EVALUATION OF THE DESIGN OF HIGH-FIDELITY SIMULATION BY THE THIRD YEAR NURSING STUDENTS IN THE SCHOOL OF NURSING

by

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Submitted in fulfilment of the requirements in respect of the degree

Master of Social Science in Nursing in the School of Nursing

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DECLARATION

I, Lorette Botha, student number hereby declare that the dissertation on the Evaluation of the design of high-fidelity simulation by third year nursing students in the School of Nursing, submitted to the University of the Free State for the qualification, Master of Social Sciences in Nursing, is my original work and has not been previously submitted to any other university for the same qualification.

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12 January 2018

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LETTER FROM LANGUAGE EDITOR

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DECLARATION

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SUMMARY

For many years, simulation has been used as a learning strategy. Student nurses can learn to integrate clinical skills, apply content knowledge, practice teamwork, develop inter-professional communication skills, perform physical assessments, apply nursing care principles, develop critical thinking skills, and much more. High-fidelity simulation design needs to be planned and integrated into the undergraduate nursing curriculum carefully to ensure optimal learning and enabling students to deliver optimal care within the clinical environment.

In order to reach these competencies through the use of simulation, the School of Nursing at the University of the Free State has been using simulation as a teaching and learning strategy in the undergraduate and postgraduate programs since 2010. Initially it has been a growing experience through continuous efforts to address short-falls and improving each simulation scenario. However, the question arose whether the simulations we do, comply with the standards set out for quality simulation experiences on an international level.

In 2005, Pamela Jeffries published “A Framework for Designing, Implementing, and Evaluating Simulations Used as Teaching Strategies in Nursing.” which conceptualized practices concerning the planning and running of simulations as a teaching tool. The framework described five major constructs, namely: educational practices, teacher (facilitator), students, simulation design characteristics and outcomes. The aim of the study is to describe the instructional design of high-fidelity simulation from third year nursing students’ perspective in the School of Nursing regarding design characteristics and criteria of the Jeffries simulation model.

A quantitative, non-experimental, cross-sectional descriptive design was used for this study. Most of the third year undergraduate nursing students (30 students) evaluated the five design characteristics of Jeffries’ simulation model by means of completing the 20 item Simulation Design Scale (SDS) instrument immediately after participating in a high-fidelity simulation scenario about a patient with burn wounds. The self-report instrument was designed by the National League for Nursing and aims to evaluate the five design characteristics, using a 5-point Likert scale.

When designing high-fidelity simulation scenarios, meticulous planning needs to incorporate all the important aspects, including authenticity, scaffolding, alignment and constructivism. By including these aspects, the students have a greater chance of achieving the learning outcomes. Within this study, the researcher aims to describe the aspects involved in the planning and designing of a high-fidelity simulation scenario.

Results indicate not only the evaluation of the five design characteristics for a specific simulation scenario, but also the relationship between the adherence to and importance of these characteristics, as seen through the eyes of third year undergraduate nursing students. The importance of debriefing was rated highest of the five categories, with fidelity second, closely followed by support. When the students evaluated the design characteristics, they rated problem solving and support at an equal highest score, with debriefing in second place.

Within this research study, the students indicated that they recognized each design characteristic, rating the presence of each at a very high level, indicating overwhelmingly positive feedback scores. Where the students assessed the simulation scenario, they rated support and problem solving at the highest scores, closely followed by debriefing. This evaluation provides a very positive perspective from the third year undergraduate student's view of the design of high-fidelity simulation scenarios within the third year undergraduate program at the School of Nursing, University of the Free State in South Africa.

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INTRODUCTION

1.1 Introduction

Worldwide educators aim to supply healthcare systems with newly qualified professional nurses who are able to apply their knowledge in the clinical setting. There exists an increased emphasis on the use of simulation by global nursing education providers to promote transfer of learning to the practical setting (Botma, Van Rensburg, Coetzee, & Heyns, 2013:2; Livesay, Lawrence, & Miller, 2015:1).

Through simulation students gain confidence in rendering patient care, can identify their strengths and weaknesses, and are offered an opportunity to apply in practice what they learned in the classroom (Botma, 2014:4; Jeffries, 2005:102; Reese, Jeffries, & Engum S.A., 2010:34). The students learn new skills, which include an increase in knowledge, improved skill performance, satisfaction, and improved critical thinking, to name a few (Robinson-Smith, Bradley, & Meakim, 2009:e203).

Simulations should be well-designed in order to achieve the outcomes mentioned above. Well-designed high-fidelity simulation-based education is effective and complements education in the patient care settings (Issenberg, McGaghie, Petrusa, Lee Gordon, & Scalese, 2005:10). Critical aspects of the design process are authenticity, scaffolding, alignment and constructivism. A simulation design template was developed that guides the lecturers at the School of Nursing (SoN) on the application of these four design elements. The question arises whether the simulations SoN do comply with the standards set out for quality simulation experiences on an international level.

1.2 Background

Patient simulators and simulation have developed over the last few years to form a crucial part of nursing and medical training. High-fidelity simulation design needs to be planned and integrated into the undergraduate nursing curriculum carefully to ensure optimal student learning and enabling students to deliver optimal care within the clinical environment.

The SoN at the University of the Free State has been using simulation as a teaching and learning strategy in the undergraduate and postgraduate programmes since 2010. In the first four years of using simulation, it has been a growing experience through continuous efforts to address short-falls and improving each simulation scenario. Currently, the staff shares feelings of accomplishment with the progress made this far. However, the question arises whether the simulations we do, comply with the standards set out for quality simulation experiences on an international level, for example, the standards portrayed in the simulation model that was designed by Jeffries (2005:97).

Extensive resources were required to establish the scene and prepare for the running of the simulation laboratories. The School of Nursing renovated the existing skill laboratory into a set of simulation laboratories from a funded project. Figure 1.1 portrays seven examination rooms at a primary healthcare facility or private unit in a hospital, which are mostly used for skill demonstrations, skill practice, Standardized Patient (SP) scenarios, and practical examinations.

Figure 1 1 Skills laboratory

The ward space consists of three beds, including a cot, as seen in Figure 1.2. A number of medium fidelity simulation models were purchased and are mainly used in the ward setup.

Figure 1 2 Ward unit

High-fidelity simulators were purchased and comprise two adults, a birthing model with new-born baby, and a child. Any of these can be used in a bed in the critical care unit bed space, (figure 1.3) the pediatric unit, the shack in an informal settlement (figure 1.4), or the community space area. A number of medium-fidelity models were also purchased and are mainly used in the ward setup. Most of the task-trainers or low fidelity models are used in the seven primary care or private ward setup.

Figure 1 3 Critical Care Unit bed space

Figure 1 4 Community space area

Identified staff was trained specifically to run simulations with the high-fidelity simulators. Additionally, a number of lectures were trained on how to develop a simulation scenario, run the simulation, and debriefing. These facilitators now train educators in health sciences nationally and regionally.

1.3 Problem statement

The SoN made a huge capital investment when the simulation laboratories were built. Every effort was made to utilise this asset optimally, striving towards high quality education. A template was developed to use during the planning phase of each simulation session in an attempt to enhance the quality of each scenario. Simulation sessions were gradually phased into the curriculum to summarise each theoretical theme upon completion, optimising the use of simulation as a learning strategy. Qualitative studies were done evaluating learning experiences and planning strategies to enhance meaningful learning. No quantitative evaluation has been done by the students; therefore this study was performed to answer the following question: To what extent does current simulation implementation in the third year of a four year program reflect the design characteristics and criteria as specified by Jeffries' simulation model from the students' perspective?

1.4 Aim

The aim of the study was to describe the instructional design of high-fidelity simulation from the third year nursing students' perspective in the School of Nursing regarding design characteristics of the Jeffries simulation model.

1.5 Objectives

The objectives of this study were to describe the:

- Adherence of the University of the Free State School of Nursing's instructional design to the design characteristics of Jeffries' simulation model
- Third year undergraduate students' perspective of the importance of each element of the design characteristics of Jeffries' simulation model
- Associations between the importance and adherence of the design characteristics.

1.6 Theoretical framework

A few frameworks exist for the developing and designing of simulation sessions. The University of Maryland Baltimore School of Nursing (UMB SoN) developed a clinical simulation protocol which is based on Benner's conceptual framework, considering nurses with different levels of clinical competence, with a facilitator providing prompts throughout a scenario to assist students in reaching the desired outcomes (Larew, Lessans, Spunt, Foster, & Covington, 2006:17).

Jeffries designed a framework to form the basis to the design, implementation and evaluation of simulation sessions (Jeffries, 2005:96; Mills, West, Langtree, Usher, Henry, Chamberlain-Salaun, & Mason, 2014:16; Weaver, 2011:37). It is known as a simulation model, and includes best practices in education, student factors, teacher factors, simulation design characteristics, as well as outcomes (Jeffries, 2005:96; Mills et al., 2014:16). Please see **figure 1.5** for Jeffries' simulation model. The reason for this design being used is because the School of Nursing decided to apply it to the planning document of simulation sessions to enable staff to contextualize each session. The researcher chose this framework by Jeffries as basis for evaluating the design characteristics of simulation sessions run in the school, because firstly it was used within the design of each scenario, and secondly because an evaluation questionnaire exists which was designed specifically for testing this model.

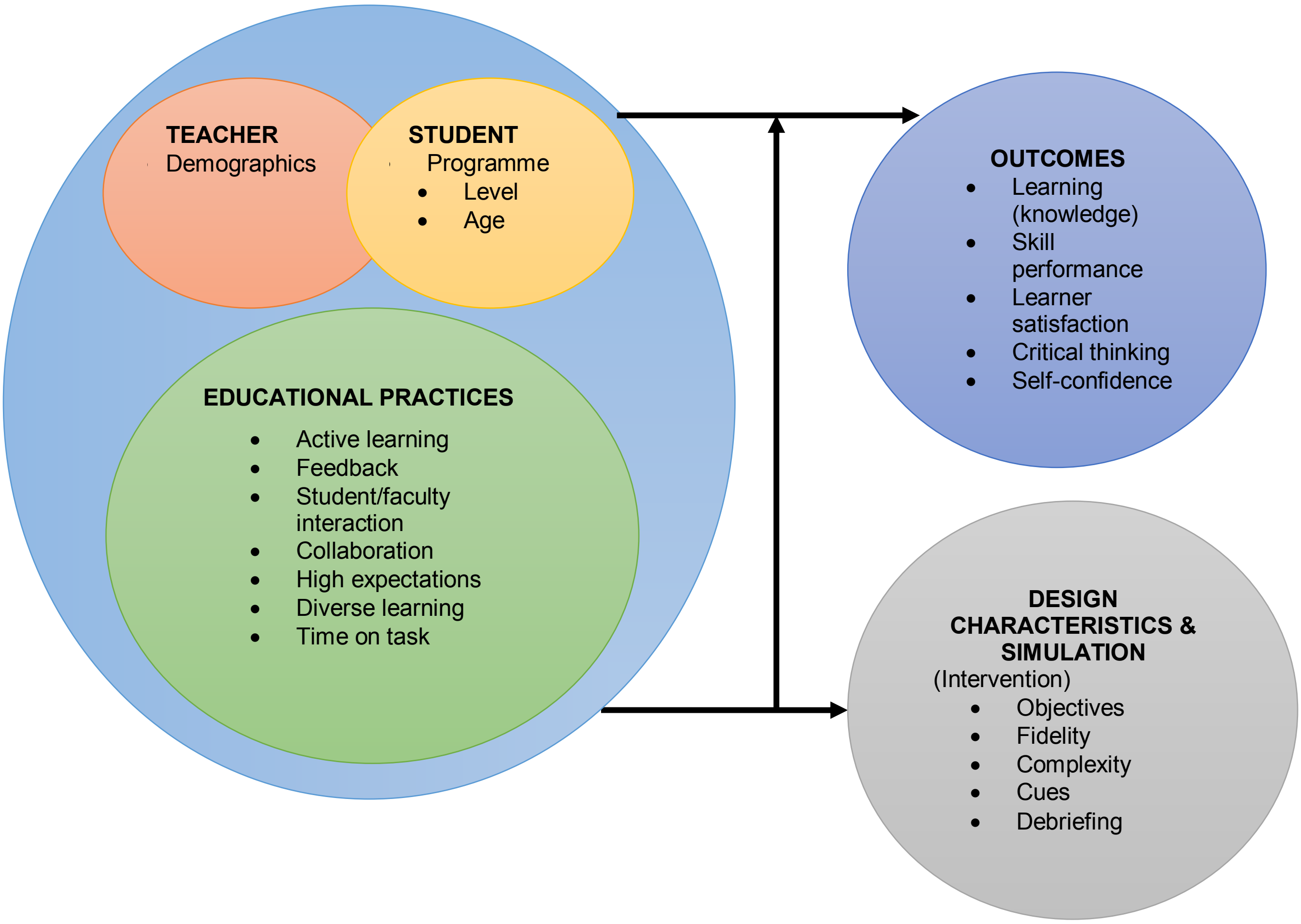

Figure 1 5 Simulation model by Jeffries (2005:97)

The simulation model as shown in Figure 1.5 guides the design and implementation of simulation and can also serve as a method to assess outcomes (Jeffries, 2005:97; Mills et al., 2014:12; Przybyl, Androwich, & Evans, 2015:135). It specifies the relevant variables and their relationships needed to conduct research in an organized and systematic fashion. A variety of likely variables can be related within this model (Jeffries, 2005:97). The researcher will now discuss the concepts within the simulation model to orientate the reader with regards to the concepts used within the model.

