lack of sufficient knowledge was an influencing factor in the use of simulation and the participants' responses further show that 36 (70.6%) agreed that a lack of skilled staff in the use of simulation was a factor that influenced the use of simulation.

The participants' (n=51) responses indicate that 29 participants (56.9%) regarded running costs of a simulation facility as an influencing factor in the use of simulation; only 19 participants (37.3%) did not think that set-up cost can be regarded as an influencing factor in the use of simulation.

Space requirements were regarded as a factor limiting the use of simulation by 68.6% of the participants and 43 participants (84.3%) regarded student numbers as a factor influencing the use of simulation.

The reported lack of facilities and space requirements might be the result of increased student numbers and inadequate funding for simulation set-up and running costs of facilities. The lack of skilled staff to effectively and creatively implement simulation in facilities currently available within a limited financial allocation might be the most important factor.

The responses also show that 39 participants (76.5%) felt that they had too little time available to develop scenarios for simulation activities.

4.5 OPINIONS REGARDING THE BENEFITS OF SIMULATION INTRODUCTION OR USE IN UNDERGRADUATE TEACHING

In this section, the participants' opinions regarding the possible benefits of the introduction of simulation or the use that simulation may have in undergraduate pharmacy education, are presented.

The participants were asked to provide their opinions using a four-response category scale which included "never", "rarely", "often" and "always". The responses in Figure 4.9 were grouped for visual representation into two categories; namely may "never or rarely be of benefit", and may "often or always" be of benefit to undergraduate pharmacy students.

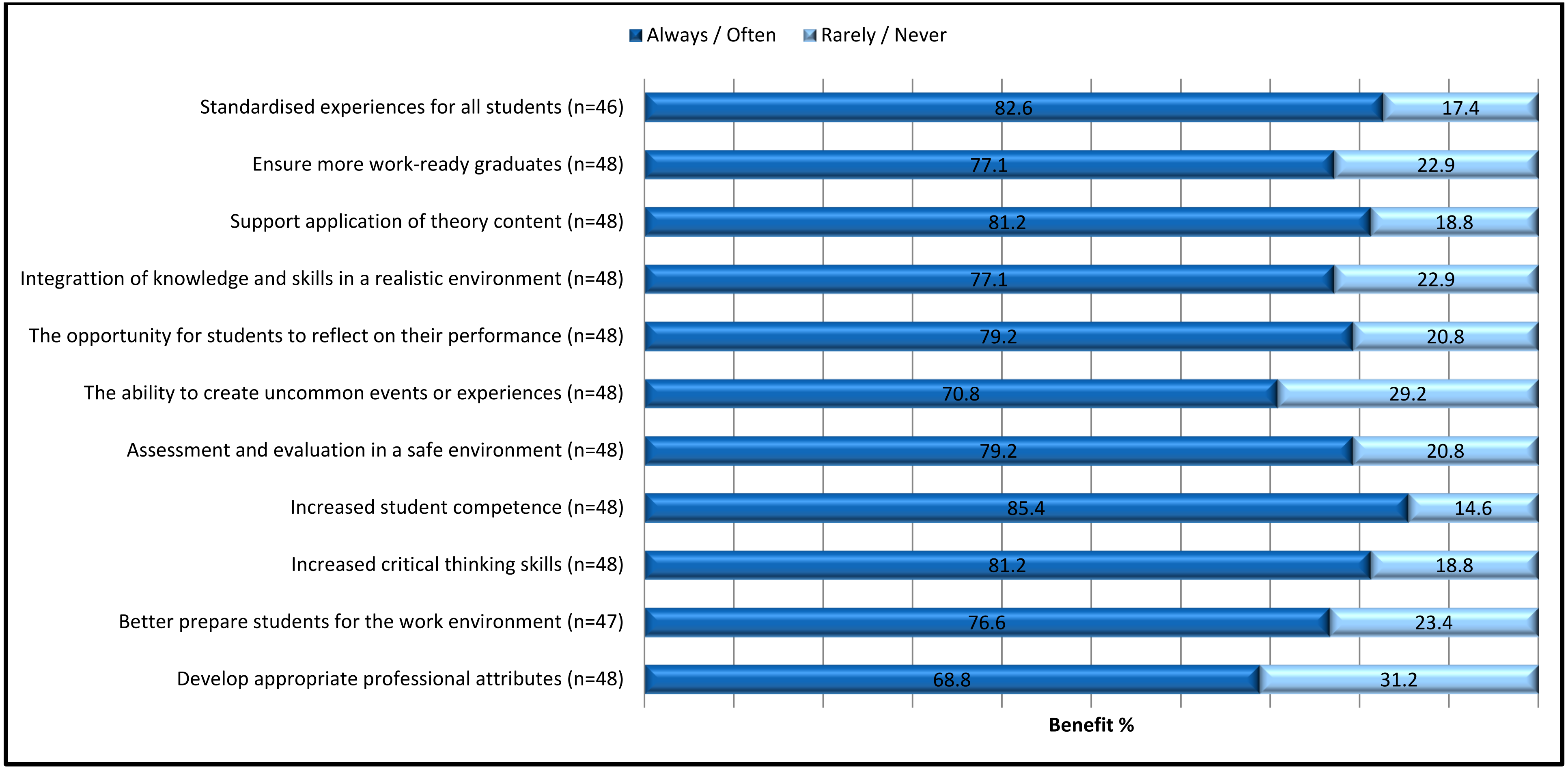

FIGURE 4.9: PARTICIPANTS' OPINIONS REGARDING THE POSSIBLE BENEFITS OF SIMULATION USE OR INTRODUCTION IN PHARMACY EDUCATION

Figure 4.9 shows that 68.8% of the participants were of the opinion that simulation could improve the development of appropriate professional attributes.

The majority of participants were of the opinion that the use of simulation could better prepare students for the work environment (76.6%), increase their critical thinking skills (81.2%) and increase student competence (85.4%).

The results reveal that 79.2% of the participants believed that simulation allows for assessment and evaluation in a safe environment and 70.8% agreed that it represents an opportunity to create uncommon events or experiences for students.

The opportunity for students to reflect on their own performance was regarded by 79.2% of the participants as a possible benefit of simulation, while 77.1% agreed that the integration of knowledge and skills in a realistic environment might be of benefit.

The use of simulation to support the practical application of the theory content may be beneficial according to 81.2% of the participants, while 77.1% believed simulation may for more work-ready pharmacists.

Standardised experiences for all students were viewed by 82.6% of the participants as a possible benefit for the use or introduction of simulation in undergraduate pharmacy education.

The majority of the participants agree that the possible benefits of simulation use in undergraduate education are overwhelmingly positive. Keeping this in mind, the researcher questions the current lack of simulation use (cf. 4.3.10) and propose lack of skilled staff in simulation as a possible explanation (cf. 4.4) for the underutilisation of simulation.

4.6 OPINIONS REGARDING SIMULATION FACILITIES

This section refers to the participants' opinions regarding facilities and simulation equipment.

4.6.1 Availability of dedicated facilities

Most of the participants (n=51, 60.8%) indicated that they had dedicated simulation facilities available. Figure 4.10 gives an indication of the participants' knowledge regarding the availability of dedicated simulation facilities.

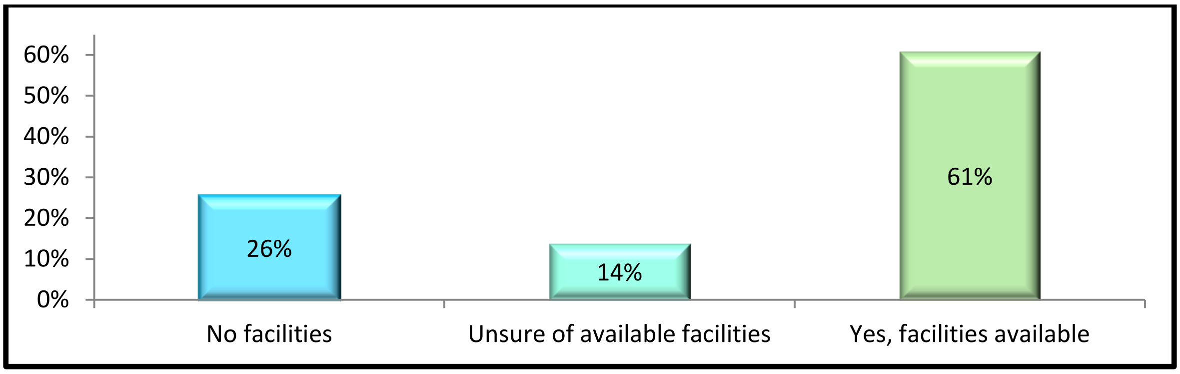

FIGURE 4.10: AVAILABILITY OF DEDICATED SIMULATION FACILITIES (n=51)

The majority of the participants (70%) indicated limited to no use of simulation (cf. 4.3.10). It is possible that available simulation facilities might not be relevant to the participants' subject area. It is also possible that available facilities are not being utilised for simulation activities. It is important to address the "unsure" responses to optimise use of available facilities.

4.6.2 Location of simulation facilities

Participants were asked about the facilities currently used (%) for simulation activities. Figure 4.11 gives an indication of the facilities currently used by the participants.

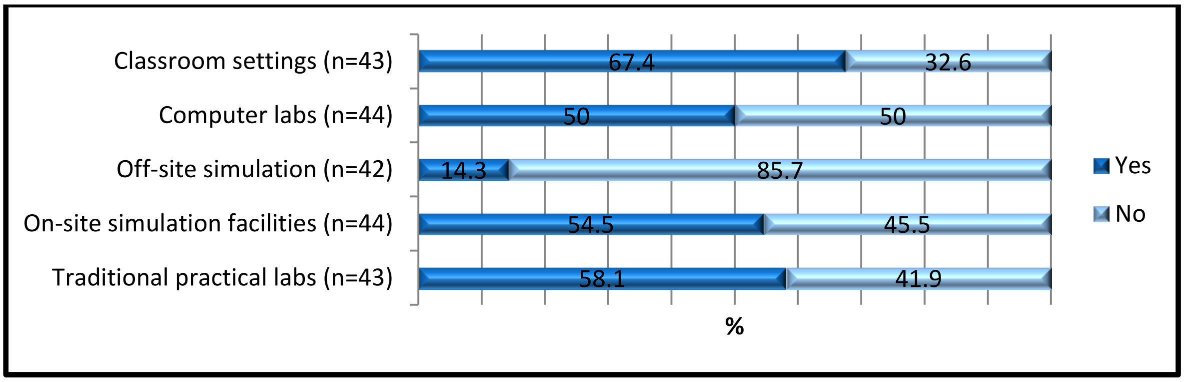

FIGURE 4.11: LOCATION (FACILITIES USED) FOR CURRENT SIMULATION ACTIVITIES

As seen in Figure 4.11, the majority of the participants (58.1%) indicated that they used traditional practical laboratories for simulation activities and 54.5% made use of on-site simulation facilities. Only 14.3% indicated that they used off-site simulation facilities.

Out of the 44 replies to this question, half (50%) of the participants use computer laboratories, while 67.4% made use of their classroom as a simulation setting.

4.6.3 Equipment

In the questionnaire, the participants were asked if they have any simulation equipment that is underutilised and to explain why they think the equipment might not be used. Figure 4.12 represents the responses of the participants.

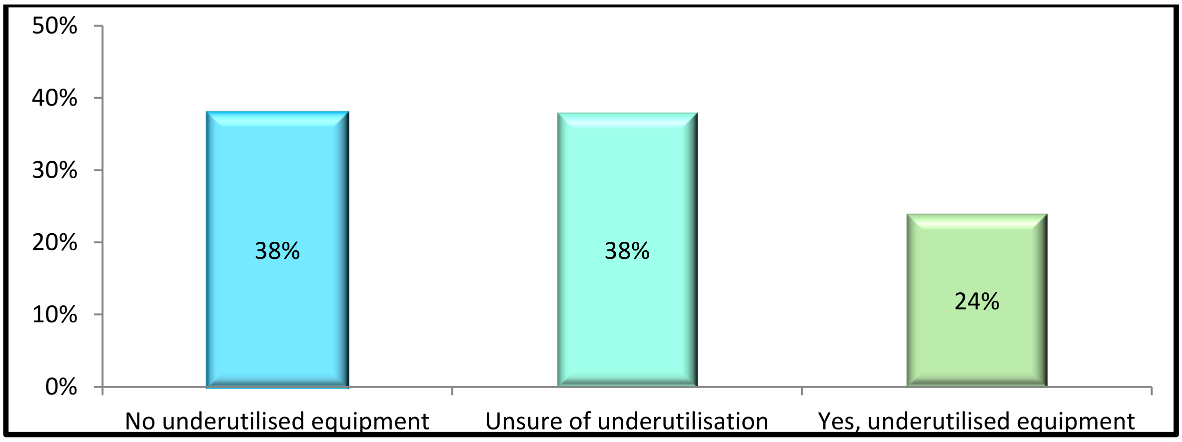

FIGURE 4.12: UNDERUTILISED EQUIPMENT (n=50)

The participants' (n=50) responses show that 19 participants (38%) indicated that they did not have simulation equipment that was not being used, while 19 participants (38%) were unsure. On the other hand, a total of 12 participants (24%) indicated that they had underutilised equipment and a few reasons were mentioned, namely:

- *"Can do more, not using 100% for all the 4 years of study. Busy introducing to all levels of students";*
- *"Groups too large – easier to show pictures / give a written case study" and "Lack of knowledge on how to optimize the resources/time";*
- *"Lack of knowledgeable staff members";*
- *"Med School pooled sim lab is currently being set up – so facilities and rosters are disorganized";*

- *"Shortage in assisting personnel, classrooms too large, lecturers not competent to implement effectively";*
- *"Student groups are just too big to handle in these set-ups" and*
- *"There is a lot of politics in between divisions and with the exception of a few people there is very little cooperation".*

4.7 OPINIONS ABOUT SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION

The final section of the questionnaire gave the participants the opportunity to give their opinion regarding the use of simulation in undergraduate pharmacy education.

Responses were received from 43 participants (83%) and 9 participants did not respond to the question. The responses from the participants were grouped according to different themes in Table 4.3 to Table 4.8. Responses were reported in the participants' own words.

Table 4.3 represents participants who had a non-specific positive response. Table 4.4 represent participants who had positive responses with accompanying limitations for the use of simulation. Table 4.5 represents participants who had positive responses with accompanying explanations. In Table 4.6, participants who had recommendations are represented, while participants in Table 4.7 were unsure or had a feeling of negativity. One participant in Table 4.8 had not used simulation.

TABLE 4.3: POSITIVE COMMENTS FROM PARTICIPANTS (n=7)

Positive comments from participants
• "*Valuable*" • *"Would be fantastic to use more often"* • *"A definite need!"* • *"If we had the opportunity to use simulations we would use it"* • *"It is beneficial"* • *"Think it is very important and in our practicals we apply simulation activities in all the facets necessary for undergraduate education"* • *"I think it's a great tool".*

TABLE 4.4: POSITIVE COMMENTS WITH IDENTIFIED LIMITATION RECEIVED FROM PARTICIPANTS (n=9)

Positive comments with limitations
• .. "*Can work in small groups*" • .. "*Simulation can add value to pharmacy education but is seldom practiced due to large student numbers and limited infrastructure and human resource. The class roster does not make provision for enough practical exposure. Traditional lectures are still practiced - exposure to possibilities of simulation in pharmacy can add value*" • .. "*A very good method. One needs a lot of time for initial preparation for this specific method. I think that this is definitely the way to go!*" • .. "*A very positive but time consuming experience because of large student groups*" • .. "*I think it is an excellent tool to enhance the theory, although the time taken to plan for this is demanding and can be limiting*" • .. "*Very good if managed well*" • .. "*I think that the use of simulation in the undergraduate pharmacy programme is a very useful and good technique to use, however, not all modules is suitable for the use of simulation programmes. Currently I do not make use of simulation*" • .. "*I think students will benefit from the use of simulation, but I also think it is very time-and labour intensive*" • .. "*Simulation based education may play a valuable role in the training of pharmacy students BUT the reality is that large student numbers of 200+ students per class and a lack of knowledgeable support staff are limiting factors*".

TABLE 4.5: POSITIVE COMMENTS WITH ACCOMPANYING EXPLANATIONS RECEIVED FROM PARTICIPANTS (n=18)
[Table continues on next page]

Positive comments from participants with explanations
• .. "*Simulation has the ability to give every student the same experience in a controlled environment. Simulation forms an integral part of my module in our simulated pharmacy*" • .. "*Very useful because of all the benefits marked above. Students also enjoy the use of simulation*" • .. "*Very important in a clinical pharmacy setting*" • .. "*It is vital. Pharmacy is a practical profession. It requires students to see how things are done and to be able to practise on the skills they are taught. Sadly, too much emphasis is placed on practical labs for pharmaceutics and pharmaceutical chemistry and not enough on other subjects*" • .. "*Very important for developing examination skills and to apply theoretical principles in real life situations*" • .. "*Gaining skills in a safe environment for students and patients*" • .. "*Very important. Give the necessary competence and positive mind-set to the student to go out and apply the skills in the real world. Students have a very positive experience when learning Unisolve program on the simulation facilities!*" • .. "*I support it. It could help to save costs associated with real-time laboratory experiments and activities*" • .. "*It gives students a real world experience, they have to make split decisions, drawing on their integrated knowledge it prepares students for the world of work because they have a better*

idea of what to expect and what to do"

- *"I can only really talk about role-playing scenarios as this is the only simulation I use. I use role-playing to teach motivational interviewing to students. I ask for volunteers that would play out a scenario that would involve behaviour change between a 'patient' and 'pharmacist'. It is useful to analyse the core skills used or not used by the student. I also have role-playing assignments, in which students record a simulated consultation and have the peer to mark the consultation and give advice on how the student could improve"*
- *"Excellent cost effective method. Puts the learning back in students' hands"*
- *"I've used it in the past when delivering a Pharmacist Initiated Therapy module and students gained a tremendous amount of confidence in interacting with simulated patients. Furthermore, they were able to apply knowledge on history-taking and therapeutics in a simulated environment which assesses a higher level of learning"*
- *"If simulation is used, the student gets a glimpse of a real life situation (although simulated). This often helps the student to see where theoretical knowledge as well as abilities can be used"*
- *"Simulation has its role and its place in training undergraduates. I think it seals or complements theory and what the student is trying to comprehend. What is seen and practically felt improves cognitive aspect"*
- *"For me it is closer to the truth than nothing at all. Ideally I would like all training to happen at the bedside, but it is not possible. Therefore a combination of simulation and real life patients are used at our institution"*
- *"The use of simulation in undergraduate pharmacy education is essential in reaching desired outcomes i.e. to convert theoretical knowledge into practical skills to benefit the patient: (quality of life and health related outcomes). The result: win-win outcome among patient (healthier/better quality of life), pharmacist (work satisfaction/making as significant difference), business (financial/sustainable) and ultimately the economy of South Africa (creating jobs/decrease financial burden to government. Simulation in undergraduate pharmacy education ensures well prepared students; ready to make a significant difference in the workplace right from the start"*
- *"Simulations help in developing critical thinking and integrating theoretical knowledge with practical real life situations. It greatly develops the skills of the students"*
- *"Great learning opportunity for students. Students can learn to integrate theory and practice. Effective method for lecturers to assess and evaluate the level of knowledge and competency of the students".*

TABLE 4.6: SUGGESTIONS RECEIVED FROM PARTICIPANTS (n=2)

Suggestions
• *"It should be compulsory for all lecturers - especially those teaching 10+ years"* • *"Simulation may be more valuable in clinical situations than in the subject which I teach. WE do a lot of laboratory work which can be equated to real life requirements i.e. making pharmaceutical products etc.".*

TABLE 4.7: PARTICIPANTS WITH FEELINGS OF NEGATIVITY OR FEELING UNSURE ABOUT THE USE OF SIMULATION (n=6)

Feeling of negativity or Unsure
• *"Not sure as the theoretical part should always be done first and mastered first before simulation can be incorporated".* • *"may be of benefit"*

- *"It is very expensive and problematic with large groups. It is time-consuming and if employed, it should be well thought-through, otherwise it is a waste of time"*
- *"Could be valuable in certain fields within the Pharmacy curriculum"*
- *"It depends on the specific definition of simulation. In my context I assume this questionnaire refers to computer based simulation of chemical experiments. In that case I think it is of limited value. On the other hand, one could consider chemistry practical a simulation of a real scenario"*
- *"May play a role in patient-interaction scenarios. The curriculum of pharmacology is simply to detailed and full to set aside time for simulation. Stimulation of thinking by explanation, lecturing and debating is in my opinion more effective with respect to pharmacology".*

TABLE 4.8: NO OPINION (n=10)

No opinion
• *"Have not used in Pharmacology"* • Nine (9) participants did not give any opinions.

4.8 SUMMARY OF THE CHAPTER

In this chapter, the questionnaire results were represented visually, graphed or tabled and briefly discussed.

Regrettably, the study received limited response (38.8%) from all the teaching institutions, but still seems to be well distributed between the various subject areas.

In Chapter 5, the results will be reflected on.

CHAPTER 5

INTERPRETATION AND DISCUSSION OF RESULTS

5.1 INTRODUCTION

In chapter 4, the results of the questionnaire survey were presented and displayed visually. In this chapter, we will consider and discuss some of these results, which represent the opinions of undergraduate pharmacy lecturers. The researcher aimed to determine possible factors influencing participant responses. In this regard, possible links between participant replies were investigated through statistical analysis.

5.2 DEMOGRAPHIC FACTORS POTENTIALLY INFLUENCING OPINIONS

The researcher investigated the possible relation between the participants' demographic information and their opinions regarding simulation and the use thereof.

5.2.1 Gender as an opinion-influencing factor

The participants' opinions regarding factors influencing the use of simulation (cf. 4.4) were analysed in relation to gender (cf. 4.3.1). The results show that the gender of participants does not have a statistically significant influence on their opinions.

5.2.2 Simulation workshop attendance as opinion-influencing reason in relation to factors possibly limiting the use of simulation

The researcher investigated the attendance of a simulation workshop as a possible influencing factor in the use of simulation in undergraduate pharmacy education. The responses in relation to the attendance of simulation workshops (cf. 4.3.9) indicate that 76.9% of participants had no prior simulation training, nor attended any workshops relating to the use of simulation in education before. Only 23.1% (12 participants) have had training, or had attended a simulation workshop. Figure 5.1 represents a comparison of the participants' opinions of factors limiting the use of simulation, based on whether they had undergone simulation training or not.

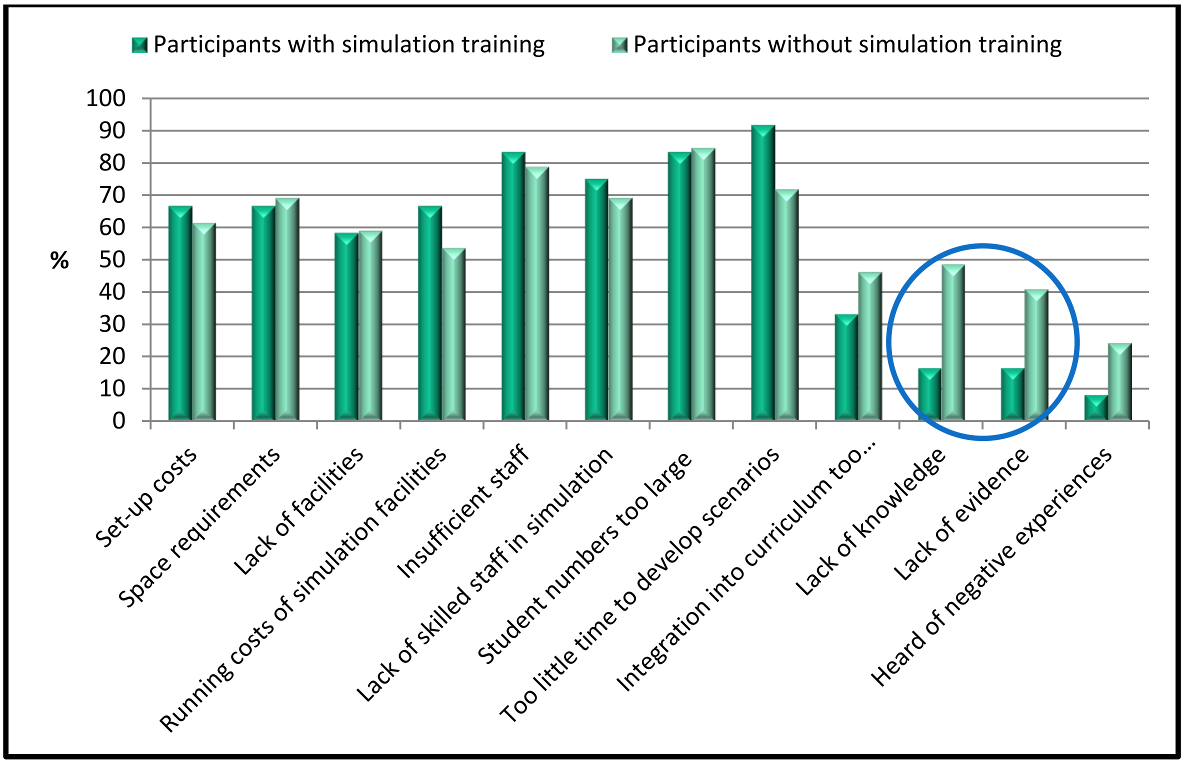

FIGURE 5.1: ATTENDANCE OF A SIMULATION WORKSHOP OR TRAINING IN RELATION TO PARTICIPANTS' OPINION OF FACTORS LIMITING THE USE OF SIMULATION

Figure 5.1 indicates that the attendance of a simulation workshop or training in simulation activities does not have a significant influence on the participants' opinions relating to most factors limiting the use of simulation. The graph shows that both groups (those who had attended training before and those who have not had the opportunity to attend simulation training) follow the same trends. The majority of these correlations are, however, relatively insignificant, with p-values ranging from 0.2536 to 1.0000.