Effective teaching and learning using simulation are dependent on teacher and student interactions, expectations and roles (Cant & Cooper, 2010:4; Issenberg et al., 2005:10; Jeffries, 2005:98; Lewis, Strachan, & Smith, 2012:87). The traditional classroom instruction is teacher centred, whereas in simulation it is student centred. The facilitator prepares the students for the simulation session and provides support not only during the simulation session, but also during the debriefing session. By doing this, the students feel more relaxed and comfortable to participate in the simulation session, and overall improve their learning experience (Cant & Cooper, 2010:12). According to the Standards of best practice for simulation design, pre-briefing of students should be present with each simulation session to improve student learning and satisfaction (Franklin, Boese, Gloe, Loice, Decker, Sando, Meakim & Borum, 2013:S20; Lanzara, 2014:7). The facilitator, who is also the classroom teacher, is responsible for designing the scenario, using the technology, and setting up the equipment (Jeffries, 2005:98).

Students must be self-directed and -motivated during simulation sessions, and this can only happen when they know the ground rules for the activity (Jeffries, 2005:98). Students need to be informed clearly about any roles they may need to play during simulation sessions (Jeffries, 2005:98), including orientation and what is expected of them during the scenario (Lanzara, 2014:7). It was found that students who participated in simulation preparation gained about twice the amount of core bedside cardiology skills in comparison to students who only had little to no interventions (Issenberg et al., 2005:13). Another study found that simulation scenarios assist undergraduate nursing students to feel better prepared for clinical placements (Mills et al., 2014:14).

The degree to which best practices in education are incorporated in the design and implementation of the simulation sessions influences the outcomes presented in the framework. Seven educational practices were incorporated in the model that has proved to increase student learning and satisfaction (Chickering & Gamson, 1987:2; Jeffries, 2005:98). These seven educational practices guide simulation design and implementation. They are: active learning, prompt feedback, student/staff interaction, collaborative learning, high expectations, allowing diverse styles for learning, and time on task (Chickering & Gamson, 1987:2; Mills et al., 2014:14).

The outcomes form part of the final component of the simulation model and are typically associated with undergraduate and graduate nursing courses. These include knowledge, skill performance, learner satisfaction, critical thinking and self-confidence (Jeffries, 2005:98; Cant & Cooper, 2010:12).

Well incorporated simulation design characteristics and appropriate organization of students in simulation means that successful learning can take place. This is evident in the intervention itself, with specific attention to the objectives, fidelity, complexity, cues, and debriefing (Jeffries, 2005:100; Mills et al., 2014:16). Characteristics are a feature or quality that belongs typically to a person, place, or thing to identify them (Oxford online dictionary). This study addresses five design characteristics, which are objectives and information, support, problem solving, feedback/guided reflection and fidelity. See **Addendum** B for the Simulation Design Scale instrument of the National League for Nursing (NLN) that will be used to measure these constructs.

Objectives are set by the educator (Eppich & Cheng, 2015:108) and need to be clear to guide the students' learning and outcome accomplishments (Franklin et al., 2013:S20; Jeffries, 2005:100). Together with objectives, the students need information about the activity, process, and the amount of time required, role expectations, and outcome expectancies. When well-planned strategies are used, it provides the structure for the achievement of the learning objectives (Jeffries, 2005:100; Korteling, Helsdingen, & Sluimer, 2017:28). Objectives are statements of specific measurable results that participants are expected to achieve during a simulation-based learning experience (Meakim, Boese, Decker, Franklin, Gloe, Loice, Sando, & Borum, 2013:S7). Objectives were derived from the content of the theory in the third year's main subject of general nursing sciences.

Fidelity or realism means that the simulation mimics clinical reality, is process-based, and has established validity (Jeffries, 2005:100). In other words, fidelity is the authenticity or the degree to which a simulated experience represents reality (Meakim et al., 2013:S6). Very few simulation scenarios are completely realistic, but it does promote better learning outcomes when the scenario is very real (Sando, Coggins, Meakim, Franklin, Gloe, Boese, Decker, Loice & Borum, 2013:S32). Fidelity improves with the use of a fully equipped hospital room and providing the student with information that would typically be available in the practice setting (Maas & Flood, 2011:e232).

The complexities of simulations vary from simple to complex, with different levels of uncertainty, constructed with high or low levels of relevant information (Jeffries, 2005:101). When a simulated patient has multiple problems, or the patient problems are in relationship with one another, or clinical information is available but irrelevant, the students experience it as a complex scenario (Jeffries, 2005:101). For the students to manage and prioritize their actions, relate closely to the complexity of the scenario (Bambini, Washburn, & Perkins, 2009:79).

Cues are support that staff or other designated persons can provide students with during a simulation scenario (Ahn & Kim, 2015:707; Jeffries, 2005:101), helping the students to achieve the stated objectives (Meakim et al., 2013:S5). It is aimed at helping students progress through an activity, providing information about the current or approaching step that the student is on, and it is suggested that obvious cues are provided during the simulation session (Ahn & Kim, 2015:710). An example of a cue is additional patient information. How and when cues are delivered has been reported in literature in an inconsistent manner, often lacking clarity (Jeffries, 2005:101).

A facilitated debriefing session follows a simulation session. During the debriefing session the participants' reflective thinking is encouraged and the facilitator provides feedback regarding the participants' performance. Participants have the opportunity to explore their emotions, ask questions, reflect and provide feedback to each other. Debriefing attempts to stimulate meta-cognition, to monitor and adjust cognition processes and future action, especially in the practical setting (Meakim et al., 2013:S5). Debriefing is often overlooked as a valuable tool within simulation. During the debriefing activity, the positive aspects of the experience are reinforced, reflective learning is encouraged (Jeffries, 2005:101), and experiences are transformed into learning through reflection (Eppich & Cheng, 2015:106). Students get the opportunity to link theory to practice and research, to think critically, and to discuss how to intervene professionally in complex situations (Jeffries, 2005:101). Relevant teaching points can be reviewed during the debriefing session, evaluating the simulation scenario from a teaching point of view. Staff and student feedback is essential with regard to simulation as a teaching strategy.

Using simulation as a teaching strategy is still a complex, multidimensional and challenging process. Simulation design, implementation and evaluation are made possible by using the framework of this simulation model to identify the components of the process and their relationships (Jeffries, 2005:102; Swanson, Nickolson, Boese, Cram, Stineman, & Tew, 2011:e82). Thus nursing educators can attempt to develop and evaluate simulation as a teaching method.

1.7 Concept clarifications

A conceptual definition is the theoretical meaning or abstract of a concept within a study. This was used to describe instructional design, simulation, high-fidelity simulation, importance and adherence. An operational definition tells the researcher exactly what he must do to measure the concept and collect the needed information (Polit & Beck, 2014:44). Third year nursing students and simulation design characteristics were described using operational definitions. Concepts were selected from the study’s aim and objectives to explain the context of these and help to understand the purpose fully.

Instructional design consists of three phases, namely analysis, development, and evaluation (Karagiorgi & Symeou, 2005:18). They claim that during analysis, the content, the learner, and the instructional setting must be taken into consideration in relation to the learning outcomes. Also, during the developing phase, the instructional objectives are subdivided into smaller items to achieve specific performance objectives (Karagiorgi & Symeou, 2005:19). Students will only be successful when evaluation confirms a true picture of the pragmatic or instrumental sense in the context they participated in (Karagiorgi & Symeou, 2005:21). Botma and friends renamed these three steps into formulating clear outcomes, designing assessment tasks relating to the outcomes, and designing learning activities for students to successfully complete the tasks (Botma, Brysiewicz, Chipps, Mthembu, & Phillips, 2014:19). Instructional design is about using a well-designed learning environment to help students move from being incompetent to being competent with regards to a certain task or performance. Within this study, the focus is specifically on the designing elements of the learning environment, evaluated by the students who partook in the simulation scenario.

Simulation means to mimic problems, events or conditions within a professional environment by using devices, trained persons, lifelike virtual environments and contrived social situations (Issenberg et al., 2005:10). Simulation creates a safe environment which represent the clinical setting, ideal for students to learn and grow, providing an opportunity to apply their knowledge and skills. Students then learn while reflecting during the debriefing session, talking about the scenario and “putting it together” for themselves.

In **high-fidelity simulation** (HFS) a full scale computerized patient simulator, virtual reality or standardized patients are used. These are extremely realistic and provide the learner with a high level of interactivity and realism (Meakim et al., 2013:S6). It involves the students’ cognitive thinking, psychomotor skills and emotional involvement. Within this study, the students were caring for a critically ill patient within an acute setting, connected to a cardiac monitor. Although the patient was a manikin, he was talking with the students and displayed specific signs and symptoms related to his verbal concerns which they addressed in a timely manner.

Third year nursing students are registered for the third-year program of the Bachelor Degree at the School of Nursing. The third-year program includes specific simulation sessions at the end of identified learning themes, for students to practice and learn their knowledge and skills, preparing them for the clinical setting.

Design characteristics of Jeffries’ simulation model, as described within the Theoretical Framework section, are as follows: objectives, fidelity, complexity, cues and debriefing. The objectives for the high-fidelity simulation session the students participated in correlate with the objectives of the theoretical theme they completed on Burn Wounds. These include the calculation of percentage of burn wounds, the fluid therapy needed for this specific patient with regard to the percentage and depth of the burns. Also, it focused on observing the patient for signs and symptoms of compartment syndrome, associated with circumferential burn wounds.

The manikin was dressed in burned clothes, his skin was treated with make-up to create burn wounds, and real hair was burned in the room to represent the smell a real burn wound patient has when admitted. These actions increased the fidelity of the scenario, making it more realistic for the students.

Based on the theory of burn wounds addressed in the preceding class sessions, the students were able to calculate the burn wound percentage according to the Rule of nine, calculate the fluid therapy according to the Parkland Formula, and observe for signs and symptoms relating to compartment syndrome. This ensured the complexity level of their simulation activities to be in line with the theoretical component.

To support the students and provide cues, they were pre-briefed of what to expect in the simulation scenario, documents in the patient's folder assisted in calculating the burn wound percentage and fluid treatment, and a Registered Nurse was available for assistance in the room if the students called upon her. A telephone in the room gave the students direct access to the treating doctor in case they needed to call him. The patient communicated symptoms of compartment syndrome that could assist the students in recognizing the side effect of the circumferential burn wound.