Table 5.1 shows that there are significant differences regarding participants' lack of knowledge about simulation (p-value = 0.0319) and the lack of evidence (p-value = 0.0244). The lack of fundamental knowledge regarding simulation among lecturers may indeed be the most pertinent factor influencing the data and the opinions of the participants regarding the use of simulation and its application.

TABLE 5.1: CHI-SQUARE CORRELATION FOR THE VARIABLES (n=52)

Possible influencing factor	N	DF	Chi-Square	Probability	Fischer's p-value	Simulation Training (n = 12)				No Simulation Training				
						Disagree %	Mildly Disagree %	Mildly Agree %	Agree %	N	Disagree %	Mildly Disagree %	Mildly Agree %	Agree %
Set-up costs	51	3	3.1858	0.3638	0.4628	33.33	0.00	41.67	25.00	39	30.77	7.69	20.51	41.03
Space requirements	51	3	0.0286	0.9987	1.0000	25.00	8.33	25.00	41.67	39	25.03	7.69	25.64	43.59
Lack of facilities	51	3	0.7870	0.8526	0.9076	33.33	8.33	16.67	41.67	39	25.64	15.38	23.08	35.90
Running costs of simulation facilities	51	3	0.9149	0.8218	0.8420	16.67	16.67	25.00	41.67	39	25.64	20.51	25.64	28.21
Insufficient staff	50	3	0.5300	0.9123	0.9522	8.33	8.33	25.00	58.33	38	13.16	7.86	31.58	47.37
Lack of skilled staff in simulation	51	3	0.2476	0.9696	1.000	8.33	16.67	33.33	41.67	39	12.82	17.95	33.33	35.90
Student numbers too large	51	3	2.7914	0.4249	0.4893	0.00	16.67	33.33	50.00	39	10.26	5.13	33.33	51.28
Too little time to develop scenarios	51	3	4.0131	0.2601	0.3324	8.33	0.00	33.33	58.33	39	12.82	15.38	41.03	30.77
Integration into curriculum too difficult	51	3	1.6206	0.6547	0.7119	41.67	25.00	25.00	8.33	39	23.08	30.77	35.90	10.26
Lack of knowledge	51	3	8.3910	0.0386	**0.0319**	66.67	16.67	0.00	16.67	39	25.64	25.64	30.77	17.95
Lack of evidence	51	3	8.2485	0.0411	**0.0244**	66.67	16.67	0.00	16.67	39	30.77	28.21	33.33	7.69
Heard of negative experiences of others	49	3	3.6130	0.3064	0.2536	66.67	25.00	0.00	8.33	37	56.76	18.92	21.62	2.70

5.2.3 Simulation training and number of years lecturing

The researcher investigated whether the attendance of simulation training and / or workshops by lecturers (cf. 4.3.9) was being influenced by the number of years teaching (cf. 4.3.6). Statistical analysis revealed that the 12 participants who had attended simulation training had been teaching for 10.79 years on average. The 40 participants who had not attended any training had been teaching for 12.02 years.

The lecturers' number of teaching years does not seem to influence the attendance of simulation workshops or training (DF = 50, t Value=-0.38 and Pr>|t|=0.7054).

5.2.4 Simulation training and the current use of simulation

The correlation between the use of simulation (cf. 4.3.10) and the attendance of simulation training (cf. 4.3.9) was investigated.

The results of the statistical analysis indicate that there is a positive correlation between attendance of simulation training and the use of simulation in undergraduate teaching. The results of the Chi-square analysis are: DF=4, Value=11.9950, Probability=0.0177 and the Pr>P=0.0103.

TABLE 5.2: FREQUENCY TABLE FOR ATTENDANCE OF SIMULATION AND SIMULATION USE

Have you attended simulation training?	N	How often do you use simulation? %				
		Not at all	Very little	Somewhat	Quite a bit	A Great deal
Yes	12	8.33	25.00	33.33	16.67	16.67
No	39	43.59	38.46	7.69	2.56	4.69
N	**51**	**18**	**18**	**7**	**3**	**5**

It would appear that lecturers who had received training are more familiar with simulation and the use thereof. It is also likely that lecturers who make use of simulation attend simulation workshops.

5.2.5 Simulation training attendance as influencing factor on participants' opinion regarding development of skills

Participants' opinions regarding the possible benefits of the introduction of simulation training, or use of simulation, in undergraduate pharmacy education (cf. 4.5) were analysed in the context of the attendance of simulation training or workshops by the participants (cf. 4.3.9). Results show no correlation or statistical significance.

5.3 NUMBER OF YEARS TEACHING AS OPINION-INFLUENCING REASON IN RELATION TO FACTORS POTENTIALLY LIMITING THE USE OF SIMULATION

The researcher investigated the participants' number of years teaching experience in undergraduate pharmacy education (cf. 4.3.6) as a potential influence on their opinions regarding factors limiting the use or possible use of simulation in undergraduate education (cf. 4.4). Analysis of variance (ANOVA) was used to analyse the responses from the participants. The results are presented in Table 5.3.

TABLE 5.3: NUMBER OF YEARS TEACHING AS AN INFLUENCING FACTOR

Possible influencing factor	ANOVA F-Value	P-value	N
Set-up costs	0.28	0.8408	51
Space requirements	0.75	0.5261	51
Lack of facilities	0.97	0.4147	51
Running costs of simulation facilities	1.07	0.3700	51
Insufficient staff	0.44	0.7253	50
Lack of skilled staff in simulation	0.22	0.8795	51
Student numbers too large	1.13	0.3456	51
Too little time to develop scenarios	0.12	0.9469	51
Integration into curriculum too difficult	1.06	0.3750	51
Lack of knowledge	1.12	0.3486	51
Lack of evidence	0.63	0.5996	51
Heard of negative experiences of others	0.48	0.6985	49

The researcher found no statistical significance between the lecturers number of teaching years and their opinions regarding factors influencing the use of simulation.

5.4 SUBJECT AREA AND SIMULATION

The researcher further investigated the participants' subject area (cf. 4.3.8), the current frequency of simulation use (cf. 4.3.10) and the facilities most commonly used.

5.4.1 The current use of simulation in different subject groups

The researcher investigated whether the use of simulation (cf. 4.3.10) was being influenced by the participants' subject area (cf. 4.3.8). Table 5.4 represents the different subject areas and their current use of simulation in those areas.

The 5-point scale to indicate the current use of simulation included the following options, 5 – "A great deal", 4 – "Quite a bit", 3 – "Somewhat", 2 – "Very little" and 1 – "Not at all". The frequency of current simulation use was calculated for all the participants in the different subject areas in relation to simulation training.

TABLE 5.4: THE CURRENT FREQUENCY OF SIMULATION USE IN DIFFERENT SUBJECT GROUPS

Subject Area	N	Number of participants with simulation training	DF	Chi-Square	Fischer's p-Value
Pharmacy Practice	16	5	1	0.8697	0.4777
Clinical Pharmacy	9	4	1	2.7993	0.1852
Pharmaceutical Chemistry	10	1	1	1.1927	0.4199
Pharmacology	11	3	1	0.1384	0.7012
Pharmaceutics	13	1	1	2.3111	0.2529

The researcher found no statistical significance between the different subject groups, the attendance of simulation training and their frequency of simulation use.

5.4.2 The types of simulation used in different subject areas

The researcher investigated the types of simulation (cf. 4.3.11) currently being used by the participants in the different subject areas (cf. 4.3.8). Table 5.5 represent the different subject areas and the types of simulation currently used (cf. 4.3.11).

The 4-point scale used to indicate the current use of simulation included the following options, 4 – "Always", 3 – "Often", 2 – "Rarely" and 1 – "Never". The types of simulation used were analysed for participants within the different subject areas.

TABLE 5.5: CHI-SQUARE ANALYSIS OF THE TYPES OF SIMULATION CURRENTLY BEING USED WITHIN PHARMACY PRACTICE VERSUS OTHER SUBJECT AREAS

				Pharmacy Practice					Remaining subject				
Types of simulation	**DF**	**Chi-Square**	**P-value**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**
Peer-to-peer (role-play)	2	5.1285	0.0907	14	35.71	7.14	57.14	0.00	34	58.82	17.65	23.53	0.00
Screen-based computer simulations	3	1.9454	0.6397	15	60.00	13.33	20.00	6.67	34	41.18	29.41	20.59	8.82
Low-fidelity mannequins	3	3.5372	0.3035	14	71.43	14.29	7.14	7.14	34	85.29	5.88	8.82	0.00
Medium-fidelity mannequins	2	1.6711	0.6050	14	85.71	14.29	0.00	0.00	34	88.24	5.88	5.88	0.00
High-fidelity mannequins	2	0.8319	1.000	13	92.31	7.69	0.00	0.00	34	85.29	8.82	5.88	0.00
Students as standardised patients	3	2.9445	0.3458	14	42.86	21.43	21.43	14.29	34	61.76	20.59	14.71	2.94
Actors as standardised patients	2	8.4331	0.3458	14	71.43	21.43	7.14	0.00	34	97.06	0.00	2.94	0.00
Internet-based simulations	3	4.7874	0.2432	14	78.57	7.14	14.29	0.00	34	47.06	29.41	17.65	5.88
Avatars or virtual reality	3	1.2607	0.9217	14	78.57	7.14	14.29	0.00	32	78.13	3.13	12.50	6.25

TABLE 5.6: CHI-SQUARE ANALYSIS OF THE TYPES OF SIMULATION CURRENTLY BEING USED WITHIN CLINICAL PHARMACY VERSUS OTHER SUBJECT AREAS
[Table continues on next page]

				Clinical Pharmacy					Remaining subjects				
Types of simulation	**DF**	**Chi-Square**	**P-value**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**
Peer-to-peer (role-play)	2	2.4803	0.3533	9	33.33	11.11	56.56	0.00	39	56.41	15.38	28.21	0.00
Screen-based computer simulations	3	1.4778	0.6042	9	33.33	22.22	33.33	11.11	40	50.00	25.00	17.50	7.50
Low-fidelity mannequins	3	9.5411	**0.0211**	9	56.56	11.11	33.33	0.00	39	87.18	7.69	2.56	2.56
Medium-fidelity mannequins	2	9.3187	**0.0330**	9	67.67	11.11	22.22	0.00	39	92.31	7.69	0.00	0.00

High-fidelity mannequins	2	12.1841	**0.0043**	9	55.56	22.22	22.22	0.00	38	94.74	5.26	0.00	0.00
Students as standardised patients	3	2.4889	0.3760	9	33.33	33.33	22.22	11.11	39	61.54	17.95	15.38	5.13
Actors as standardised patients	2	1.9750	0.4044	9	88.89	0.00	11.11	0.00	39	89.74	7.69	2.56	0.00
Internet-based simulations	3	0.6699	0.9223	9	56.56	22.22	22.22	0.00	39	56.41	23.08	15.38	5.13
Avatars or virtual reality	3	3.2701	0.2730	8	62.50	0.00	25.00	12.50	38	81.58	5.26	10.53	2.63

TABLE 5.7: CHI-SQUARE ANALYSIS OF THE TYPES OF SIMULATION CURRENTLY BEING USED WITHIN PHARMACEUTICAL CHEMISTRY VERSUS OTHER SUBJECT AREAS

					Pharmaceutical Chemistry				Remaining subjects				
Types of simulation	**DF**	**Chi-Square**	**P-value**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**
Peer-to-peer (role-play)	2	0.4286	0.8686	8	62.50	12.50	25.00	0.00	40	50.00	15.00	35.00	0.00
Screen-based computer simulations	3	3.7903	0.3216	8	25.00	37.50	37.50	0.00	41	51.22	21.95	17.07	9.76
Low-fidelity mannequins	3	2.2154	1.0000	8	100.00	0.00	0.00	0.00	40	77.50	10.00	10.00	2.50
Medium-fidelity mannequins	2	1.3714	1.0000	8	100.00	0.00	0.00	0.00	40	85.00	10.00	5.00	0.00
High-fidelity mannequins	2	1.4109	1.0000	8	100.00	0.00	0.00	0.00	39	84.62	10.26	5.13	0.00
Students as standardised patients	3	4.3667	0.2743	8	87.50	0.00	12.50	0.00	40	50.00	25.00	17.50	7.50
Actors as standardised patients	2	1.0047	0.6157	8	87.50	12.50	0.00	0.00	40	90.00	5.00	5.00	0.00
Internet-based simulations	3	2.2909	0.5162	8	37.50	37.50	25.00	0.00	40	60.00	20.00	15.00	5.00
Avatars or virtual reality	3	2.6901	0.8080	8	100.00	0.00	0.00	0.00	38	73.68	5.26	15.79	5.26

TABLE 5.8: CHI-SQUARE ANALYSIS OF THE TYPES OF SIMULATION CURRENTLY BEING USED WITHIN PHARMACOLOGY VERSUS OTHER SUBJECT AREAS

					Pharmacology					Remaining subjects			
Types of simulation	**DF**	**Chi-Square**	**P-value**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**
Peer-to-peer (role-play)	2	1.4752	0.5628	11	63.64	18.18	18.18	0.00	37	48.65	13.51	37.84	0.00
Screen-based computer simulations	3	1.1248	0.8101	11	54.55	27.27	9.09	9.09	38	44.74	23.68	23.68	7.89
Low-fidelity mannequins	3	3.2931	0.6248	11	100.00	0.00	0.00	0.00	37	75.68	10.81	10.81	2.70
Medium-fidelity mannequins	2	0.6234	1.0000	11	90.91	9.09	0.00	0.00	37	86.49	8.11	5.41	0.00
High fidelity-mannequins	2	0.6390	1.0000	11	90.91	9.09	0.00	0.00	36	96.11	8.33	5.56	0.00
Students as standardised patients	3	1.0981	1.0000	11	63.64	18.18	18.18	0.00	37	54.05	21.62	16.22	8.11
Actors as standardised patients	2	1.6593	1.0000	11	100.00	0.00	0.00	0.00	37	86.49	8.11	5.41	0.00
Internet-based simulations	3	0.9971	0.7838	11	54.55	18.18	18.18	9.09	37	56.76	24.32	16.22	2.70
Avatars or virtual reality	3	1.5732	0.7798	11	81.82	9.09	9.09	0.00	35	77.14	2.86	14.29	5.71

TABLE 5.9: CHI-SQUARE ANALYSIS OF THE TYPES OF SIMULATION CURRENTLY BEING USED WITHIN PHARMACEUTICS VERSUS OTHER SUBJECT AREAS
[Table continues on next page]

					Pharmaceutics					Remaining subjects			
Types of simulation	**DF**	**Chi-Square**	**P-value**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**	**N**	**Never %**	**Rarely %**	**Often %**	**Always %**
Peer-to-peer (role-play)	2	2.0343	0.3841	12	66.67	16.67	16.67	0.00	36	47.22	13.89	38.89	0.00
Screen-based computer simulations	3	05108	0.9924	13	46.15	30.77	15.38	7.69	36	47.22	22.22	22.22	8.33
Low-fidelity mannequins	3	1.8803	0.8540	12	91.67	8.33	0.00	0.00	36	77.78	8.33	11.11	2.78
Medium-fidelity mannequins	2	2.2857	0.5853	12	100.00	0.00	0.00	0.00	36	83.33	11.11	5.56	0.00
High-fidelity mannequins	2	2.3582	0.5865	12	100.00	0.00	0.00	0.00	35	82.86	11.43	5.71	0.00

Students as standardised patients	3	1.8123	0.7549	12	58.33	16.67	25.00	0.00	36	55.56	22.22	13.89	8.33
Actors as standardised patients	2	0.7855	1.0000	12	91.67	8.33	0.00	0.00	36	88.89	5.56	5.56	0.00
Internet-based simulations	3	1.3760	0.6537	12	58.33	25.00	8.33	8.33	36	55.56	22.22	19.44	2.78
Avatars or virtual reality	3	1.7258	0.6105	11	72.73	0.00	18.19	9.09	35	80.00	5.71	11.43	2.86

It is evident that the types of simulations used in Clinical Pharmacy include low-fidelity mannequins, medium-fidelity mannequins and high-fidelity mannequins. Even though the results may show some statistical significance, the use of simulation in pharmacy education are still not significant in most areas of pharmacy education.

5.4.3 Types of simulation used and the relationship with simulation workshop attendance

The use of different simulation modalities was investigated in relation to the attendance of simulation training. Table 5.10 represents the analysis of the use of various simulation modalities in relation to the attendance of simulation training.

TABLE 5.10: THE USE OF DIFFERENT SIMULATION MODALITIES IN RELATION TO SIMULATION TRAINING

Types of simulation	N	DF	Value	Probability	Fischer's P-value	Simulation Training (n = 12)				No Simulation Training				
						Never %	Rarely %	Often %	Always %	N	Never %	Rarely %	Often %	Always %
Peer-to-peer (role-play)	48	2	14.2610	0.0008	**0.0005**	8.33	16.67	75.00	0.00	36	66.67	13.89	19.44	0.00
Screen-based computer simulations	49	3	2.0631	0.5594	0.5502	41.67	16.67	25.00	16.67	37	48.65	27.03	18.92	5.41
Low-fidelity mannequins	48	3	9.3675	0.0248	**0.0223**	58.33	8.33	25.00	8.33	36	88.89	8.33	2.78	0.00
Medium-fidelity mannequins	48	2	6.7937	0.0335	**0.0278**	66.67	25.00	8.33	0.00	36	94.44	2.78	2.78	0.00
High-fidelity mannequins	47	2	6.1104	0.0471	0.1052	75.00	8.33	16.67	0.00	35	91.43	8.57	0.00	0.00
Students as standardised patients	48	3	8.3556	0.0392	**0.0240**	25.00	25.00	33.33	16.67	36	66.67	19.44	11.11	2.78
Actors as standardised patients	48	2	6.4910	0.0389	**0.0432**	75.00	8.33	16.67	0.00	36	94.44	5.56	0.00	0.00
Internet-based simulations	48	3	7.4972	0.0576	0.1016	58.33	8.33	16.67	16.67	36	55.56	27.76	16.67	0.00
Avatars or virtual reality	46	3	3.7895	0.2851	0.1720	58.33	8.33	25.00	8.33	34	85.29	2.94	8.82	2.94

Statistically, lecturers (n=12) who had attended simulation training appear to use peer-to-peer simulations (p-value=0.0005); low fidelity (p-value=0.0223) and medium fidelity (p-value=0.0278) mannequins; as well as students (p-value=0.0240) and actors (p-value=0.0432) as standardised patients more than lecturers who had not attended any training.

5.4.4 Types of simulation and their frequency of use

The types of simulations and their frenquency of use are represented in Table 5.11. Participants use screen-based computer simulations, avatars or virtual reality; as well as peer-to-peer (role-play) and students as standardised patients statistically significantly more than other simulation modalities. These modalities are more accessible and not too expensive to use.

TABLE 5.11: THE FREQUENCY OF DIFFERENT SIMULATION MODALITIES' USE
[Table continues on the next few pages]

Types of simulation	N	DF	Value	Probability	p-value	Results						
							How often do you use simulation? %					
How often do you use the following types of simulation?							Not at all	Very Little	Somewhat	Quite a Bit	A Great deal	N
Peer-to-peer (role-play)	48	8	15.2672	0.0542	**0.0431**	Never	75.00	58.82	28.57	0.00	20.00	**25**
						Rarely	12.50	11.76	14.29	0.00	40.00	**7**
						Often	12.50	29.41	57.14	100.00	40.00	**16**
						Always	0.00	0.00	0.00	0.00	0.00	**0**
						N	**16**	**17**	**7**	**3**	**5**	**48**
Screen-based computer simulations	49	12	34.0665	0.0007	**0.0007**	Never	81.25	33.33	28.57	0.00	40.00	**23**
						Rarely	6.25	44.44	42.86	0.00	0.00	**12**
						Often	6.25	22.22	14.29	100.00	20.00	**10**
						Always	6.25	0.00	14.29	0.00	40.00	**4**
							16	**18**	**7**	**3**	**5**	**49**
Low-fidelity mannequins	48	12	15.4402	0.2182	0.1107	Never	93.75	82.35	57.14	33.33	100.00	**39**
						Rarely	6.25	5.88	14.29	33.33	0.00	**4**
						Often	0.00	11.76	14.29	33.33	0.00	**4**
						Always	0.00	0.00	14.29	0.00	0.00	**1**
						N	**16**	**17**	**7**	**3**	**5**	**48**
Medium-fidelity mannequins	48	8	10.7130	0.2185	0.0781	Never	93.75	94.12	71.43	66.67	80.00	**42**
						Rarely	0.00	0.00	28.57	33.33	20.00	**4**
						Often	6.25	5.88	0.00	0.00	0.00	**2**
						Always	0.00	0.00	0.00	0.00	0.00	**0**
						N	**16**	**17**	**7**	**3**	**5**	**48**

High-fidelity mannequins	47	8	6.7239	0.5667	0.4249	**Never**	93.33	88.24	85.71	66.67	80.00	**41**
						Rarely	6.67	5.88	0.00	33.33	20.00	**4**
						Often	0.00	5.88	14.29	0.00	0.00	**2**
						Always	0.00	0.00	0.00	0.00	0.00	**0**
						N	**15**	**17**	**7**	**3**	**5**	**47**
Students as standardised patients	48	12	28.3174	0.0050	**0.0017**	**Never**	87.50	52.94	28.57	0.00	40.00	**27**
						Rarely	6.25	35.29	0.00	33.33	40.00	**10**
						Often	6.25	5.88	42.86	66.67	20.00	**8**
						Always	0.00	5.88	28.57	0.00	0.00	**3**
						N	**16**	**17**	**7**	**3**	**5**	**48**
Actors as standardised patients	48	8	9.0918	0.3346	0.2022	**Never**	100.00	88.24	71.43	66.67	100.00	**43**
						Rarely	0.00	5.88	14.29	33.33	0.00	**3**
						Often	0.00	5.88	14.29	0.00	0.00	**2**
						Always	0.00	0.00	0.00	0.00	0.00	**0**
						N	**16**	**17**	**7**	**3**	**5**	**48**
Internet-based simulations	48	12	19.0705	0.0868	0.0835	**Never**	75.00	47.06	42.86	33.33	60.00	**27**
						Rarely	18.75	41.18	14.29	0.00	0.00	**11**
						Often	6.25	11.76	28.57	66.67	20.00	**8**
						Always	0.00	0.00	14.29	0.00	20.00	**2**
						N	**16**	**17**	**7**	**3**	**5**	**48**
Avatars or virtual reality	46	12	21.1951	0.0476	**0.0110**	**Never**	93.75	86.67	71.43	33.33	40.00	**36**
						Rarely	6.25	6.67	0.00	0.00	0.00	**2**
						Often	0.00	6.67	14.29	66.67	40.00	**6**
						Always	0.00	0.00	14.29	0.00	20.00	**2**
						N	**16**	**15**	**7**	**3**	**5**	**46**

5.4.5 The current facilities used for simulation in the different subject areas

The researcher investigated the different facilities currently being used by the different subject areas (cf. 4.3.8). Table 5.12 reflects the facilities currently being used for simulation activities.

TABLE 5.12: ANALYSIS OF THE TYPES OF FACILITIES CURRENTLY BEING USED WITHIN DIFFERENT SUBJECT AREAS

Subject Area	Pharmacy Practice			Clinical Pharmacy			Pharmaceutical Chemistry			Pharmacology			Pharmaceutics		
	Yes	DF	Chi-Square	Yes	DF	Chi-Square	Yes	DF	Chi-Square	Yes	DF	Chi-Square	Yes	DF	Chi-Square
	No	Fisher's p-value		No	Fisher's p-value		No	Fisher's p-value		No	Fisher's p-value		No	Fisher's p-value	
Classroom settings	46.15%	1	3.8457	88.89%	1	2.3844	75.00%	1	0.2557	42.86%	1	2.3015	75.00%	1	0.4330
	53.85%	0.0774		11.11%	0.2307		25.00%	1.000		57.14%	0.1900		25.00%	0.7199	
Computer labs	35.71%	1	1.6762	55.56%	1	0.1397	75.00%	1	2.444	42.86%	1	0.1699	46.15%	1	0.1092
	64.29%	0.3319		44.44%	1.000		25.00%	0.2404		57.14%	1.000		53.85%	1.000	
Off-site simulation facilities	15.38%	1	0.0186	0	1	1.9091	42.86%	1	5.600	0	1	1.400	25.00%	1	1.575
	84.62%	1.000		100%	0.3120		57.14%	0.0478		100%	0.5668		75.00%	0.3292	
On-site simulation facilities	64.29%	1	0.7857	44.44%	1	0.4656	28.57%	1	2.2651	37.50%	1	1.1458	66.67%	1	0.9778
	35.71%	0.5186		55.56%	0.7095		71.43%	0.2172		62.50%	0.4361		33.33%	0.4982	
Traditional practical labs	42.86%	1	1.99	55.56%	1	0.0312	42.86%	1	0.8024	28.57%	1	3.0036	84.62%	1	5.3668
	57.14%	0.1977		44.44%	1.000		57.14%	0.4274		71.43%	0.1101		15.38%	0.0412	

The results for the various subject groups are not statistically significant for most facilities. The use of traditional practical laboratories in Pharmaceutics (p-value=0.0412) and off-site simulation facilities in Pharmaceutical Chemistry (p-value=0.0478) reaches statistical significance. The researcher would have expected the use of traditional practical laboratories for both these subject areas. The type and availalbility of off-site facilities used in Pharmaceutical Chemistry needs to be investigated further.

5.4.6 The availability of dedicated facilities and simulation equipment

The researcher investigated the participants knowledge regarding the availability and use of simulation equipment (cf. 4.6.3) and dedicated simulation facilities (cf. 4.6.1) at their various training institutions.

The researcher also investigated the possibility that participants who had attended simulation training or workshops may be more knowledgeable regarding the availability and use of equipment and facilities see Figure 5.2. The responses show that the participants who had attended simulation training were indeed more informed regarding dedicated simulation facilities.