The educator who observed a specific group of students facilitated the debriefing session in another room. This included reflecting on their feelings and thoughts, playing back the recorded scenario to them, allowing the students to reflect, ask questions, and learn from the scenario.

The **importance** of the design characteristics is that these are of great significance and value in relation to the development of, and application within the simulation scenario. The **adherence** of the design characteristics to the simulation scenario reflects the commitment to a cause or a belief. The design characteristics need to be interwoven into the simulation scenario to improve the quality and outcome of the session.

1.8 Research design

A quantitative, non-experimental, cross-sectional descriptive design was used (De Vos, Strydom, Fouchè, & Deport, 2011:156; Grove, Burns, & Gray, 2013:24; Maree, Creswell, Ebersöhn, Eloff, Ferreira, Ivankova, Jansen, Nieuwenhuis, Pietersen, Plano Clark, & van der Westhuizen, 2012:145) to describe the third year students' perspective of five specific design characteristics within a high-fidelity simulation session.

1.9 Data collection method

Students completed the 20 item Simulation Design Scale (SDS) instrument which was designed by the National League for Nursing (NLN), aimed at evaluating the five design characteristics of Jeffries' simulation model (Jeffries, 2005:97; Jeffries, 2007:94). It is a self-report instrument using 5-point Likert scales, with options to choose from as follows: Option 1: Not important, Option 2: Somewhat important, Option 3: Neutral, Option 4: Important, and Option 5: Very Important (Jeffries, 2007:94). Please see **Addendum B** for this instrument. The standardized questionnaire was written and tested in English and has not been translated or tested in Afrikaans. Therefore, it was presented to the group only in English.

1.9.1 Pilot Study

A group of five post graduate Intensive Care Nursing students completed the questionnaire voluntarily after they completed a high-fidelity simulation session within their own program. After completion, they were asked to comment on the clarity of the questionnaire as well as if they had any suggestions towards possible changes to the standard questionnaire. The post graduate students were comfortable with all the questions and had no suggestions with regard to any changes that may be needed. The researcher could confirm that the questions fit into the context of the University. Note was taken of the time the students took to complete the questionnaires as well, and if they had any suggestions.

1.9.2 Reliability

Reliability of an instrument means that it should produce the same result after being applied to different groups (Botma, Greeff, Mulaudzi, & Wright, 2010:177) and the researcher needed to provide proof of the reliability of the instrument. The 20-item NLN Simulation Design Scale questionnaire consists of five subscales, namely objectives, support, problem-solving, feedback and fidelity. It has a reported Cronbach's alpha of 0.92 for the presence of these features (Jeffries & Rizzolo, 2006:2).

1.9.3 Validity

Content validity aids in ensuring adequate content coverage. Content validity was accomplished by a review of the questionnaire by 10 experts in medical/surgical nursing (Ahn & Kim, 2015:708; Jeffries & Rizzolo, 2006:2).

1.10 Population

The population implies the total set of individuals or objects having some common characteristics (Polit & Beck, 2014:387). The population in this study included all the third year undergraduate nursing students (46 students) who participated in a specific simulation scenario during the first semester in their third academic year of the four year Baccalaureus in Nursing programme at the University of the Free State. A total of 46 students were invited to participate in the study.

1.10.1 Sample and sample size

A complete collection sampling was done (Cowen, Manion, & Morrison, 2011:158), also known as comprehensive sampling, because every participant in a group was invited to participate (McMillan & Schumacher, 2010;327). All the third year students of the specific year were invited to partake in the study. Each student completed the questionnaire individually immediately upon completion of the debriefing section.

1.11 Data collection

Firstly, the researcher obtained approval from the Health Sciences Research Ethics Committee of the University of the Free State (**Addendum A**) to perform this study. Then the researcher obtained permission from the Head of the Nursing School, the Dean of the Faculty, the Student Dean as well as the Vice Rector Academia before the research was commenced. Please see **Addendum C** for the approval letter from the National League of Nursing to the researcher to use the questionnaire.

During a theory contact session, the third year Nursing students received information in the form of a leaflet (**Addendum D**) as well as an explanation about the planned research. The questionnaire was explained and how it would be completed voluntarily and electronically immediately after the high-fidelity session. Students had an opportunity to ask questions or raise any possible concerns during the information session.

The questionnaire was distributed electronically by the Centre for Teaching and Learning (CTL) at the University, and loaded on the University's Blackboard™ platform, which the students were very familiar with. Access to the questionnaire was only made available on the day of the data collection, and the results stored on Blackboard™ immediately after completion. Data from the survey was extracted by staff at the CTL in an anonymous manner, saved and sent to the researcher and biostatistician.

1.12 Data Analysis

A biostatistician at the Department Biostatistics within the Faculty of Health Sciences performed the analysis of data. The analysis includes descriptive statistics like frequencies and percentages for categorical data. The biostatistician calculated associations between the adherence and importance of the five design characteristics, as stipulated within the questionnaire. The full data analysis is discussed in chapter four.

1.13 Ethical Issues

The Belmont Report was published in April 1979 (Botma et al., 2010:342) and includes three principles to consider in the ethical approach of any research study. It highlights the ethical principles for protecting people participating in research projects, focussing on three aspects: respect for people, beneficence and justice (Polit & Beck, 2014:81). Chapter three provides a full discussion and application of each of these principles.

1.13.1 Respect for people

The basic principle of respect for people must be honoured at all times (Botma et al., 2010:277). Respect for people was assured by obtaining consent from the students prior to participating in the study. The researcher obtained permission to perform the study prior to commencement, and gave the respondents a full description of the study, not only verbally but also written. The information leaflet was compiled according to the Ethics Committee's criteria. The four elements of consent were maintained, namely disclosure, comprehension, competence and voluntarism (Grove et al., 2013:180).

1.13.2 Beneficence/Non-maleficence

The principle of beneficence is concerned with the right of a person to be safe from any harm and discomfort (Botma et al., 2010:20). The risk/benefit ratio is taken into consideration, with emphasis on the fact that the benefits of any study should always outweigh the risks (Botma et al., 2010:10; Polit & Beck, 2014:83).

Non-maleficence is the freedom from torture and degrading treatment (Standing, 2014:159). The researcher confirmed that there is no risk of harm to the students who participate in the study. The only possible discomfort for the students could be from spending the time while completing the questionnaire immediately after the simulation scenario. The students' participation could lead to the improvement of future high-fidelity simulation scenarios.

1.13.3 Justice

The principle of justice means that the students who participate in a study should be treated in a fair manner and not be discriminated against. It means the students have the right to fair treatment and privacy (Botma et al., 2010:19; Polit & Beck, 2014:85). All the students that completed their simulation scenario and debriefing session had the opportunity to participate in completing the questionnaire.

1.14 Value of Study

This research will contribute to the body of knowledge and maybe serve as ground work for future research projects, or a baseline to work from. As a school relatively new in simulation we will grow from this experience.

A few stakeholders exist and each one will benefit from this study. The researcher will obtain a higher academic qualification. The School of Nursing may benefit from the research in the sense that the research may identify a gap in the design of the high-fidelity simulated learning experiences. Students, who are the service consumer, could benefit from better designed learning experiences. Furthermore, this research will be the first quantitative measurement of the design characteristics of the simulated learning experiences in the School of Nursing.

1.15 Layout of the chapters

Chapter 2 contains a literature review of all the aspects included in the simulation model of Pamela Jeffries (Jeffries, 2005:97), with specific focus on the design characteristics. Within chapter 3, the design and research technique is motivated and described, discussing the methodology of the study. Chapter 4 reveals the analysis of the results of this research study, and in chapter 5, the researcher discusses the results in relation to the research objectives, limitations of the study, and the conclusions drawn from the study.

1.16 Summary

Chapter one visited the background and purpose of this research study, including a summary of the aims, design and methodology, orientating the reader. With this in mind, we can progress to the literature review, focusing on appropriate literature to support the conduction of this research project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Simulation has been used as a learning strategy by nurse facilitators, preparing nursing students to be competent and confident practitioners. Simulation design needs to be planned and integrated into the undergraduate nursing curriculum carefully to ensure optimal student learning and enable students to deliver optimal care within the clinical environment. Thidemann and Söderhamn (2013:1603) agree with Botma et al. (Botma, Van Rensburg, Coetzee, & Heyns, 2015:507), by stating that simulation, as a teaching and learning strategy, has been proven to integrate theory with practice. Simulation not only amalgamates clinical skills with content knowledge, but also merges teamwork, inter-professional communication, physical assessment, nursing therapeutics and critical thinking (Levett-Jones, McCoy, Lapkin, Noble, Hoffman, Dempsy, Arthur and Roche; 2011:706).

In order to reach these competencies through the use of simulation, the School of Nursing (SoN) at the University of the Free State has been using simulation as a teaching and learning strategy in the undergraduate and postgraduate programs since 2010. The aspects of authenticity, scaffolding, alignment and constructivism are built into a template that the facilitators implement during the design and running of high-fidelity simulation sessions. In the first four years of using simulation, it has been a growing experience through continuous efforts to address short-falls and improving each simulation scenario. However, the question arises whether the simulations we do comply with the standards set out for quality simulation experiences on an international level.

In 2005, Pamela Jeffries published “A Framework for Designing, Implementing, and Evaluating Simulations Used as Teaching Strategies in Nursing.” which conceptualized practices concerning the planning and running of simulations as a teaching tool (Jeffries, 2005:97). The framework describes the five major constructs namely: educational practices, teacher, students, simulation design characteristics and outcomes. The aim of this chapter is to review the literature relevant to the planning and running of simulation sessions aimed at undergraduate nursing students, with special attention to the design characteristics and criteria of the Jeffries simulation model. Components of the simulation model include teacher demographics and student characteristics, educational practices, outcomes, as well as the design characteristics. Simulation has been used as a learning strategy for many years within different disciplines, evolving into an innovative teaching tool that we apply into our curriculums today.

2.2 Simulation as a teaching and learning strategy

Clinical simulation as a teaching and learning strategy, has evolved at an astronomical rate over the last half a decade (Jeffries et al., 2015:292) (). During simulation, simulators are used for education or training purposes(Cooper & Taqueti, 2004:i11), creating a quality representation of reality (Merriam Webster, 2017: online) .The simulated realty creates a safe environment for new graduates making their transition to practice (Jeffries et al., 2015:292)).

The process of learning has been studied for many years using methods of science, deliberately relating and arranging external and internal components of a learning situation in order to facilitate learning. Instruction is designed to facilitate learning, based on the desired learning outcome (Botma, Brysiewicz, Chipps, Mthembu, & Phillips, 2014:19). Learning is viewed as information processing, experiential growth and a socio-cultural dialogue. Therefore instruction needs to address each component of learning, and simulation is relevant to each of these perspectives (Jeffries, 2007:23). Due to the limited number of clinical placement areas and the availability of technology, emphasis has been put on simulation as a pedagogy.

2.2.1 Levels and types of simulation used in simulation

Different levels of simulation, also called simulation strategies, have been described by Alinier (2007:e245) with relation to simulation techniques which are as follows:

- Level 0: Pen and paper exercise
- Level 1: Basic 3-D mannequin models, low-fidelity simulation models and part-task simulators

- Level 2: Screen-based computer simulators using simulation software, videos, DVDs or Virtual Reality as well as surgical simulators
- Level 3: Standardizes patients, trained in role play
- Level 4: Intermediate fidelity full body size patient simulators controlled by a computer, but not fully interactive
- Level 5: Interactive patient simulators or computer controlled model driven patient simulators, also called high-fidelity simulation platforms (from Alinier, 2007:e245; Chen, Huang, Liao, & Liu, 2015:2445).