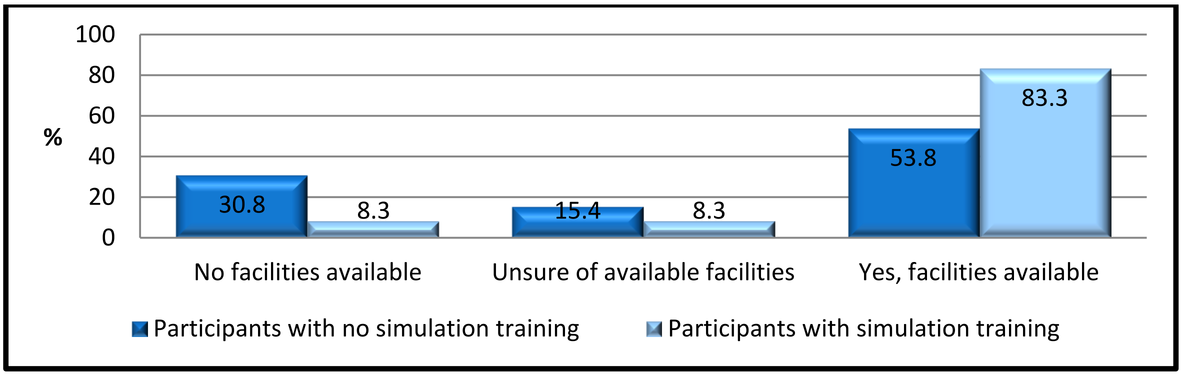

FIGURE 5.2: KNOWLEDGE REGARDING AVAILABILITY OF DEDICATED SIMULATION FACILITIES – SIMULATION TRAINING

The availability of dedicated facilities may be one of the drivers for the attendance of simulation training. In the questionnaire the participants were asked if they had any simulation equipment that was underutilised and to explain why they thought the equipment might not be used (cf. 4.6.3). The number of participants unsure of available facilities and equipment would ideally be as few as possible.

The participants had the option to give explanations for the underutilisation of equipment. Some of these explanations include:

- *"Can do more, not using 100% for all the 4 years of study. Busy introducing to all levels of students";*
- *"Groups too large – easier to show pictures / give a written case study" and "Lack of knowledge on how to optimize the resources/time";*
- *"Lack of knowledgeable staff members";*
- *"Time for preparation, staff to manage, and only one / few expensive product available!"*

The explanations for underutilisation of equipment were all from participants who had never had any simulation training; participants who have had simulation training agreed that lack of knowledge is one of the most influential factors (cf 5.2.2).

5.4.7 Knowledge about availability of dedicated facilities between different subject lecturer groups

Figure 5.3 shows a comparison of the knowledge regarding the availability of dedicated simulation facilities among participant groups, divided according to the subject area they teach.

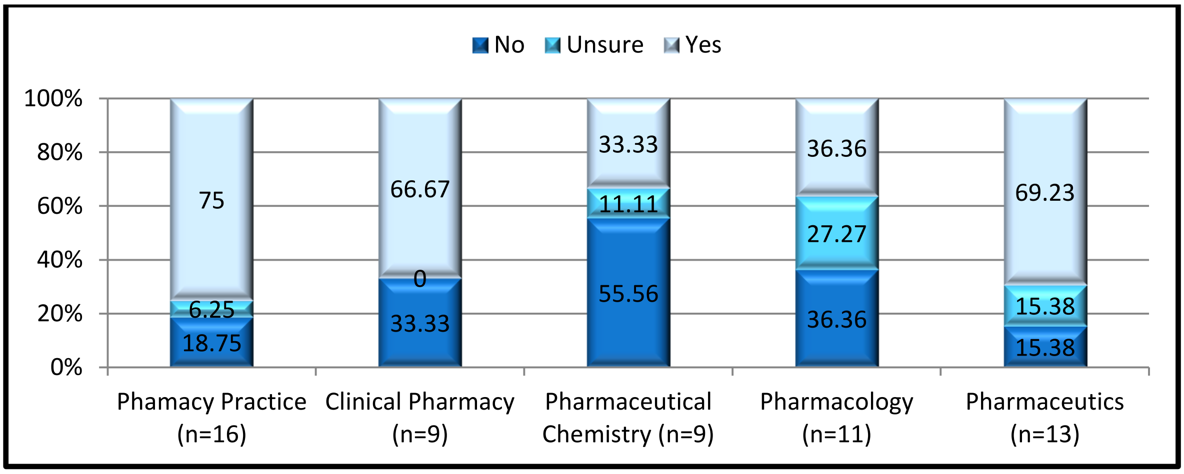

FIGURE 5.3: KNOWLEDGE REGARDING AVAILABILITY OF DEDICATED SIMULATION FACILITIES WITH SUBJECT AREAS

Lecturers from Clinical Pharmacy were more informed regarding available facilities. Accordingly, it appears that the nature of the subject matter may be an important driver for the use of simulation and simulation modalities (cf. Table 5.6).

5.5 PARTICIPANTS' OPINIONS

Table 5.13 represent the opinions of participants who had received simulation training regarding the use of simulation in undergraduate pharmacy education. The responses from participants with simulation training are all positive in nature, subject to some limitations.

TABLE 5.13: COMMENTS FROM PARTICIPANTS WITH SIMULATION TRAINING

Positive comments from participants
• *"Valuable"* • *"A definite need!"* • *"It is beneficial"*
Positive comments with limitations
• *"A very positive but time consuming experience because of large student groups"* • *"Very good if managed well"*
Positive comments from participants with explanations
• *"Simulation has the ability to give every student the same experience in a controlled environment. Simulation forms an integral part of my module in our simulated pharmacy"* • *"It is vital. Pharmacy is a practical profession. It requires students to see how things are done and to be able to practise on the skills they are taught. Sadly, too much emphasis is placed on practical labs for pharmaceutics and pharmaceutical chemistry and not enough on other subjects".* • *"Very important for developing examination skills and to apply theoretical principles in real life situations".* • *"It gives students a real world experience, they have to make split decisions, drawing on their integrated knowledge it prepares students for the world of work because they have a better idea of what to expect and what to do"* • *"Excellent cost effective method. Puts the learning back in students' hands"*

5.6 SUMMARY OF THE CHAPTER

In this chapter the results from Chapter 4 were investigated further and discussed.

The researcher strongly agrees with the results of the questionnaire (cf. 5.2.2), which indicate that the lack of knowledge about simulation not only plays a significant role in its use, but also shapes and influences opinions regarding simulation.

The researcher recognises that participants may lack fundamental knowledge regarding simulation and simulation terms. Although the participants also identified lack of evidence as a possible limiting factor, the researcher suggests that a lack of knowledge influenced the participant's response.

The results show that the number of years teaching undergraduate pharmacy education does not have a significant influence on the use and opinions regarding simulation. There is a popular saying *"we teach as we were taught"* and the researcher suggests that this might be supported in the results. Pharmaceutics practical sessions were and are traditionally done in practical laboratories (cf. Table 5.12). The researcher acknowledges that the practical subject matter lends itself towards traditional practical laboratories, but suggests that further research must be done to incorporate other options and technologies; for example, computer-based models as well.

The movement from product to patient in pharmacy is becoming somewhat evident in the use of mannequins and standardised patients, respectively (cf. Table 5.6) in the subject area Clinical Pharmacy. The statistical significance of simulation use is however, very small. The researcher recommends that all subject areas investigate relevant types of simulation for incorporation into their individual modules.

The attendance of simulation training likely promotes the use of different simulation modalities (cf. 5.4.3) or *vice versa*. The researcher proposes that participants who had attended training gained the necessary knowledge to use simulation. These participants were also more informed about available facilities for simulation activities and equipment that are currently underutilised (cf. 5.4.6).

The following recommendations can be made from the study:

- Pharmacy Schools should investigate their individual situation regarding simulation as these results are based on a total response rate of ≈39%. Each individual pharmacy school should be able to assess their unique position.
- Consideration should be given to increase simulation training for lecturers in subject areas where simulation can be used.
- Available simulation resources for pharmacy training should be investigated further, including possible national and/or international collaboration through the use of virtual platforms.

- Pharmacy schools should investigate opportunities for simulation sessions to be added or lectures to be replaced or augmented by simulation sessions if at all possible.
- Communication between different departments and/or schools should be addressed and increased, especially regarding the availability of simulation facilities and/or equipment.
- Publishing the research results in accredited higher education, pharmacy related and simulation journals.
- Further research on simulation-based activities to improve graduate readiness for the workplace.
- Implementing the proposed simulation activities to achieve learner competence (cf. Table 5.14).

TABLE 5.14: EARLY IDENTIFICATION OF POSSIBLE SIMULATION ACTIVITIES FOR CURRICULUM INTEGRATION [Compiled by the Researcher, NAUDé A, 2015]
(Table continues on next page)

SAQA Associated Assessment Criteria for learner competencies (SAQA 2012:Online)	Examples of simulation modalities
• Design, manufacture and test new drugs as part of a team • Design and test new pharmaceutical products and dosage forms • Develop, manufacture, test, register, compound, pack and store pharmaceutical products. Manage, organise and control such processes	• Team-based drug development simulation using a production line. • Simulation activity in practical laboratories • Computer-based models
• Describe sources and procedures for supplying medicines in the public and private sector • Explain medicine distribution systems, prevention of degradation, maintenance of integrity and the cold chain, and the scientific and pharmaceutical principles involved in specific case studies	• Procurement simulations, • Virtual reality, computer models, Virtual procurement • Case studies
• Develop a pharmaceutical care plan for an individual patient in a case study and then describe the implementation and monitoring of the plan as well as the principles involved • Discuss the drug action in the human body, side effects, contra-indications and the principles involved • Identify drug-related problems and then discuss the prevention of these problems	• Standardised patient / Virtual patient • Role-play simulations • Case-studies • Computer based models or Virtual pharmacy
• Read and interpret prescriptions, discuss and employ applicable pharmaceutical and pharmacological principles, and apply legal and ethical requirements and good	• Dispense prescriptions in a simulated pharmacy environment

pharmacy practice • Discuss and evaluate the desired outcomes in the therapeutic treatment of various diseases • In a given case study advice a patient and a medical practitioner on the optimal use of the prescribed medicine	• Role-play • Case studies / Computer-based simulations • Standardised patient or Virtual patient • Role-play simulations
• Record an anamnesis • Recognise and discuss symptoms and signs and the causes of diseases and social factors affecting it • Command physical examination methods (under supervision) on the primary health care level • Treat diseases (under supervision) on the primary care level in accordance with the Standard Treatment Guidelines of the South African Essential Drug Programme for Primary Care	• Standardised patient simulations (actors or students as standardised patients) • Virtual pharmacy and virtual patient • Peer-physical examinations • Case studies • Role-play
• Measure blood pressure, interpret it, advise the patient and apply sound clinical and scientific judgement for referral to medical practitioners • Perform and interpret applicable screening tests, and advising the patient in accordance with pharmacy practice principles where applicable • Communicate findings and advice to the health care team and the patient and discuss the patient's concerns with him/her	• Mannequin-based simulations • Computer simulations • Low fidelity simulations • Standardised patient-simulations • Virtual patients • Case studies • Role-play
• Educate patients and the general public by verbally discussing information on health care to individual patients, the general public and health professions • Educate patients and the general public by designing posters with information on health care. Effectively use drug information sources and information systems	• Scenario simulations with standardised patients (students or actors as standardised patients) • Simulations using the information technology systems installed in the retail, institution and primary healthcare units

5.7 CONCLUDING REMARKS

The lack of knowledge regarding simulation seems to run through the results of the study. Participants who had attended simulation training were more familiar with simulation and its use than the other participants. The use of simulation and its modalities were limited to a few participants and subject areas.

The limitations and conclusions reached from this study will be discussed in Chapter 6.

CHAPTER 6

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

6.1 INTRODUCTION

The researcher conducted the study: the opinions on and use of simulation in undergraduate pharmacy education at South African Universities to gain insight into and to make recommendations regarding the use of simulation at pharmacy training institutions.

In the previous chapter, the results of the questionnaire survey were interpreted in relation to the objectives of the study.

The South African Pharmacy Councils' GPES requires simulation integration into undergraduate pharmacy curricula to deliver competent practice-ready eight-star pharmacists able to address the healthcare needs of the community. In this study, the use of simulation was investigated, as well as the undergraduate lecturers' opinions regarding simulation.

The aim of Chapter 6 is to provide a reflection on the study. The chapter begins with an overview of the study, followed by answers to the research questions and addressing the objectives of the study. The chapter concludes with recommendations, limitations and concluding remarks.

6.2 OVERVIEW OF THE STUDY

The study was performed and completed based on two research questions. The research findings served as the basis for assessing the current use and opinions regarding simulation in undergraduate pharmacy education at South African Universities as well as for making recommendations.

The research questions were presented in Chapter 1 (cf. 1.3). These research questions directed the study and formed the outcome of the study. The two research questions and main findings are reviewed below.

6.2.1 Research question one

The first research question was identified as:
What is the current state of simulation use in undergraduate pharmacy education?

The following objective was pursued:
To gain a deeper understanding regarding simulation, the value of simulation as educational tool in education and the current status of simulation use in pharmacy in South Africa.

This objective addressed research question one.