Decker and colleagues (Decker, Sportsman, Puetz, & Billings, 2008:75) summarize the same types of simulation, and add to the above list: peer-to-peer learning where peer collaboration is used to develop and master specific skills. Apart from the different levels of simulation, there are different types of human patient simulators, namely standardized patients (SPs), low- medium- and high-fidelity human patient simulators, and hybrid simulations which combine the two (Botma et al., 2014:86; Oermann, 2015:83). One simulation device can be used in more than one capacity, for example, high- or medium-fidelity, depending on how it is used and for what purpose (Seropian, Brown, Gavilanes, & Driggers, 2004:165). Examples of the different types of simulation combined with the levels of fidelity within simulation, including student actions, are listed in table 2.1 (Meakim, Boese, Decker, Franklin, Gloe, Lioce, Sando & Borum, 2013:S6).

Table 2 1 Examples of different types of simulation combined with student actions. *Source: (Meakim et al., 2013:S7)*

	Low Fidelity	Medium Fidelity	High Fidelity
	Case Studies Partial Task Trainers and static mannequins	Computer-based self-directed learning systems Realistic mannequins with heart sounds, breath sounds or pulses	Standardized patients, Virtual reality or full scale computerized patient simulators
Student actions	Role-playing or performing of skills	Students solve a problem and perform a skill while making decisions	High level of interactivity and realism for the learner

2.2.2 The simulation process

Simulation can be used as a teaching and learning strategy for students to achieve the set outcomes which are aligned with their course learning objectives. The educational goals of the simulation need to be clearly defined to maximize the student's learning outcomes (Chen et al., 2015:2451). The student outcomes need to match the student's abilities and skills for the student to be successful (Oermann, 2015:89). The outcomes of a simulation scenario are determined by the quality of the scenario, the degree of realism, the availability of all equipment, the student's preparedness for the simulation and the facilitator's familiarity with the equipment (Mikasa, Cicero, & Adamson, 2013:e362). A simulation experience consists of four stages, namely developing, briefing, the simulated scenario, with debriefing to follow immediately. Each of these four stages will be discussed briefly.

Aebersold and Tschannen (2013:6) recommend the following five step process to develop simulation scenarios, namely to (1) identify the key concept; (2) describe the competency and standard mapping; (3) build the scenario; (4) set debriefing guidelines; and (5) perform beta testing and refinement (if needed) of the scenario. At the School of Nursing (SoN) where this research was performed, the simulation scenario was developed with curriculum goals and course objectives in mind. As seen in **figure 2.1**, pedagogical principles, fidelity, student preparation and training, staff preparation and training, and debriefing are the key areas when planning a high-quality simulation scenario.

Pedagogical principles include the integration and aligning of the program with course objectives and simulation objectives. Scaffolding of learning experiences to support and promote learning include: knowledge, psychomotor skills, clinical reasoning, reflective thinking and the use of technologies. The students have been introduced to simulation from their first year of studies, creating familiar experiential learning opportunities.

Simulation technologies and approaches need to be consistent with learning objectives, resources and cost-effectiveness. Environmental fidelity was kept in line with learning objectives, including equipment and patient information supporting the acute setting of the burn wound patient. The students received a structured orientation prior to the simulation session, including simulation objectives and structure, as well as orientation of the simulation environment. Facilitators were present during the planning of the burn wound scenario, discussing the goals and objectives, including debriefing planning. The design characteristics are discussed in more detail in chapter four during the data analysis.

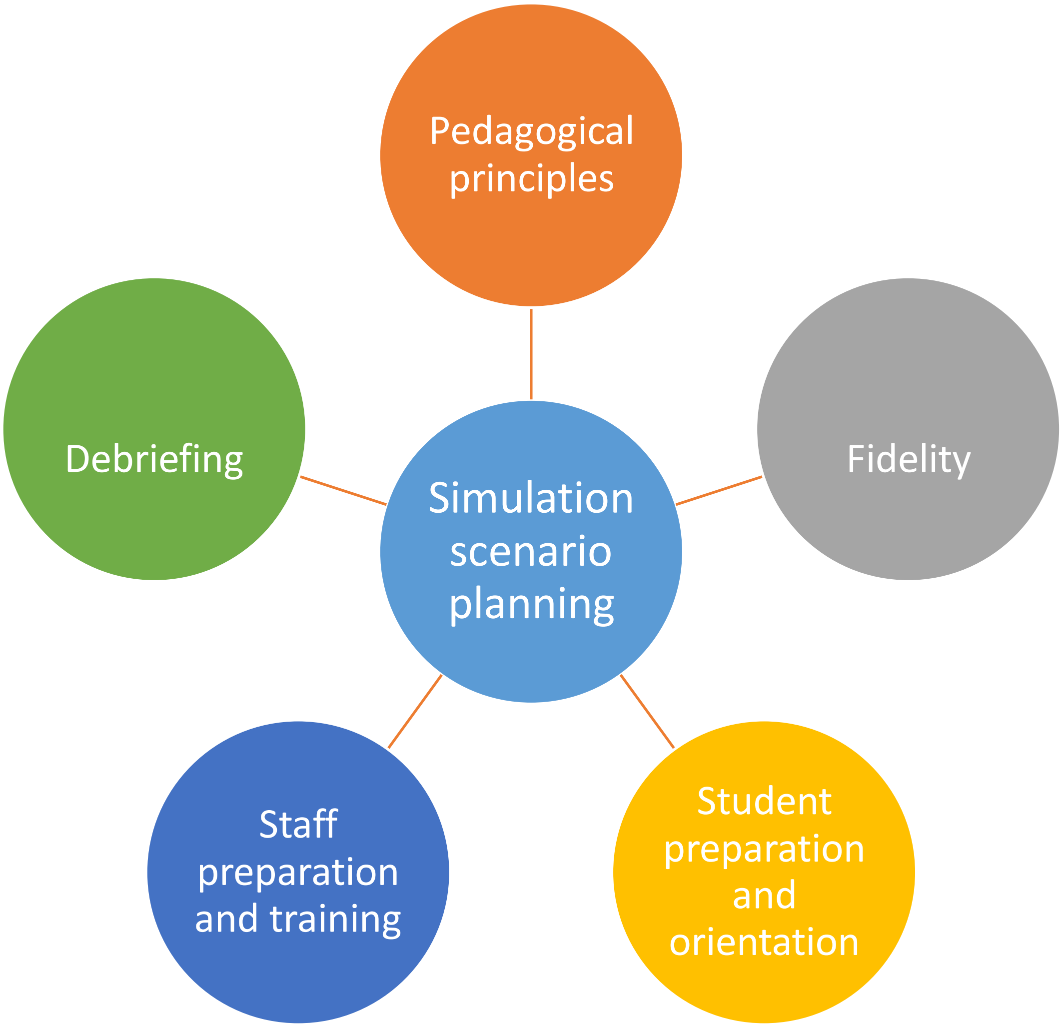

Figure 2 1 Planning of a simulation scenario

During the briefing period, students have to be prepared for the simulated learning experiences by gaining the required declarative and procedural knowledge in the form of lectures, learning packages, or skills training. Prepare students and assist them in their performance during simulation scenarios (Arthur, Levett-jones, & Kable, 2013:1360). Students need to be briefed well before the simulation starts to be successful and demonstrate their best performance during the simulation. Briefing includes information about the simulated patient similar to the hand-over of a patient (Motola, Devine, Chung, Sullivan, & Issenberg, 2013:e1514; Oermann, 2015:88) and may include orientation of the simulation scenario environment (Lanzara, 2014:7).

Students need to receive academic support during the briefing period (Cant & Cooper, 2009:12), to reduce their anxiety and improve their learning (Arthur et al., 2013:1360).

When running a simulation session, cues must be appropriate for the knowledge level of the students (Reese, Jeffries, & Engum, 2010:34). Appropriate cues and fidelity help students to be successful in interpreting the simulated reality (Oermann, 2015:88; (Paige & Morin, 2013a:e482).

Debriefing is a collaborative learning experience (Mariani, Cantrell, & Meakim, 2014:330) between facilitators and students within a safe environment. It provides a reflective learning experience (Groom, Henderson, & Sittner, 2014:341) with a holistic approach to review knowledge and technical skills, and focuses on the students' reactions and emotions about the learning experience (Mariani, Cantrell, Meakim, Prieto, & Dreifuerst, 2013a:e147). Meaningful learning occurs during debriefing (Mariani et al., 2013a:e153; Paige, Arora, Fernandez, & Seymour, 2015:126; Lioce et al., 2015a:S6), when participants hear others' ideas and priorities (Lasater, 2007:502). Facilitators should ensure that participants discuss the scenario outcomes during the debriefing session (Gaba, 2013:6) so that they can understand the purpose and construction of the session. Immersive simulation evokes strong emotions and students should be given the opportunity to voice their feelings and clarify why they experienced it (Mills, West, Langtree, Usher, Henry, Chamberlain-Salaun, & Mason, 2014:13; Gaba, 2013:5). Debriefing provides the opportunity for students to identify their strengths and weaknesses (Botma, 2014a:4).

2.2.3 The value of simulation as a learning experience

Students value simulation to a great extent irrespective of the level of fidelity of the scenario (Levett-Jones et al., 2011b:705; Levett-Jones, Lapkin, Hoffman, Arthur, & Roche, 2011a:380)

Students who have been exposed to a simulated learning experience reported the following advantages:

- increased their self-confidence (Botma et al., 2014:56; Valizadeh, Amini, Fathi-Azar, Ghiasvandian, & Akbarzadeh, 2013:157).
- improved skill retention (Adamson, 2015:287).

- integration of clinical skills, content knowledge, teamwork, inter-professional communication, physical assessment, nursing therapeutics and critical thinking (Levett-Jones et al., 2011b:706).
- Transfer of learning, or the ability to apply classroom learning in the clinical setting, (Botma et al., 2013:2) reflection (Burke & Mancuso, 2012:548). (Tosterud, Hedelin, & Hall-lord, 2013:262; Beattie, Koroll, & Price, 2010:6).
- engage in clinical judgment, problem solving and critical thinking (Brewer, 2011:311; Przybyl & Evans, 2015:145; Meakim et al., 2013:S4).

2.2.3 Role of the Facilitator

Facilitators overall hold similar views about simulation design which should be planned according to a standardized framework to be able to develop effective simulation-based experiences (Jeffries, 2005:97; Paige & Morin, 2015b:18; Lioce, Meakim, Fey, Chmil, Mariani & Alinier, 2015:309). Purposeful and effective simulation design upholds structure, process and outcomes within a program, supporting the institutional goals and mission, strengthening the overall value of simulation based education (Lioce et al., 2015:309). The roles of the lecturer in simulation is focused on reflective abilities, knowledge of simulation as a teaching strategy, knowledge of the students' abilities, as well as knowledge of learning theories (Jones, Reese, & Shelton, 2014:357). Jones and colleagues list the roles and responsibilities of the lecturer or facilitator in simulation as follows:

- Up-to-date clinical information and up-to-date skills;
- Organize resources available;
- Flexible and reflective capabilities;
- Clear communication skills;
- Knowledge of learning theory;
- Context of learning environment;
- Role model and guide;
- Knowledge of pedagogy of simulation;
- Knowledge of student characteristics and abilities; and
- Knowledge of subject matter.

The lecturer needs to provide maximal learner support throughout the simulation and debriefing experiences (Jeffries, 2005:98; Fink, 2005:27). Sufficient support, for example providing instruction in a manner that maximizes understanding, sets students up for success (Clapper, 2010:e13). Positive interpersonal interaction between the facilitator and students promotes success of the students (Fink, 2005:44). Adamson (2015:287) emphasizes the importance of a simulation facilitator's personality, teaching ability, nursing competence, interpersonal relationships, technological skills, and ability to design scenarios, as important characteristics which influence simulation positively (Adamson, 2015:287).

2.2.4 Role and responsibilities of the students

Nursing students need to be self-directed and motivated and prepare themselves for the simulation session by engaging with the theory and skills related to the simulation scenario to be performed. During the simulation session, students need to fully participate in the scenario, taking responsibility to help themselves and their peers in order to optimize their learning experience (Jeffries, 2005:98; Fink, 2005:27).

The student shares the responsibility with the lecturer of creating and maintaining a trusting relationship within the simulation environment. Through "buying-in" to the authenticity of the simulation experience, the quality of the simulation experience in enhanced and disbelief is suspended (Jeffries, Rodgers, & Adamson, 2015:292). Students contribute to realism by wearing uniform and acting professionally during the simulation (Dieckmann, Gaba, & Rall, 2007:189; Adamson, 2015:286).

2.2.5 Disadvantages of simulation as a learning strategy

A disadvantage of simulation is the costs of setting up and running a simulation laboratory (Oermann, 2015:138). Budget constrains may influence the purchase of necessary network devices, like routers, and consumable costs are always high. Learner errors may lead to extra costs to repair the damage (Lin, Hou, Wu, & Chang, 2014:51; Oermann, 2015:138). Running costs can be decreased by using students to act as patients (Kelly, Berragan, Husebø, & Orr, 2016:313).

In addition to maintaining simulation laboratories, the staff should be developed and supported in developing simulation scenarios and using simulated related equipment and techniques (Levett-jones & Lapkin, 2014:63; Richardson et al., 2014:313). Most debriefers have not had any training in debriefing (Thomas & Arnold, 2011:233), nor have their competence levels been assessed with regards to their debriefing skills (Fey & Jenkins, 2015:361). In conclusion, developing and running simulation sessions is a time-consuming and expensive exercise, with only a few trained staff members to utilize the expensive, high maintenance simulation laboratories (Richardson et al., 2014:308; Valizadeh et al., 2013:158).All the debriefers present at this research study had been trained in simulation and debriefing.

2.3 Simulation Model

In 2005, Pamela Jeffries published “A Framework for Designing, Implementing, and Evaluating Simulations Used as Teaching Strategies in Nursing.” which conceptualizes practices concerning the planning and running of simulations as a teaching tool. The framework consists of five major constructs, namely educational practices, teacher (also called the facilitator), student, simulation design characteristics and expected student outcomes (Jeffries, 2005:97; Groom, Henderson, & Sittner, 2014:341). See **figure 2.2** for the simulation model designed by Pamela Jeffries. Each construct will be discussed in detail.

2.3.1 Educational practices

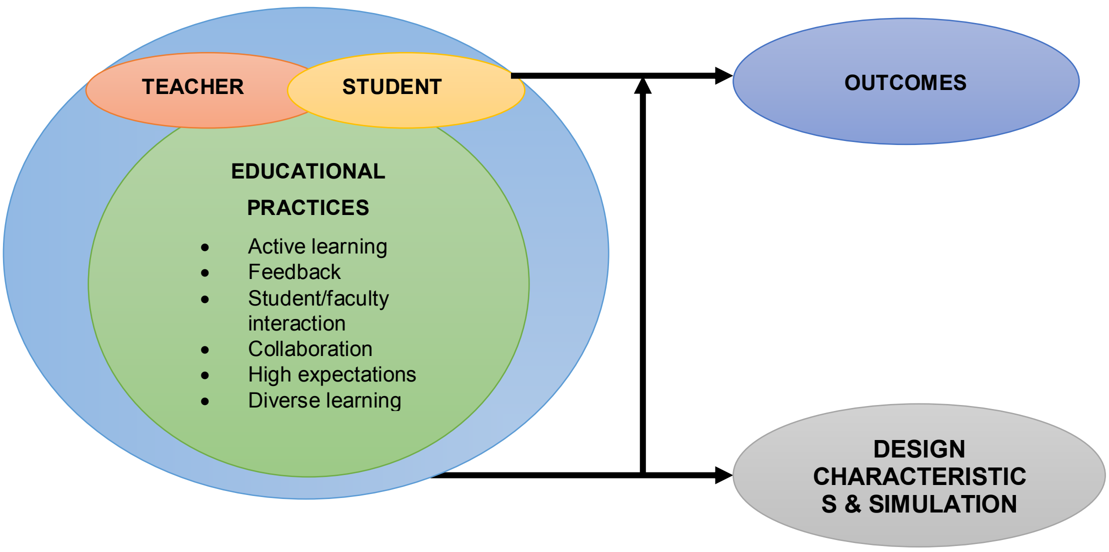

Figure 2 2 Simulation Model by Jeffries (2005:97)

The educational practices component of the framework is based on seven pedagogical principles, namely active learning, feedback, student/faculty interaction, collaborative learning, high expectations, diverse learning styles, and time on task.

2.3.1.1 Active Learning

Active learning is when "students are doing things while thinking about the things they are doing" (Fink, 2005:16). Active learning includes all course-related actions that students perform in class other than listening to a lecture or taking notes (Felder, Brent, & Carolina, 2009:2). Students actively engage with learning material in such a manner that higher order cognitive thinking is stimulated. Oftentimes active learning involves group work (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt & Wenderoth, 2014:8413).

During the scenario, students get the opportunity to actively participate, for example to assess a "patient". Assessment includes collecting information through observation, history taking, physical assessment, and side room and laboratory investigations. Noticing objective, subjective and environmental cues and interpreting the cues (Jeffries, 2005:98) assists students in solving problems. Simulation participants should decide which one of the healthcare needs to address first and select and implement the best available solution within the given scenario in collaboration with the patient (Karagiorgi & Symeou, 2005:19). Nursing interventions are based on best available evidence and consideration of patient preferences and the effect is monitored. Students reflect on their decisions during debriefing which encourages meta-cognition (Fink, 2005:16; Tanner, 2006:209; Clapper, 2010:e12).

Through simulation students actively gain understanding and acquire appropriate patterns of behaviour, leading to the desired outcomes (Kuiper, Heinrich, Matthias, Graham, & Bell-Kotwall, 2008:2) thereby promoting deep learning (Pascoe & Singh, 2008:96; Jeffries, 2007:22). Simulation and active learning provide students with opportunities to make independent decisions and become competent nurse practitioners (Swanson, Nicholson, Boese, Cram, Stineman, & Tew, 2011:e82).

Students that observed simulated scenarios reported that they achieved their learning outcomes just as well as or even better than those who actively participated in the simulation. Tools that structure the observation improve the role satisfaction for observers. Students value the observer role for improving role clarity and developing an observer's perspective on debriefing (O'Regan, Molloy, Watterson, & Nestel, 2016:1). Examples of such a tool is a check-off instrument or a list of behaviours, which serve as a written record and can be shared with the students during the debriefing session (Prion, 2008:e74). Advantages of having observers are that the observers feel less stressed (O'Regan et al., 2016:4) and it is less labour intensive and time consuming than having all students rotating through a simulated scenario (Gillan, Parmenter, Riet, & Jeong, 2013:1438). The observing student learn to be an effective observer, to think critically, and to prioritize patient care (Partin, Payne, & Slemmons, 2011:186).

Active learning is the preferred, empirically validated teaching practice in regular classrooms (Freeman et al., 2014:8410) because it has a greater impact on student mastery of cognitive skills than lecturing (Momsen, Long, Wyse, & Ebert-May, 2010:438). Active learning, like simulation education, enables students to make connections between theoretical concepts and clinical practice. Through simulation training and active learning, students develop problem solving skills, apply a higher level of thinking, and develop more complex skills over time. By means of effective instructional scaffolding the facilitator organizes and structures cues so that students focus on the stated learning outcomes (Sittner, Aebersold, Paige, Graham, Schram, Decker & Lioce, 2015:296).

Examples of methods used to promote active learning include case scenarios, simulations of real life clinical problems requiring assessment and decision-making skills, role-playing with actors, debates, concept/mind maps and student applied demonstrations (Jeffries, 2005:98; Oermann, 2015:73). Students construct knowledge while engaging actively with information. However, it may happen that the newly constructed knowledge is incorrect. Therefore, the facilitator needs to check the scientific validity of the knowledge and give feedback on the deliverables produced during active learning.

2.3.1.2 Feedback

Prompt feedback is essential to complete a learning opportunity (Botma et al., 2014:30) and students prefer feedback to be given in a timely manner, but are willing to wait longer for a more detailed and quality feedback (Ferguson, 2011:60). Students have a desire to receive direct and honest feedback about their clinical performance in simulation (Lasater, 2007:502). Feedback should not be confused with evaluation, because it is informal, frequent, and less judgmental than evaluation (Botma et al., 2014:135).

2.3.1.2.1 Benefits of Feedback

Effective feedback promotes student confidence, motivation and self-esteem, improved clinical practice, enhanced interpersonal skills and a sense of personal satisfaction (Clynes & Raftery, 2008:406). The receiving and providing of constructive feedback positively influences the milieu of the simulation environment, and enhances reflection when all participants provide clear, concise communication while mutually respecting each other (Gloe, Sando, Franklin, Boese, Decker, Lioce, Meakim & Borum, 2013:S13).

Students experience feedback as helpful, informative and encouraging, guiding them towards desired learning outcomes (Franklin, Boese, Gloe, Lioce, Decker, Sando, Meakim & Borum, 2013:S19). Feedback makes students aware of their performance, knowledge and decision-making skills (Boese, Cato, Gonzalez, Jones, Kennedy, Reese, Decker, Franklin, Gloe, Lioce, Meakim & Sando 2013:S25; Jeffries, 2005:99). Feedback by trained facilitators is a principle feature in simulation-based education; it improves student performance (Eppich & Cheng, 2015b; Gardner, 2013:166-168; Issenberg, McGaghie, Petrusa, Lee Gordon, & Scalese, 2005:21-23). Students who practice skills (tasks) and receive feedback grow in self-confidence and perseverance, improve their educational outcomes, learn effectively and become clinically competent (Eppich & Cheng, 2015:106; Issenberg et al., 2005:21-23). Feedback gives students direction, boosts their confidence, increases their motivation to learn, and increases their self-esteem (Botma et al., 2014:135).

2.3.1.2.2 Guidelines on giving feedback

Different techniques exist on how to give feedback with a common focus on stimulating and fostering critical thinking. Students grow while critically analysing their own learning when given the opportunity to evaluate themselves (Botma et al., 2014:138). Constructive feedback should be delivered with mutual respect during simulation and debriefing, positively influencing the milieu of the simulation environment (Gloe et al., 2013:S13). Providing students with appropriate, team-based structured debriefing and feedback is seen as one of the best practices for simulation enhanced inter-professional education (Decker et al., 2015:295). In order to enhance feedback, Beckman and Lee (2009:341) developed the mnemonic called "FIT & ABLE" as seen in **Table 2.2**. The researcher adapted the table.

Table 2 2 Feedback mnemonic: FIT & ABLE (Beckman & Lee, 2009:341; Merrill, 2002:49; Eppich & Cheng, 2015:106)

F	Frequent	Give feedback frequently in the form of a brief verbal response or nonverbal cues.
I	Interactive	Both the teacher and student need to give feedback. Ask the student: "How do you think you did?"
T	Timely	Feedback must be given immediately after the observed behaviour. Students are willing to wait for more detailed and quality feedback.
A	Appropriate Level	Feedback must be honest and on the students' level.
B	Behaviour Specific and Balanced	Feedback must be focused on observed behaviour and not on personality traits, on strengths and weaknesses. To recover from error and avoid in future
L	Labelled	Label it as feedback because the student may interpret it as a friendly conversation.
E	Empathetic	Be sensitive to the social context while giving feedback.

Feedback can be in the form of verbal or written feedback. According to a study performed by Buckley, undergraduate students prefer to have written feedback over verbal feedback, because they can review the feedback in their own time and hold the lecturer to account for the written feedback. Conversely, some students prefer verbal feedback because it is usually more detailed than written feedback and they can engage in dialogue to clarify facts (Buckley, 2012:244). "Sandwiching" is a technique used during verbal feedback, that contains two positive components either side of a corrective component (Beckman & Lee, 2009:341).