The research question aimed to provide a clear picture of the current situation regarding the use of simulation in undergraduate pharmacy education. Chapter 2 provided conceptualisation and contextualisation of the subject; see Figure 2.1 for a diagrammatic overview of Chapter 2, where simulation integration as required component of GEPS into the pharmacy curriculum was highlighted.

The literature review provided a clear understanding of simulation and an overview of simulation concepts (cf. 2.3), as well as the necessary information for development of the questionnaire.

Data collection was done through an online questionnaire survey sent to undergraduate pharmacy lecturers. Ensuring the reliability and validity of the study were described in Chapter 3 (cf. 3.4) and the survey data were reported in Chapter 4.

In conclusion, the use of simulation (cf. 4.3.10) as well as the types of simulation used (cf. 4.3.11) was found to be limited. The researcher made several recommendations with regard to simulation (cf. 5.6) and endeavoured to provide a number of examples of simulation modalities that can be incorporated into the pharmacy curriculum (cf. Table 5.14).

6.2.2 Research question two

The second research question was identified as:
What are lecturers' opinions regarding the use of simulation?

The following objective was pursued:

To determine the current availability, use and opinions of all resources involved in a simulation setting by means of inquiry into technology used; resources available and opinions regarding the use of simulation of lecturers involved in undergraduate pharmacy education.

This objective addressed research question two.

In response to research question two, the literature review as described in Chapter 2 provided the necessary background to compile the questionnaire survey. The data gathered using the questionnaire survey, presented in Chapter 4 represents the opinions of the participants regarding the use of simulation, which include opinions regarding possible influencing factors, while potential benefits of simulation use were assessed. The availability of facilities and equipment, as well as technology currently being used was also determined. The interpretation, as well as possible relationships between some factors were discussed in Chapter 5.

Demography of the participants included the gender (cf. 4.3.1); registration with the SAPC as a pharmacist (cf. 4.3.2) as well as current employment (cf. 4.3.3). The number of students in each module (cf. 4.3.4), curriculum models used (cf. 4.3.5) and number of years involved in undergraduate pharmacy education (cf. 4.3.6) were also identified.
The gender of the participants (cf. 4.3.1) was investigated as a response influencing factor (cf. 5.2.1).

A possible relationship between the number of years lecturers had been involved in undergraduate pharmacy education already (cf. 4.3.6) and attendance of simulation training and/or workshops (cf. 4.3.9) were investigated (cf. 5.2.3).

Primary teaching strategies (cf. 4.3.7) currently being used by participants and the subject area(s) (cf. 4.3.8) participants are involved in were identified. The attendance of any simulation training (cf. 4.3.9) and the frequency (cf. 4.3.10) and types (cf. 4.3.11) of simulation used in the various subject areas were identified and investigated (cf. 5.4) further. Participants' knowledge regarding the availability of dedicated simulation facilities in various subject areas were considered (cf. 5.4.7).

The relationship between attendance of simulation training (cf. 4.3.9) and use of simulation (cf. 4.3.10) was investigated (cf. 5.2.4).

Participant's opinions regarding factors influencing the use of simulation (cf. 4.4) were determined and potential influencing factors investigated, namely - number of years teaching undergraduate pharmacy (cf. 5.3) and simulation training (cf. 5.2.2).

The opinions of the participants relating to the benefits of simulation (cf. 4.5) for students were described in Chapter 4, and the attendance of simulation training as an influencing factor investigated (cf. 5.2.5).

The availability of dedicated simulation facilities (cf.4.6.1), the location of these facilities (cf. 4.6.2), and underutilised equipment (cf. 4.6.3) as well as reasons for underutilisation were discussed in Chapter 4. The researcher investigated the participants' knowledge regarding the availability of facilities and reasons for underutilised equipment (cf. 5.4.6) in relation to attendance of simulation training by the participants.

Participants' opinions about simulation in undergraduate pharmacy education (cf. 4.7) were grouped into themes.

In conclusion, participants agreed that some factors limit the use of simulation, including large student numbers, time constraints, and lack of skilled staff as well as insufficient number of staff members in general. Lack of knowledge regarding simulation emerged as the most influential factor limiting the use of simulation. Facilities and equipment seem to be available at some institutions but a number of participants were uninformed regarding availability.

The majority of the participants felt that simulation integration would have positive benefits for the students and opinions appear mostly positive with some suggestions, explanations and limitations given by the participants.

6.3 LIMITATIONS OF THE STUDY

The researcher recognises the following limitations in the study:

Only 52 participants completed the online questionnaire; a low completion rate of 38.8%. One training institution did not respond and the 55.8% response from the North-West University may have impacted the results.

The researcher could possibly have explained terms relating to simulation in more detail to participants without prior simulation training. The researcher recognises that some participants did not have adequate background information and knowledge about simulation. Provision of additional information and explanation of terms could, however, have had an additional negative impact on the completion rate.

6.4 CONTRIBUTION AND SIGNIFICANCE OF THE STUDY

The research made a valuable contribution by providing School Directors a clear picture of the current use of simulation in undergraduate pharmacy education as well as factors potentially limiting its use.

By assessing the current situation, recommendations were made to assist lecturers in integrating simulation into the pharmacy curriculum and significantly improving the use of simulation.

6.5 RECOMMENDATIONS

For this study to produce noteworthy and valuable results, the researcher takes the opportunity to make the following additional recommendations:

- That the findings of this study be sent to the various School Directors, to have a clear understanding of the current use of simulation in pharmacy education in South Africa;
- That the findings of this study be sent to the various School Directors, to address the lack of knowledge regarding available simulation facilities and equipment;
- The successful implementation of more simulation activities to enhance undergraduate pharmacy education and ultimately improve service delivery to patients from better prepared, practice-ready pharmacists;
- That the research results be presented at national congresses and in journal articles;
- Further research on simulation-based activities and assessment in pharmacy education.

6.6 CONCLUDING REMARKS

Simulation is an innovative learning pedagogy essential in healthcare provider education at all levels and in all healthcare domains. With an overwhelming demand for practice-ready competent pharmacists, as well as multiple drivers for the use of simulation with other pedagogies in the pharmacy curriculum, the incorporation and integration of simulation into the pharmacy curriculum need to be deliberate and carefully planned to ensure success for faculty as well as students.

The study investigated the current use of simulation and opinions of the lecturers involved in undergraduate pharmacy education regarding the use of simulation. The research identified a significant lack of knowledge regarding simulation and its use.

The use of simulation in undergraduate pharmacy in South Africa is still meagre in most subject areas and by the majority of the participants. It is, however, clear that simulation and its application have limitless possibilities in undergraduate pharmacy education and that the potential benefits for students (cf. 4.5) are overwhelmingly positive.

REFERENCES

Aldous, C., Rheeder, P. & Esterhuizen, T. 2011. *Writing your first clinical research protocol.* Cape Town: Juta.

Aulton, M.E. 2007. Pharmaceutics: *The design and manufacture of medicine*. 3rd ed. Edinburgh: Churchill Livingston.

American College of Clinical Pharmacy. The Definition of Clinical Pharmacy. *Pharmacotherapy* 28(6):816-817.

Anderson, C., Brock, T., Bates, I., Rouse, M., Marriot, J., Manasse, H., Futter, B., Bhojraj, S., Brown, A & Gal, D. 2011. Transforming Health Professions Education. *American Journal of Pharmaceutical Education* 75(2):22.

Anderson, S. 2002. The state of the world's pharmacy: a portrait of the pharmacy profession. *Journal of interprofessional care* 16(4):391-404.

Baruch, Y & Holtom, B.C. 2008. Survey response rate levels and trends in organizational research. *Human Relations* 61(8):1139-1160.

Basheti, I.A. 2014. The effect of using simulation for training pharmacy students on correct device technique. *American Journal of Pharmaceutical Education* 78(10):1-10.

Boulos, M.N.K., Hetherington, L. & Wheeler, S. 2007. Second Life: an overview of the potential of 3-D virtual worlds in medical and health education. *Health Information and Libraries Journal* (24):233-245.

Bradley, P. 2006. The history of simulation in medical education and possible future directions. *Medical Education* 40(3):254-262.

Bradley, P. & Postlethwaite, K. 2003. Simulation in clinical learning. *Medical Education* 37(1):1-5.

Caine, R. & Caine, G. 1995. Reinventing schools through brain-based learning. *Educational Leadership* 52(7):43-47.

Cannon-Diehl, M.R. 2009. Simulation in healthcare and nursing: state of the science. *Critical Care Nursing Quarterly* 32(2):128-136.

CHE (Council on Higher Education). 2011. Work-Integrated Learning: Good Practice Guide. *HE Monitor* August:12.

Chen, A.M.H., Kiersma, M.E., Yehle, K.S. & Plake, K.S. 2015. Impact of an aging simulation game on pharmacy students' empathy for older adults. *American Journal of Pharmaceutical Education* 79(5):1-10.

Cruess, R.L., Cruess, S.R., Boudreau, J.D., Snell, L. & Steinert, Y. 2014. Reframing medical education to support professional identity formation. *Academic Medicine* 89(11):1446-1451.

Cruess, R.L., Cruess, S.R. & Steinert, Y. 2015. Amending miller's pyramid to include professional identity formation. *Academic Medicine* doi: 10.1097IACM.0000000000000913

Davies, C. 2013. Kolb Learning Cycle.
(http://www.ldu.leeds.ac.uk/ldu/sddu_multimedia/kolb/static_version.php)
Retrieved on 25 May 2013.

Delport, C.S.L. & Roestenburg, W.J.H. 2011. Quantitative data-collection methods: questionnaires, checklists, structured observation and structured interview schedules. In De Vos, A.S., Strydom, H., Fouché, C.B. & Delport, C.S.L (Eds). *Research at grass roots: For the social sciences and human service professions.* 4th ed. Pretoria: Van Schaik.

Douglass, M.A., Casale, J.P., Skirvin, J.A. & DiVall, M.V. 2013. A virtual patient software program to improve pharmacy student learning in a comprehensive disease management course. *American Journal of Pharmaceutical Education* 77(8):1-7.

Dunn, W.F. 2004. Education theory: Does simulation really fit? In Dunn, W.F. (Ed.). *Simulators in critical care and beyond*. Des Plaines, IL: Society of Critical Care Medicine.

Elfrink, V.I., Kirkpatrick, B., Nininger, J. & Schubert, C. 2010. Using learning outcomes to inform teaching practices in human patient simulation. *Nursing Education Perspectives* 31(2):97–100.

Flanagan, B., Nestel, D. & Joseph, M. 2004. Making patient safety the focus: Crisis Resource Management in the undergraduate curriculum. *Medical Education* 38(1):56-66.

Frenk, J., Chen, L., Bhutta, J.C., Cohen, J., Crisp, N., Evans, T., Fineberg, H., Garcia, P., Ke, Y., Kelly, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D. & Zurayk, H. 2010. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *The Lancet* 376(9756):1923-1958.

Fouché, C.B. & Delport, C.S.L. 2011. Writing the research proposal. In De Vos, A.S., Strydom, H., Fouché, C.B. & Delport, C.S.L. *Research at grass roots: For the social sciences and human service professions.* 4th ed. Pretoria: Van Schaik.

Fouché, C.B. & De Vos, A.S. 2011. Formal formulations. In De Vos, A.S., Strydom, H., Fouché, C.B. & Delport, C.S.L. (Eds). *Research at grass roots: For the social sciences and human service professions.* 4th ed. Pretoria: Van Schaik.

Fowler, J. 2008. Experiential learning and its facilitation. *Nurse Education Today* 28(4):427-433.

Gaba, D. 2004. The future vision of simulation in health care. *Quality and Safety in Health Care* 13(Suppl. 1):i2-i10.

Galbraith, A., Bullock, S., Manias, E., Hunt, B. & Richards, A. 1999 *Fundamentals of Pharmacology.* Singapore: Pearson Education Limited.

Goddard, W. & Melville, S. 2004. *Research Methodology: An introduction.* 2nd ed. Lansdowne: Juta.

Grabinger, S. 1996. Rich environments for active learning. In Jonassen, D. (Ed.). *Handbook of research for educational telecommunications and technology*. New York: MacMillan.

Health Worfkorce Australia. 2011. Use of Simulation in Pharmacy School Curricula. (http://www.hwa.gov.au/sites/default/files/simulation-in-pharmacy-school-curricula-201108.pdf)
Retrieved on 18 January 2014.

Issenberg, S.B., McGaghie, W.C., Petrusa, E.R., Gordon, D.L. & Scalese, D.L. 2005. Features and uses of high-fidelity medical simulations that to effective learning: a BEME systematic review. *Medical Teacher* 27(1):10-28.

Issenberg, S.B. 2006. The scope of simulation-based healthcare education. *Simulation in Healthcare* 1(4):203-208.

Jeffries, P.R. 2005. A framework for designing, implementing, and evaluating simulations used as teaching strategies in nursing. *Nursing Education Perspectives* 26(2):96-103.

Khan, K., Pattison, T. & Sherwood, M. 2011. Simulation in medical education. *Medical Teacher* 33(1):1-3.

Kneebone, R. 2006. Crossing the line: Simulation and boundary areas. *Simulation in Healthcare* 1(3):160-163.

Labuschagne, M.J. 2012. Clinical simulation to enhance undergraduate medical education and training at the University of the Free State. (Unpublished Ph.D. thesis) University of the Free State, Bloemfontein.