It is suggested that feedback during debriefing should be in the form of the “PEARLS” method: Promoting Excellence and Reflective Learning in Simulation (Eppich & Cheng, 2015:113; Rutherford-Hemming, Lioce, Kardong-Edgren, Jeffries, & Sittner, 2016:6). This method includes reaction, description, analysis and summary phases (Eppich & Cheng, 2015b:108 ; Rutherford-Hemming et al., 2016:6) which will be discussed shortly.

Reaction includes open-ended questions with regard to the students’ feelings, allowing all the students to express their initial thoughts and feelings. This provides an opportunity for any student to voice their feelings if they choose (Eppich & Cheng, 2015b:108).

During the description phase, any student can be invited to summarize their perspective of the key elements of the scenario; this is to ensure that all the students and the facilitator are clear about the main issues of the scenario. The facilitator can note any aspects that need to be addressed later in the debriefing during this stage (Eppich & Cheng, 2015b:108).

During the analysis phase, the facilitator revisits the learning objectives of the simulation scenario, using an appropriate strategy depending on the available debriefing time, evident rational or content area. Self-assessment strategies are learner centred, and one example is called the plus/delta technique, which includes questions like “what went well and why was it good”, versus “what would you do different next time”. It summarizes the behaviours and actions into “good” versus “what needs to change” (Eppich & Cheng, 2015:107; Fanning & Gaba, 2007:120). The facilitator can initiate an in-depth discussion or uses directive feedback to close any performance gaps of the identified issues.

The summary phase of the debriefing may be conducted in two different ways. Firstly, the students could be asked to confirm their “take home message”, while the facilitator evaluates their statement against the set learning objectives (Eppich & Cheng, 2015b:111). Otherwise, the facilitator can summarize the scenario by providing a concise review of the main take-home messages, aligning it with the learning objectives, controlling the end of the debriefing session. Eppich and Cheng favours the students to perform the summary, and suggests facilitators manage debriefing time to allow for this (Eppich & Cheng, 2015b:112).

Another three techniques exist which could be used to engage students in the feedback or debriefing process (Fanning & Gaba, 2007:120). Firstly, facilitators can use funnelling, where the facilitator guides the students but refrains from making comments. Secondly, the facilitator can use framing, enhancing the relevance and meaning of the experience. Lastly, the facilitator can use frontloading, by asking punctuated questions either before or during the simulation experience, to redirect reflection (Fanning & Gaba, 2007:120).

2.3.1.3 Student/Staff interaction

Students construct their knowledge through social interactions with peers, facilitators and clinicians (Borthick, Jones, & Wakai, 2003:111). Students learn less when they experience negative interaction from staff such as criticism, lack of assistance, or over supervision, because it creates stress for the students (Fink, 2005:43). Positive interactions between students and staff forms a major part in the success of the student, while negative interactions impede learning and impair the physical health of the student (Fink, 2005:53). The relationship between the facilitator and the student needs to be a trusting relationship to enhance learning, with a recent change in roles. Traditionally, the facilitator's role was that of a teacher, passing knowledge on to the students. Nowadays, facilitators take on the role of an approachable facilitator, being open and willing to learn from students, instead of being the "sage on the stage".

The facilitator needs to have certain qualities and skills to fulfil his/her role. Personality characteristics include openness, warmth, patience and flexibility which promote facilitation of students and enable learning to take place (Lekalakala-Mokgele & du Rand, 2005:27). Facilitators should prepare themselves for facilitation and commit themselves to a student-centred approach, providing support and mentoring of students. Students need to have sufficient orientation and receive support both in the classroom and the clinical setting to adapt to facilitation and to enhance relationships with the facilitators (Lekalakala-Mokgele & du Rand, 2005:27).

Non supportive facilitators may negatively impact the ability to learn due to increased anxiety among students, and researchers suggest that instructors should be aware of how the students perceive their interactions (Fink, 2005:48; Kleehammer, Hart, & Fogel, 1990:183). Students confirmed that one of the most anxiety-provoking and stress related factors throughout their training period was negative interactions with instructors (Fink, 2005:49), making interaction between the lecturer and the students an essential component of learning with technology (Oermann, 2015:116).

The interaction between the students and lecturers include discussions about course content, learning processes, as well as personal and professional goal setting, and are aimed at promoting the achievement of course goals (Jeffries, 2005:99). Student interaction and engagement need to be reviewed when aiming at quality improvement of a course (Oermann, 2015:77). A study done by Spies (2016:186) indicates that students need to be given the space to develop and to take ownership of their own learning before they can become owners of new knowledge and skills. She suggests that lecturers need to refrain from being "a fountain of knowledge" and stand back to allow students to discover, which is much more difficult to do than presenting lectures.

2.3.1.4 Collaboration

Collaboration is when there is interaction between multiple parties to reach a common goal (Bedwell, Wildman, DiazGranados, Salazar, Kramer & Salas, 2012:128). Within a simulation session, students work together to solve problems and share the decision-making process, allowing for collaborative learning to take place. Simulations create an environment which encourages teamwork, communication, collaboration, and sharing among students, which in turn promotes collaborative learning (Gibbons, Adamo, Padden, Ricciardi, Graziano, Levine & Hawkins, 2002:220; Jeffries, 2005:99; Oermann, 2015:70; Titzer, Swenty, & Hoehn, 2012:e326).

A fundamental approach of constructivism is to construct a collaborative learning environment for students (Decker et al., 2015:294), where they not just share the workload or come to consensus, but where they need to develop, compare, and understand multiple perspectives on issues, sharing a space where knowledge becomes explicit, available and generalized, and promotes insight into alternative perspectives (Karagiorgi et al., 2005:21). Within a simulation environment, students see alternative approaches to clinical problems and begin to realize there is more than one correct course of action (Jeffries, 2005:100). Collaboration forms part of the passion for successful leadership and also the passion of teaching, creating fruitful and sustainable relationships between lecturers and students. The ability to integrate theory is enhanced through collaborative learning because it creates a sense of safety (Spurr, Bally, & Ferguson, 2010:350; Titzer et al., 2012:e326).

Teamwork and effective communication between clinical staff are essential skills because it promotes patient safety and leads to improved quality of care (Pettit & Duffy, 2015:24). Simulation provide the ideal environment to practice teamwork within a safe, controlled environment (Titzer et al., 2012:e326). Variables in simulation design such as collaboration, problem solving and high expectations were found to be essential education practices in simulation teaching (Chen et al., 2015:2446; Jeffries & Rizzolo, 2006:4). By conveying the expectations of safe and high quality of care, the simulation facilitator sets high standards.

2.3.1.5 High Expectations

Within simulation, high expectations refers to facilitators expecting students to do well in the scenarios (Kardong-Edgren, S E Starkweather & Ward, 2008:4). Setting high expectations increases student motivation to learn and improves performance (Oermann, 2015:147). High expectations are one of the seven good practice principles in undergraduate education, based on research on good teaching and learning in colleges and universities (Chickering & Gamson, 1987:4-5; Oermann, 2015:73).

Lecturers and institutions that hold high expectations of themselves and who make extra efforts, expecting students to perform well, become a self-fulfilling prophecy (Chickering & Gamson, 1987:4-5; Jeffries, 2005:100; Maas & Flood, 2011:232). Positive results can be achieved when both students and lecturers have high expectations for the simulation process and outcomes (Jeffries, 2005:100; Maas & Flood, 2011:232).

Students are encouraged to approach a simulation scenario as a real-life situation and are expected to respond in the same way they would involving a real patient (Maas & Flood, 2011:232). Within simulations, where instructors feel free to intervene, it has been found that student nurses can be pushed to expand their competency levels and empower themselves to achieve greater learning within this safe learning environment (Vandrey & Whitman, 2001:24). Attaining higher levels of performance than expected is aligned with Vygotski’s theory of proximal zone of learning (Fink, 2005a:15).

2.3.1.6 Diverse Learning

Worldwide the health systems are becoming more and more multi-cultural, where a language barrier often exists between members of the inter-professional teams (Pettit & Duffy, 2015:24) and specifically between physicians and nurses. A safe environment is created when students' unique backgrounds, cultures, personalities, skills and abilities are taken into account. Students learn in different ways, which include visual, auditory, tactile and kinesthetic styles. Simulation incorporates all of these styles into a single, highly active, technology-rich learning experience (Miller, Leadingham, & Vance, 2010:37).

Simulation as a teaching strategy accommodates diverse learning styles (Maas & Flood, 2011:e232) and allows students from different cultural backgrounds to benefit from the experience (Jeffries, 2005:100; Tosterud et al., 2013:266). Simulation allows the kinetic student to perform actions during the scenario, stimulating the his/her sensory awareness by means of noises, smells, and the appearance of the patient and immediate surroundings (Evans, 2012:5). During the debriefing session, students get the opportunity to view their actions of the recorded scenario, reflecting on their actions. Students can discuss their thought processes, making sense of the simulation experience, and reflect on their feelings during and after the scenario. Not only does simulation stimulate learning in students with different learning styles (Beischel, 2013:241; Yockey, 2015:123), it also allows for quality learning in a short time period (Shinnick & Woo, 2015:66).

2.3.1.7 Time on Task

Faculty and students need to manage their time spent on tasks well by setting clear and realistic time frames for assignments, as well as clear and focused objectives. Ground rules concerning specific simulation sessions help to keep learning focused (Jeffries, 2005:100). Time on task is seen as one of the seven principles for good practice in undergraduate education (Chickering & Gamson, 1999:76).

Students should have the knowledge and skill to perform specific psychomotor tasks before a simulation session. It is therefore essential that students practice psychomotor skills on task-trainers until they are able to perform the task within a certain time period. Being proficient in the task before the simulated event allows students to focus on solving the problem; thereby stimulating higher-order thinking and enhancing deep learning (Oermann, 2015:73). That is why the students who participated in this study first completed the theoretical part of the theme, together with practicing the related clinical skills, before they enter the simulation scenario. Simulation is not a task training session and time on task is reduced when students walk into the simulation session by being prepared with relation to the theory and skills linked to the simulation scenario. It was found that critical thinking and knowledge scores increased when students were exposed to simulation for longer periods, increasing their time on task experiences (Adamson, 2015:284; Spies, 2016:182).

2.3.1 Learner Facilitator

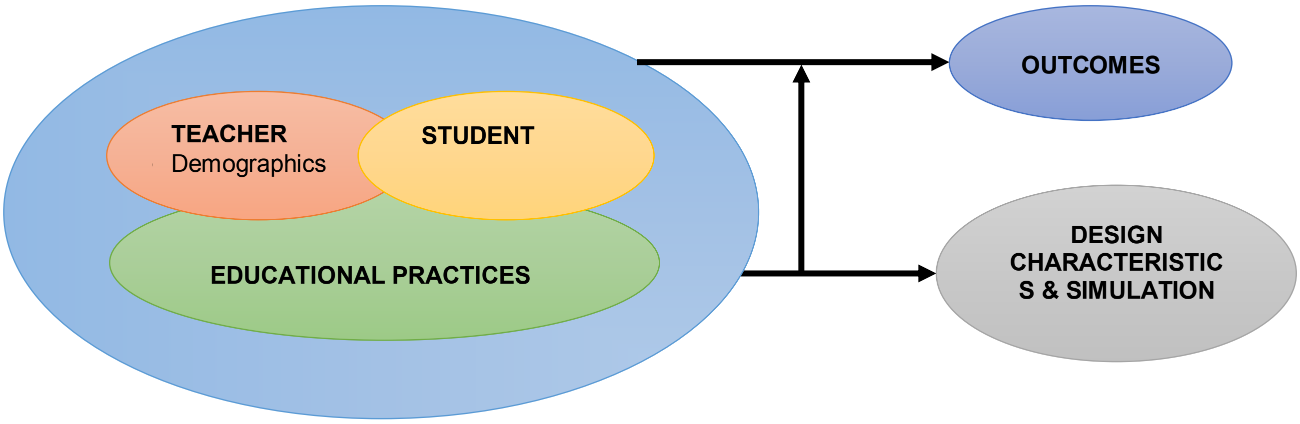

Figure 2 3 Simulation Model by Jeffries (2005:97)

The learner facilitator, previously known as the teacher, plays a crucial role in all stages of the simulation process to ensure success in student learning (Jeffries, 2005:98).

2.3.2.1 Demographics

Demographic variables are elements of subjects that are collected to describe the sample of a study during the writing stage of a proposal. A few common demographic variables include age, education, gender, or ethnic origin (Grove, Gray, & Burns, 2015:157).

All facilitators at the institution where the research was conducted have an additional qualification in Nursing Education, a post basic diploma with registration as a nurse facilitator, assessor and moderator at the South African Nursing Council. Boese and colleagues are of the opinion that all simulation facilitators should have specific formal training in simulation (2013:23) and actively maintain their skills through simulation experiences (Decker, Fey, Sideras, Caballero, Rockstraw, Boese, Franklin, Gloe, Lioce, Sando, Meakim & Borum, 2013:27). The facilitators in the School of Nursing meet this suggestion because they have all successfully completed a Certificate in Simulation, presented by Drexel University (United States) in South Africa.

It is suggested that facilitators must have facilitative personalities, characterized by openness, warmth, patience and flexibility to enable participants to learn (Lekalakala-Mokgele & du Rand, 2005:27). The facilitator takes the role of a coach, mentor, and/or guide to provide feedback to learners (Koohang, Riley, Smith, & Schreurs, 2009:96), helping students to become aware of their learning experience, motivating the students, discussing and giving examples, supporting and challenging the students, instead of acting as knowledge channels (Botma et al., 2014:34). It is important that facilitators know how to effectively use, maintain and troubleshoot simulation technology in order to keep the simulation session real (Paige & Morin, 2015a:258).

2.3.2 Student Factors

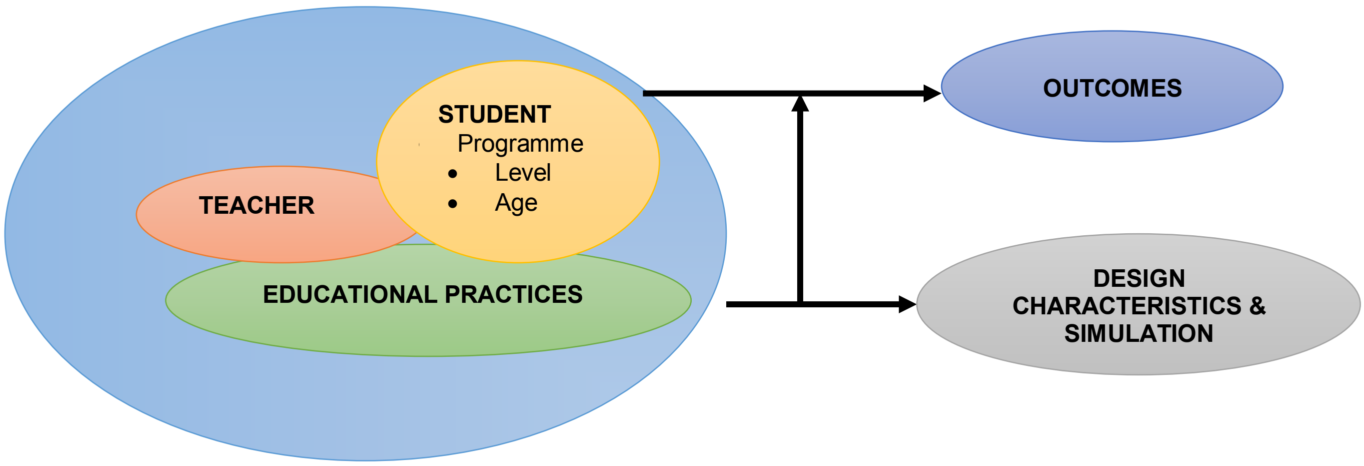

Figure 2 4 Simulation Model by Jeffries (2005:97)

Simulation scenarios should be designed, keeping in mind not only the educational level of the students, but also the content of the program, with specific knowledge of the clinical skills and theory content the students have completed, to promote learning.

2.3.3.1 Program

The program is part of a pre-registration 4-year professional degree at a NQF level 8, structured according to the levels of healthcare services in South Africa. The lowest level of healthcare is at community level and therefore the first year nursing content focuses on preventative and promotive care. There is a strong focus on basic healthcare needs and related nursing therapeutics. Simulation is primarily task training on meeting basic healthcare needs.

The second year of study focuses on competences required to meet healthcare needs of clients attending Primary Healthcare (PHC) services. Standardized patients are primarily used as PHC services focus on assessment and treatment of individual patients with common complaints. Students are exposed to complicated conditions in their third year and therefore high-fidelity simulators are mainly used to mimic complex physiological responses. In the fourth year, students study psychiatry and midwifery and a combination of simulation modalities are used. Psychiatry only uses standardized patients (SPs) for immersive simulation, as is suggested by Gaba (2007:i4) that SPs can be useful for addressing skills like communication, ethics and end of life care, which are non-technical skills. Patient centred care (Uys & Treadwell, 2014:2), therapeutic communication and patient assessment, which forms a vital component of psychiatric nursing, support the use of SPs above the traditional classroom instruction (Becker, Rose, Berg, Park, & Shatzer, 2006:109).

2.3.3.2 Level

The undergraduate students who partook in the research project are all in their third academic year of studies within the four year Baccalaureus of nursing science course. The students are expected to study in an independent manner in their third year, with the assistance and guidance of a facilitator. Themes included in the first semester of the third year program are peri-operative nursing, and certain conditions of the cardiac, respiratory, and gastro-intestinal systems, as well as burn wounds. After completing the content and task training of each theme, all the students are put through a simulation experience. The level of the simulation session needs to be aligned with the level the students have been equipped to perform at, otherwise they may feel discouraged or bored (Christensen et al., 2011).

Students are exposed to immersive simulation from their first year. The complexity of the simulated scenarios increases each year and is aligned with the level and foundational knowledge required and acquired. The simulation scenario needs to be aligned with the level of the students so that the simulation objectives can be reached (Madison, 2015:IV) and the facilitators who planned the scenario have to determine whether the students performed the intended learning outcomes (Kim & Min, 2013:75).

During the planning of the simulation scenario, the difficulty level needs to be aligned with the student's learning level as well as the desired outcomes (Motola et al., 2013:e1520).

2.3.3.3 Age

Although student demographic factors, like tolerance of ambiguity, age, and grade point average were found to be insignificantly related to the demonstration of patient safety competencies, it was suggested that nurse facilitators need to be aware of student factors that may influence the attainment of competencies (Ironside, Jeffries, & Martin, 2009:336). Age is one of the attributes that are innate to the participants of simulation, as well as gender, level of anxiety, and self-confidence (Jeffries et al., 2015:292). Most third year students who participated in this research study started studying nursing immediately after completing high school. All of the students attended the same theoretical classes, but may not have had similar clinical experiences at the stage when the research was conducted. Their different ethnic backgrounds are discussed in chapter four with the data analysis.

2.3.4 Design Characteristics

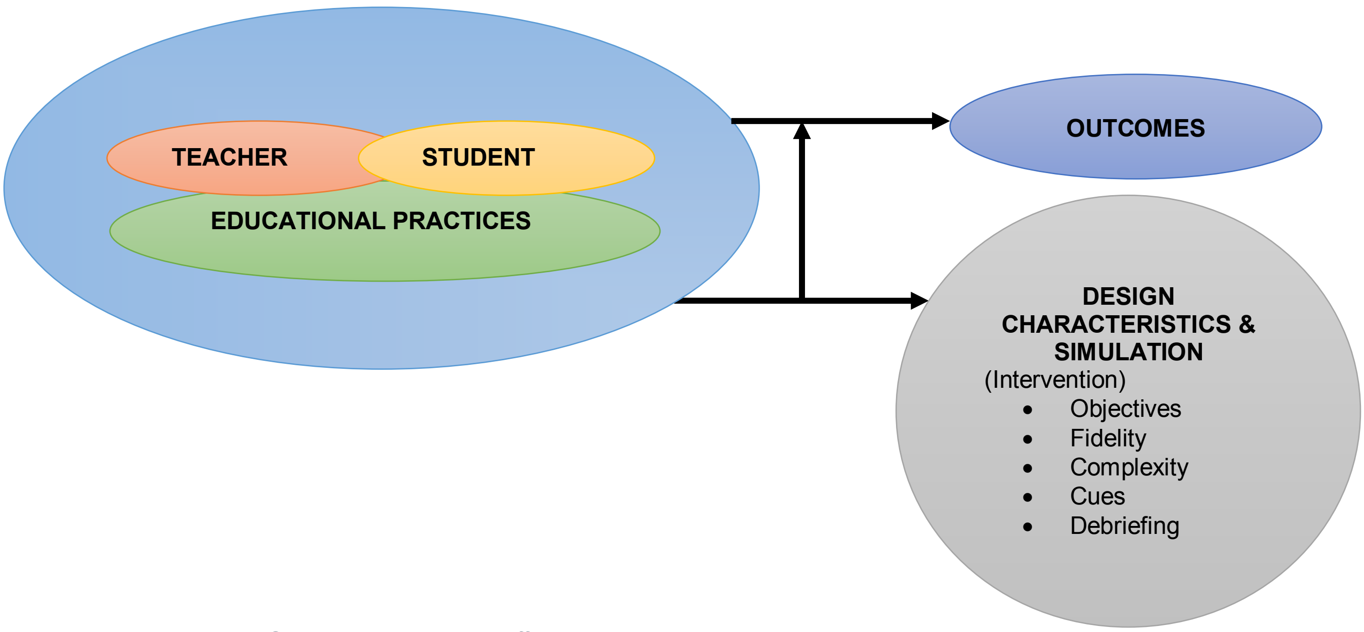

Figure 2 5 Simulation Model by Jeffries (2005:97)

The five design characteristics described in Jeffries' simulation framework are objectives, fidelity, complexity, cues (support) and debriefing, which will all be discussed. The design characteristics offer the core elements for the design, implementation and evaluation of simulation-based education (Groom et al., 2014:343; Paige & Morin, 2015b:12). Facilitators use and apply the simulation design characteristics to construct simulation scenarios, but research is needed about how students view the creations produced by facilitators (Paige & Morin, 2015a:250). Students have better learning outcomes when they have a positive perception of the simulation design characteristics (Ahn & Kim, 2015b:706).

The design of the simulation scenario need to be appropriate to support the course goals, skill competencies and learning outcomes, and should be on the level of the learner and on the level of expected patient care (Jeffries, 2005:97). The use of a template ensures that all five domains are appropriately addressed (Smith & Roehrs, 2009:77). During the beginning of the design phase, the learning outcomes are used as a starting point, followed by related assessment tasks and learning opportunities (Botma et al., 2014:20). This design process is described by Fink (2005:14-16) and Botma et al., (2014:19) as a "design down and deliver up" sequence, and is described in more detail under the objectives below.

2.3.4.1 Objectives

Objectives support the outcomes of simulation-based learning experiences (Groom et al., 2014:339; Reese et al., 2010:34). Objectives should be clear, concise, and realistic, in line with the institutional mission and educational framework, facilitating the development of clinical reasoning and promoting high quality and safe patient care (Paige & Morin, 2015a:257). Facilitators need to ensure objectives promote student knowledge, including skill performance and effective mastery, which then increases self-confidence (Lioce et al., 2013:S17).