Labuschagne, M.J. 2013. The role of simulation training in ophthalmology. *Continuing Medical Education* 31(4):157-159.

Leedy, P.D. & Ormond, J.E. 2002. *Practical research: Planning and design.* 7th ed. New Jersey: Merrill Prentice Hall.

Leedy, P.D & Ormrod, J.E. 2014. *Practical Research*. Pearson New International Edition. 10th ed. New Jersey: Merrill Prentice Hall.

Leigh, E. & Spindler, L. 2004. Simulations and games as chaordic learning contexts. *Simulation & Gaming* 35(1):53-69.

Leinster, S. 2009. Curriculum development. In Dent, J.A. & Harden, R.M. (Eds) *A Practical Guide for Medical Teachers.* 3rd ed. London: Elsevier.

Lin, K., Travlos, D.V., Wadelin, J.W. & Vlasses, P.H. 2011. Patient simulation: Simulation and introductory Pharmacy Practice experiences. *American Journal of Pharmaceutical Education* 75(10):1-9.

McCartney, J. 2013. NMMU launches new programmes, opens new facilities and celebrates excellence in pharmacy education. *South African Pharmaceutical Journal* 80(1):32-33.

McGaghie, W.G., Issenberg, S.B., Petrusa, E.R. & Scalese, R.J. 2010. A critical review of simulation-based medical education research: 2003-2009. *Medical Education* 44(1):50-63.

Mesquita, A.R., Souza, W.M., Boaventura, T.C., Barros, I.M.C., Antoniolli, A.R., Silva, W.B. & Lyra Júnior, D.P. 2015. The effect of active learning methodologies on the teaching of pharmaceutical care in a Brazilian Pharmacy Faculty. *PLoS ONE* 10(5),e0123141.

Mesquita, A.R., Lyra Júnior, D.P., Brito, G.C., Balisa-Rocha, B.J., Aguiar, P.M. & de Almeida Neto, A.C. 2010. Developing communication skills in pharmacy: A systematic review of the use of simulated patient methods. *Patient Education and Counseling* 78(2):143-148.

Michael, M., Abboudi, H., Ker, J., Khan, M.S., Dasgupta, P. & Ahmed, K. 2014 Performance of technology-driven simulators for medical students – a systematic review. *Journal of Surgical Research* 192(2):531-543.

Mouton, J. 2001. *How to succeed in your Master's and Doctoral Studies: A South African Guide and Resource Book.* 1st ed. Pretoria: Van Schaik.

Murphy, S., Hartigan, I., Walshe, N., Flynn, A.V. & O'Brien, S. 2011. Merging problem-based learning and simulation as an innovative pedagogy in nurse education. *Clinical Simulation in Nursing* 7(4):e141-e148.

Murray, D.J. 2011. Current trends in simulation training in anesthesia: a review. *Minerva Anestesiologica* 77(5):528-533.

NQF (National Qualifications Framework). 2014. Standard Glossary of Terms.

NWU (North-West University). 2014. Class discussion. FPKG 221. (Good Pharmacy Practice Module).

NWU (North-West University). 2011. Eerste simulasie-apteek in SA. (http://www.nwu.ac.za/af/content/nwu-potchefstroomkampus-nuus-eerste-simulasie-apteek-sa)
Retrieved on 10 January 2015.

NWU (North-West University). 2015. Minimum admission requirements for undergraduate studies. (Potchefstroom campus)
(http://www.nwu.ac.za/sites/www.nwu.ac.za/files/files/pc-potchefstroom-campus/MinimumRequirementsToelatingsvereistes2016.pdf)
Retrieved on 10 September 2015.

Nulty, D.D. 2008. The adequacy of response rates to online and paper surveys: what can be done? *Assessment & Evaluation in Higher Education* 33(3):301-314.

Oliver, R. 2000. *When teaching meets learning: design principles and strategies for web-based learning environments that support knowledge construction.* Australia: Edith Cowan University.

Pietersen, J. & Maree, K. 2007. Statistical analysis I: descriptive statistics. In Maree, K. (Ed.). *First steps in Research*. Pretoria: Van Schaik.

Prensky, M. 2001. Digital natives, digital immigrants. *On the Horizon* 9(5):1–6.

Rall, M., Manser, T. & Howard, S.K. 2009. Key elements of debriefing for simulator training. *European Journal of Anaesthesiology* 17(8):516-517.

Rao, D. 2011. Instructional design and assessment. Skills development using role-play in a first-year pharmacy practice course. *American Journal of Pharmaceutical Education* 75(5):84.

RSA DoH (Republic of South Africa. Department of Health). 1974. *Pharmacy Act, Act 53 of 1974.* Pretoria: Government Printers.

RSA DoH (Republic of South Africa. Department of Health). 1994. *Regulations relating to the minimum requirements of the curriculum for a degree in pharmacy in terms of section 49 of the Pharmacy Act, Act 53 of 1974.* (Notice 1528). Pretoria: Government Printers.

RSA DoH (Republic of South Africa. Department of Health). 1996. National Drug Policy for South Africa.
(www.doh.gov.za/docs/policy/drugsjan1996.pdf)
Retrieved on 15 September 2014.

RSA DoH (Republic of South Africa. Department of Health). 2000a. *Regulations relating pharmacy education and training in terms of section 33 and 34 of the Pharmacy Act, Act 53 of 1974.* (Notice 1156). Pretoria: Government Printers.

RSA DoH (Republic of South Africa. Department of Health). 2000b. *Regulations relating to the practice of pharmacy in terms of section 35A of the Pharmacy Act, Act 53 of 1974, as amended, made the regulations in the Schedule.* (Notice 1158). Pretoria: Government Printers.

RSA (Republic of South Africa). 2014. *Good Pharmacy Education Standards in terms of section 34 of the Pharmacy Act, Act 53 of 1974.* (Notice 153). Pretoria: Government Printers.

Rodgers, D.L. 2007. High-fidelity patient simulation: a descriptive white paper report. (http://sim-strategies.com/downloads/Simulation%20White%20Paper2.pdf)
Retrieved on 26 April 2013.

SAPC (South African Pharmacy Council). 2010a. *A Report on a visit to the University of ___ in terms of section 33 and section 34 of the Pharmacy Act (Act 53 of 1974).* Pretoria: SAPC.

SAPC (South African Pharmacy Council). 2010b. *Good Pharmacy Practice in South Africa.* 4th ed. Arcadia: SAPC.

SAPC (South African Pharmacy Council). 2013. *Annual Report*. Pretoria: SAPC.

SAPC (South African Pharmacy Council). 2014a. *Updated list: approved providers and course.* (http://www.mm3admin.co.za/documents/docmanager/0C43CA52-121E-4F58-B8F6-81F656F2FD17/00068672.pdf) Retrieved on 12 January 2014.

SAPC (South African Pharmacy Council). 2014b. *Statistics for registered persons and organisations page.* (http://www.pharmcouncil. co.za/B_Statistics.asp) Retrieved on 12 January 2014.

SAPC (South African Pharmacy Council). 2015a. *Approved providers and courses.* (http://www.pharmcouncil.co.za/B_Edu_Training.asp) Retrieved on 30 March 2015.

SAPC (South African Pharmacy Council). 2015b. *Education page.* (http://www.pharmcouncil. co.za/B_Edu_Overview.asp) Retrieved on 6 January 2015.

SAPC (South African Pharmacy Council). 2015c. *Statistics for registered persons and organisations page.* (http://www.pharmcouncil.co.za/B_Statistics.asp) Retrieved on 9 September 2015.

SAPC (South African Pharmacy Council). 2016. *Intern and tutor manual for the pre-registration experience of pharmacist interns.* Pretoria:SAPC

SAQA (South African Qualifications Authority). 2012. Registered Qualifications: Bachelor of Pharmacy. (http://regqs.saqa.org.za/viewQualification.php?id=72784) Retrieved on 11 March 2015.

SAQA (South African Qualifications Authority) 2013. Policy and criteria for the registration of qualifications and part qualifications on the National Qualifications Framework.

Salkind, N.J. 2014. *Statistics for People Who (think they) Hate Statistics* (5th ed.). California: Sage.

Scerbo, M.W. & Dawson, S.M.D. 2007. High fidelity, high performance? *Simulation in Healthcare* 2(4):224-230.

Schaumberg, A. 2015. The matter of 'fidelity': Keep it simple or complex? *Best Practice & Research Clinical Anaesthesiology* 29(1):21-25.

Shah, B., Gibson, J.L. & Tex, N.L. 2013*. The 21st Century Pharmacy Technician.* Burlington: Jones & Bartlett Learning.

Shilkofski, N. 2012. The value of simulation training to improve healthcare delivery. (http://hospitalmanagementasia.com/wp-content/uploads/C7-Nicole-Shilkofski.pdf) Retrieved on 26 April 2013.

Shearer, R. & Davidhizar, R. 2003. Using role play to develop cultural competence. *Journal of Nursing Education* 42(6):273-276.

SMU (Sefako Makgatho Health Sciences University). 2015
(http://www.smu.ac.za/)
Retrieved on 2 June 2015.

Stone, D.H. 1993. Design a questionnaire. *British Medical Journal* 307(6914):1264-1266.

Strydom, H. 2011. Sampling in the quantitative paradigm. In De Vos, A.S., Strydom, H., Fouché, C.B. & Delport, C.S.L. (Eds). *Research at grass roots: For the social sciences and human service professions.* 4th ed. Pretoria: Van Schaik.

Steinaker, N.W. & Bell, M.R. 1979. *The experiential taxonomy: A new approach to teaching and learning.* New York, NY: Academic Press.

UFS (University of the Free State). 2014. UFS EvaSys Procedure.
(http://supportservices.ufs.ac.za/dl/Userfiles/Documents/00007/4677_eng.pdf)
Retrieved on 11 March 2014.

UWC (University of the Western Cape). 2015a. Career opportunities with a B. Pharm degree.
(http://www.uwc. ac.za/Faculties/NS/Pharmacy/Pages/default.aspx)
Retrieved on 06 January 2015.

UWC (University of the Western Cape). 2015b. Pharmaceutical Chemistry.
(https://www.uwc.ac.za/Faculties/NS/Pharmacy/Pages/-Pharmaceutical-Chemistry-.aspx)
Retrieved on 30 November 2015.

UWC (University of the Western Cape). 2015c. Pharmacy Practice.
(https://www.uwc.ac.za/Faculties/NS/Pharmacy/Pages/Pharmacy-Practice.aspx)
Retrieved on 30 November 2015.

Van de Ridder, J.M.M., Stokking, K.M., McGaghie, W.C. & Ten Cate, O.T. 2008. What is feedback in clinical education? *Medical Education* 42(2):189-197.

van Dyk, S. 2014. A further look at the new curriculum. *South African Pharmaceutical Journal* 81(4):54-56.

Vyas, D., Ottis, E.J. & Caligiuri, F.J. 2011. Simulation: teaching clinical reasoning and problem-solving skills using human patient simulation. *American Journal of Pharmaceutical Education* 75(9):189.

WHO (World Health Organization). 2013. *Transforming and scaling up health professionals' education and training.* Switzerland: WHO.

Ziv, A., Ben-David, S. & Ziv, M. 2005. Simulation based medical education: an opportunity to learn from errors. *Medical Teacher* 27(3):193-199.

Ziv, A. 2009. Simulators and simulation-based medical education. In Dent, J.A. & Harden, R.M. (Eds). *A practical guide for medical teachers.* 3rd ed. Edinburgh: Elsevier.

Zigmont, J.J., Kappus, L.J. & Sudikoff, S.N. 2011. Theoretical foundations of learning through simulation. *Seminars in Perinatology* 35(2):47–51.

Zlotos, L., Thompson, I.D. & Boyter, A.C. 2015. Integration of an online simulated prescription analysis into undergraduate pharmacy teaching using supplemental and replacement models. *American Journal of Pharmaceutical Education* 79(3):1-7.

APPENDIX A:

QUESTIONNAIRE SURVEY

Questionnaire

Topic: **Questionnaire investigating the opinions on and use of simulation in undergraduate pharmacy education at South African Universities.**

Researcher:
Adele Naude

For office use only | | | 1-3

You have been invited to participate in this research study.
Please note that by completing this questionnaire you are voluntarily agreeing to participate in this research study.
You will remain anonymous and your data will be treated confidentially at all times.
You may withdraw from this study at any given moment during the completion of the questionnaire.
The results of the study may be published

Personal Information

1. **Gender** ☐ 4

Female	Male

2. **Are you registered with the South African Pharmacy Council as a pharmacist?**

Yes	No

☐ 5

3. **Employed at which University?** ☐ 6

☐	Nelson Mandela Metropolitan University (NMMU)
☐	North-West University (NWU)
☐	Rhodes University
☐	University of Kwazulu-Natal
☐	University of Limpopo – Medunsa Campus
☐	University of Limpopo – Turfloop Campus
☐	University of the Western Cape
☐	University of the Witwatersrand (WITS)

4. **Please indicate how many students you lecture in your module or unit?** 7-9

	1st years
	2nd years
	3rd years
	4th years

7-9
10-12
13-15
16-18

5. **Which of the following best describes your institution?** 19-20

	Outcomes-based curriculum institution
	Problem-based curriculum institution
	Other

6. **Which of the following describes your curriculum structure best?** 21-23

	Modules (semester)
	Modules (year)
	Systems (block) approach (integrated curriculum)
	Other, please specify

24-25

7. **How many years you have been lecturing undergraduate pharmacy students?** 26-27

8. **Please indicate the primary teaching strategy you use in your teaching (e.g. lectures, group-work etc.)** 28-30

	Please specify

9. **In which subject area are you involved?** 31-35

	Pharmacy Practice
	Clinical Pharmacy
	Pharmaceutical Chemistry
	Pharmacology
	Pharmaceutics
	Please specify

36

10. **Have you ever had any simulation training or attended any workshops on simulation?** 37

Yes	No

Simulation

11. Is the use of simulation influenced by any of the following?

		Disagree	Mildly Disagree	Mildly Agree	Agree		
a)	Set-up costs	1	2	3	4	☐	38
b)	Space requirements	1	2	3	4	☐	39
c)	Lack of facilities	1	2	3	4	☐	40
d)	Running costs of simulation facilities	1	2	3	4	☐	41
e)	Insufficient staff	1	2	3	4	☐	42
f)	Lack of skilled staff in simulation	1	2	3	4	☐	43
g)	Students numbers too large to engage in simulation	1	2	3	4	☐	44
h)	Too little time to develop scenarios	1	2	3	4	☐	45
i)	Integration into the curriculum too difficult	1	2	3	4	☐	46
j)	Lack of sufficient knowledge of the benefits of simulation as teaching strategy	1	2	3	4	☐	47
k)	Lack of evidence to support simulation as a reliable approach to develop competencies	1	2	3	4	☐	48
l)	Heard of negative experiences of others	1	2	3	4	☐	49
m)	Other, please specify ________					☐☐	50-51

12. How often do you use simulation?

Not at all	Very little	Somewhat	Quite a bit	A Great deal		
					☐	52

13. Please indicate the types of simulation (if any) used in your module

		Never	Rarely	Often	Always		
a)	Peer-to-peer (e.g. role-play)	1	2	3	4	☐	53
b)	Screen-based computer simulations	1	2	3	4	☐	54

c)	Low fidelity mannequins	1	2	3	4	☐ 55
d)	Medium fidelity mannequins	1	2	3	4	☐ 56
e)	High fidelity mannequins	1	2	3	4	☐ 57
f)	Simulation using students as standardised patients	1	2	3	4	☐ 58
g)	Simulation using actors as standardised patients	1	2	3	4	☐ 59
h)	Internet based simulations	1	2	3	4	☐ 60
i)	Avatars or virtual reality	1	2	3	4	☐ 61
j)	Other ______					☐☐ 62-63

Please give more details about your simulation activities

14. Which of these benefits do you think the introduction or use of simulation have in your module?

a)	Develop appropriate professional attributes	1	2	3	4	☐ 64
b)	Better prepare students for work environment	1	2	3	4	☐ 65
c)	Increased critical thinking	1	2	3	4	☐ 66
d)	Increased student competence	1	2	3	4	☐ 67
e)	Assessment and evaluation in a safe environment	1	2	3	4	☐ 68
f)	Ability to create uncommon events or experiences	1	2	3	4	☐ 69
g)	Opportunity for students to reflect on their performance	1	2	3	4	☐ 70
h)	Integrating knowledge and skills in a realistic environment	1	2	3	4	☐ 71
i)	Support application of theory content	1	2	3	4	☐ 72

j)	Ensure more work-ready graduates	1	2	3	4	73
k)	Standardised experiences for all students	1	2	3	4	74
l)	Other, please specify					75-76

15. **Do you have dedicated simulation facilities available?**

No	Unsure	Yes

77

16. **In what locations do your simulation activities take place?** 78

a)	Traditional practical labs	Yes	No	79
b)	On-site simulation facilities	Yes	No	80
c)	Off-site simulation	Yes	No	81
d)	Computer labs	Yes	No	82
e)	Classroom settings	Yes	No	83
f)	Other, please specify			84-85

17. **Do you have simulation equipment that is under-utilised?**

No	Unsure	Yes

86-87

Please explain why, if yes

18. **Please give your opinion about the use of simulation in undergraduate pharmacy education** 88-90

APPENDIX B:

LETTER TO SCHOOL DIRECTORS OF PHARMACY SCHOOLS TO REQUEST PERMISSION TO EXECUTE THE STUDY

LETTER TO SCHOOL DIRECTORS OF PHARMACY SCHOOLS TO REQUEST PERMISSION TO EXECUTE THE STUDY

North-West University
Gerrit Dekker Street,
Building G16
Potchefstroom Campus

Information and consent

Dear **Prof _______________________**

My name is Adele Naudé from the North-West University, Potchefstroom Campus, School of Pharmacy, Pharmacy Practice. I am currently registered as a Masters student at the University of Free State under the supervision of Dr M.J. Labuschagne.

I will be conducting an online questionnaire survey as part of my research (data collection), which will determine the current state of simulation use in pharmacy curricula in South Africa. I would like to invite your Pharmacy School to participate in this study.

The aim of the study is to investigate the opinions on and the use of simulation in pharmacy education in the South African Higher Education context.

There will be no risks involved in filling in the questionnaire. The questionnaire will be conducted in an online survey (EvaSys).

I hereby request your schools' participation and *request a list of all the e-mail addresses of your undergraduate academic staff members*. I kindly request that you inform your lecturers about the study and its objectives.

The data will be used by the researcher, supervisor(s), and independent coder. The questionnaires will be kept confidential and safe for an estimate of five years after publication of the research results. Thereafter it will be destroyed.

The participants' names, or any information that would identify them, will not appear on the notes or on transcripts, in order to maintain confidentiality. Your Pharmacy Schools' identity, as well as the participant will not be revealed when the study is reported or published. Participants have the right to autonomy and can withdraw at any stage from the research process should the need arise. The findings of the study will be made available in a published article. The research proposal was approved by the Free State University, Faculty of Health Sciences: **Ethics Committee ECUFS 125/2014**.

Your participation in this study is completely voluntary. Should questions arise with regard to the study, please do not hesitate to contact me, Adele Naude at (018) 299 2247 or alternatively, 082 553 0652 / email: Adele.Naude@nwu.ac.za.

______________________________ ________________
Adele Naudé Date

______________________________ ________________
Dr M.J. Labuschagne Date
Head: Clinical Simulation and Skills Unit
School of Medicine
Faculty of Health Sciences

University of the Free State

INFORMATION REGARDING THE RESEARCH PROJECT SENT TO PHARMACY SCHOOLS

THE OPINIONS ON AND USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION AT SOUTH AFRICAN UNIVERSITIES

Protocol for a study to be completed in partial fulfilment of a mini-dissertation for the degree Masters in Health Professions Education (M. HPE)

in the

Division Health Sciences Education,

Faculty of Health Sciences at the University of the Free State

CANDIDATE
Mrs Adele Naudé
Pharmacy Practice, School of Pharmacy
Faculty of Health Sciences
North-West University
Student number: 2012192957

STUDY LEADER

Dr M.J. Labuschagne
Head: Clinical Simulation and Skills Unit
School of Medicine
Faculty of Health Sciences
University of the Free State

ECUFS 125/2014

June 2014

THE OPINIONS ON AND USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION AT SOUTH AFRICAN UNIVERSITIES

1. INTRODUCTION

In this research project, an in-depth study will be done by the researcher with a view to determine the current state of simulation use in undergraduate pharmacy curricula at South African Universities, registered with the South African Pharmacy Council.

The purpose of the study is to gain better understanding regarding the current use of simulation in pharmacy education at Higher Education Institutions.

The primary aim study is to determine the current use of simulations as educational strategy or tool in pharmacy education.

The study will clarify the current state of simulation use in pharmacy education and will include all the undergraduate faculty members employed at Higher Education Institutions registered with the South African Pharmacy Council as pharmacy education sites.

2. BACKGROUND TO THE RESEARCH PROBLEM

The milieu of pharmacy education has changed remarkably. The foundations of much of modern Western medicine come from ancient Greece...........................

3. PROBLEM STATEMENT

Each of the pharmacy education institutions have their own unique curriculum design based on exit level outcomes drafted by the South African Pharmacy Council. However, the methods used to achieve the stated outcomes are unique to each institution.

The problem that will be addressed is the lack of information regarding the opinion of lecturers on and the use of simulation in pharmacy in South Africa.

No recent studies have been found in South Africa within the pharmacy context on the use of simulation and limited research are available as far as could be ascertained.

4. OVERALL GOAL OF THE STUDY

The overall goal of the study is to conduct an investigation into the current status of the use of simulation training in pharmacy education and training at higher education institutions in SA with the intention to develop guidelines for simulation integration into education and training programmes for pharmacists in future research projects.

5. AIM OF THE STUDY

The aim of the study is to investigate the opinions on and the use of simulation in pharmacy education at South African universities.

6. RESEARCH QUESTIONS

The following research questions will be addressed by the objectives of this study:

1. What is the current state of simulation use in undergraduate pharmacy education?
2. What are lecturers' opinions regarding the use of simulation?

7. OBJECTIVES OF THE RESEARCH PROJECT

7.1 To gain a deeper understanding the current status of simulation use in higher education in the changing arena of teaching and learning. **(Literature study)**

7.2 To determine the current availability, use and opinions of all resources involved in a simulation setting by means of inquiry into technology used; resources available and opinions regarding the use of simulation of lecturers involved in undergraduate pharmacy education. This will provide necessary data for a comprehensive assessment of the current status of simulation. **(Questionnaire)**

9. RESEARCH METHODOLOGY

9.1 Literature study

9.2 Empirical study

9.2.1 *Questionnaire survey*

Will be completed by all consenting lecturers involved in undergraduate pharmacy education from pharmacy schools registered with the SAPC as training institutions (cf. Appendix B)

9.2.5 ***Data gathering***

Data collection will be done with an online questionnaire (which will be available in English) The link to the questionnaire will be e-mailed to the participants. The e-mail addresses of participants for the survey will be obtained through the Directors (Heads of Pharmacy Schools).

12. SCOPE OF THE STUDY

This study will be done in the field of Health Professions Education and is interdisciplinary in the field of pharmacy education.

13. VALUE OF THE STUDY

The value of this research study will be addressing the current status of pharmacy education about simulation use in South African Pharmacy education. It will be of value for any Higher Education Institution to use the research output to rethink the possibilities of simulation use in undergraduate pharmacy education.

PERMISSION

PERMISSION FOR PHARMACY SCHOOL TO PARTICIPATE IN THE STUDY

PROJECT TITLE:

THE OPINIONS ON AND USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION AT SOUTH AFRICAN UNIVERSITIES

I understand what the lecturers of the ___________ Universities' involvement in the study means and I give permission for the research questionnaire to be distributed electronically to consenting staff members involved in undergraduate pharmacy training.

_____________________ _________________

NAME **Date**

UNIVERSITY NAME

APPENDIX C:
ETHICS APPROVAL

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS
UV

Research Division
Internal Post Box G40
☎(051) 401-7795/7794
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E-mail address: EthicsFHS@ufs.ac.za

Ms M Marais/jdpls

2015-02-09

REC Reference number: REC-230408-011
IRB nr 00006240

MS A NAUDÈ
C/O DR M LABUSCHAGNE
HEAD: CLINICAL SIMULATION AND SKILLS UNIT
FACULTY OF HEALTH SCIENCES
UFS

Dear Dr Labuschagne

ECUFS NR 125/2014
MS A NAUDÉ **SCHOOL OF PHARMACY, NWU**
PROJECT TITLE: THE OPINIONS ON AND USE OF SIMULATION IN UNDERGRADUATE PHARMACY EDUCATION AT SOUTH AFRICAN UNIVERSITIES.

1. You are hereby kindly informed that, at the meeting held on 3 February 2015, the Ethics Committee approved the above project after all conditions have been met.

2. Committee guidance documents: Declaration of Helsinki, ICH, GCP and MRC Guidelines on Bio Medical Research. Clinical Trial Guidelines 2000 Department of Health RSA; Ethics in Health Research: Principles Structure and Processes Department of Health RSA 2004; Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa, Second Edition (2006); the Constitution of the Ethics Committee of the Faculty of Health Sciences and the Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines.

3. The Committee must be informed of any serious adverse event and/or termination of the study.

4. Any amendment, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

5. A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.

6. Kindly refer to the ECUFS reference number in correspondence to the Ethics Committee Secretariat.

Yours faithfully

....
DR SM LE GRANGE
CHAIR: ETHICS COMMITTEE

Cc Dr M Labuschagne

APPENDIX D:

VERIFICATION OF LANGUAGE EDITING

22 January 2016

Luna Bergh

55 Jim Fouché Avenue

Universitas, Bloemfontein

To whom it may concern

This is to certify that I language-edited Adele Naudé's Master's Dissertation manually and parts electronically via track changes. She effected the changes herself. In this way both linguistic excellence and the candidate's ownership of her text were ensured.

Sincerely

Luna Bergh

D Litt et Phil

Language and writing specialist