Outcomes are broken down into objectives, which provide assessment goals, promote learning, and support the development of clinical judgment and reasoning (Jeffries, 2005:100; Lioce, Reed, Lemon, King, Martinez, Franklin, Boese, Decker, Sando, Gloe, Meakim & Borum, 2013:S16). Students need to be aware of the objectives to optimize their learning (Ahn & Kim, 2015b:707). Clear, concise and realistic objectives enhance learning and allow students to achieve high levels of learning, for example critical thinking and clinical judgment (Lioce et al., 2013:S16; Groom et al., 2014:339). Clearly defined objectives need to meet the criteria below to allow students to reach the expected learning outcomes in the set timeframe (Lioce et al., 2013:S17). According to Lioce and colleagues, objectives should comply with six criteria to achieve the desired outcomes (2013:s16), namely:

1. Address the domains of learning.
2. Correspond to the participant's knowledge level and experience.
3. Remain congruent with overall program outcomes.
4. Incorporate evidence-based practice.
5. Include viewing of client holistically.
6. Be achievable within an appropriate timeframe.

Objectives should be aligned with learning outcomes. The best place to start planning and designing a learning opportunity is with formulating well-defined learning outcomes, followed by the related assessment tasks and learning opportunities (Botma et al., 2014:20). A strong correlation between the simulation design and learning outcomes showed that students' self-confidence improved after they had time to practice problem-solving tasks (Ahn & Kim, 2015b:711). Learning outcomes are broken down into "SMART" objectives (Wolf & Akkaraju, 2014:35). SMART objectives are Specific, Measureable, Achievable, Relevant, and Time-Bound. When considering what we can do as instructors to facilitate learning, we need to look at the elements which we can plan and manipulate to facilitate learning. The design process, as described by Fink (2005:14-16) and Botma et al., (2014:19) demonstrates a "design down and deliver up" sequence, as seen in **Figure 2.3**.

An interrelationship exists between the design components, namely the situational factors, learning outcomes, feedback and assessment strategies, and teaching and learning activities (Botma et al., 2014:19). If any two of the components are not aligned, another component is automatically not aligned. Situational factors include the teaching and learning philosophy of the institution, the guidelines provided by the professional board and the disease profile of the country (Pascoe & Singh, 2008:92). Teacher and student factors are discussed above under sections 2.3.2 and 2.3.3. Guidelines provided by the South African Qualifications Authority (SAQA), guide learning institutions towards the level of content that need to be included in different qualifications. The country's disease profile is reviewed periodically and nursing education outcomes adapted in order to address the changed healthcare needs of the country.

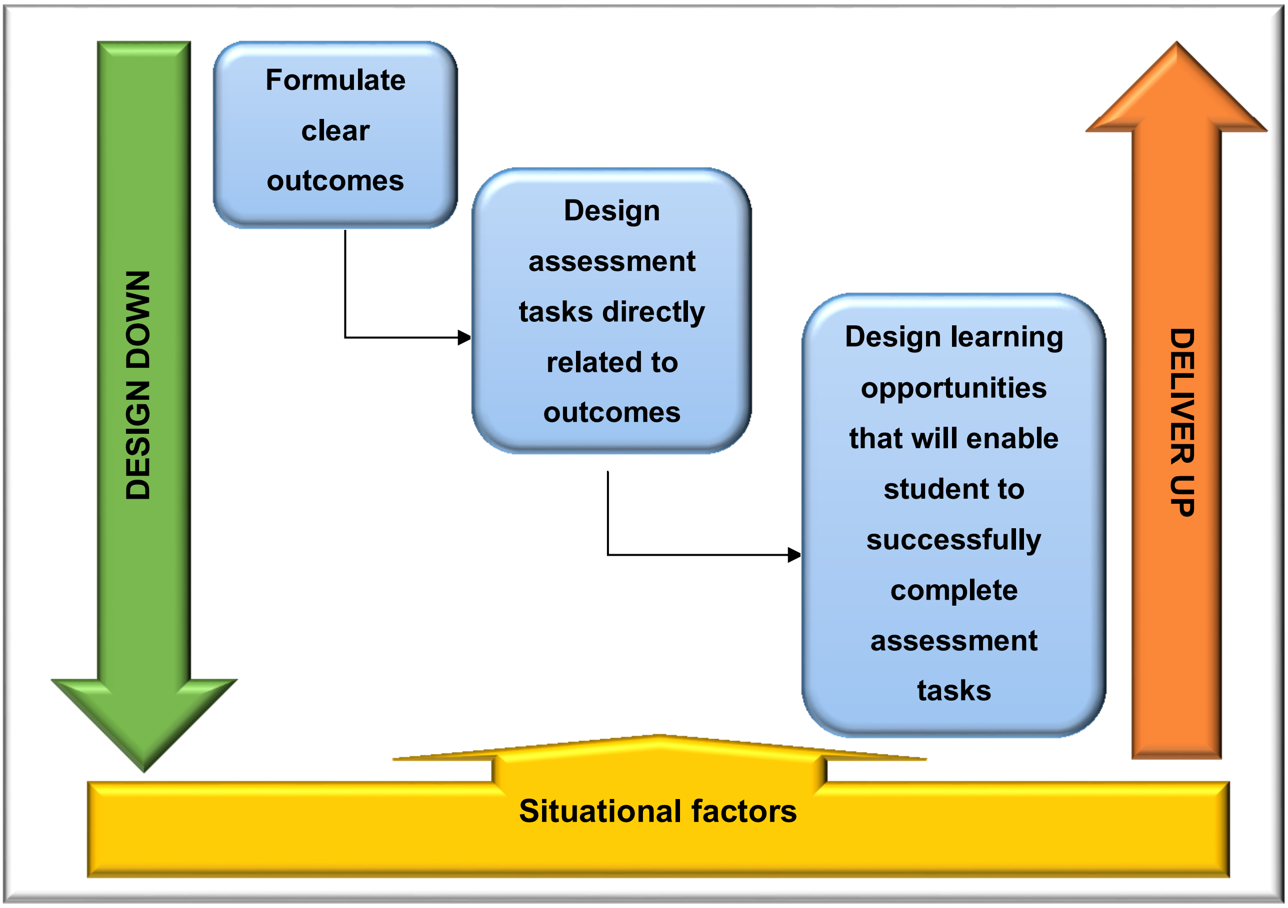

Figure 2 6 Design process to enhance constructive alignment within an instructional design (Fink, 2005:14-16). Adapted by Botha.

A few similarities are found when comparing elements of instructional design with the simulation framework as seen in Figure 2.1. Outcomes are seen as an important building block to work from within the instructional design process, where assessment and learning opportunities are derived from the outcomes, completing the process. Within the simulation framework, outcomes are seen as an essential part of the designing and planning stages of a simulation scenario. In both practices, focus is put on the outcomes during the first and final steps during the designing phase.

According to Biggs (2003:13), constructive alignment is a design for teaching aimed to encourage deep engagement. Two elements combine to form constructive alignment, namely constructivism and alignment. Constructivism is based on the meaning making of an experience by the students themselves (Biggs, Medland, & Vardi, 2003:1). Alignment of planned learning activities means that the teaching and learning activities enable the students to complete the assessment tasks.

Furthermore, the assessment task should confirm if the student has achieved the outcome(s) (Biggs, 1996:93; Botma et al., 2014:18; Kim & Min, 2013:73; Pascoe & Singh, 2008:93).

Constructive alignment is when learning outcomes, learning activities and assessments match each other, allowing students to practice and verify what they have learned. See the inter-relationship between these three aspects in Figure 2.7 below. Learners need to construct what they do to learn in a specific context and the facilitator aligns the curriculum with the planned learning activities and outcomes (Kim & Min, 2013:73)

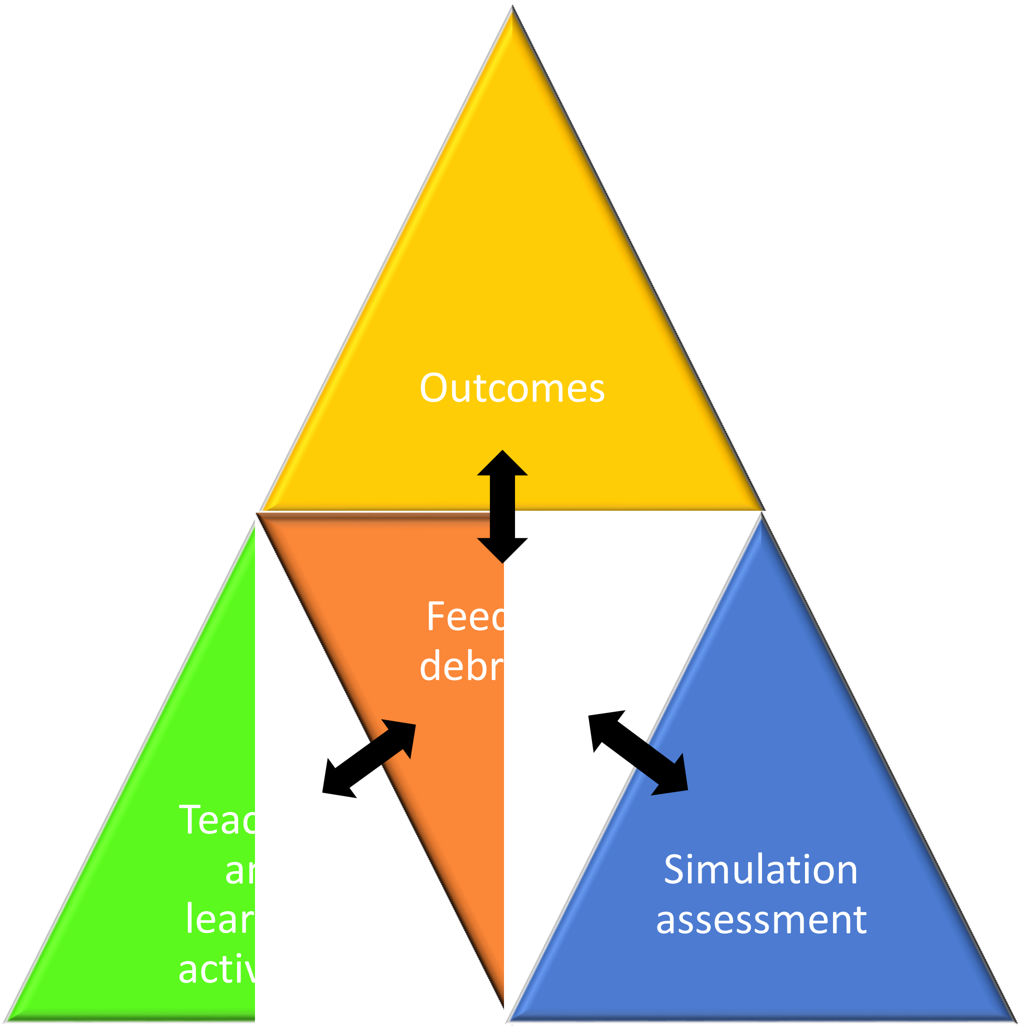

Figure 2 7 Alignment of simulation aspects

In order to align simulation experiences with the curriculum content the researcher is of the opinion that

a) The outcome and subsequent objectives should be specific, measureable, achievable within the time frame, and relevant to clinical practice and theory
b) The preceding teaching and learning activities should have prepared the student for the simulation outcome
c) The simulation should be structured in such a way that well-prepared students will achieve the outcome.

Facilitators can see simulation as a formative assessment opportunity, which includes feedback (debriefing) to assist students in achieving the learning objectives (Sando, Coggins, Meakim, Franklin, Gloe, Boese, Decker, Loice & Borum, 2013:S30; Sittner et al., 2015:296). During the debriefing of the students immediately after a simulation experience, the facilitator focuses on the students' emotional (affective) experience, the student's performance with relation to the psychomotor skills, cognitive skills, as well as affective skills demonstrated in accordance with the learning objectives. The facilitator may ask prompting questions to assist in the discovery of new knowledge. It is therefore crucial that the simulation design and learning outcomes are aligned (Ahn & Kim, 2015:711). Constructive alignment of teaching and learning activities, simulation scenario and simulation outcome enables the students to meet the outcomes and competencies set out per simulation session.

Simulation exercises should not be viewed as independent learning experiences, but should be integrated into a curriculum, matching learning objectives. Thereby an evidence-based simulation curriculum is developed, engaging students and lecturers across the academic program (Oermann, 2015:66).

2.3.4.2 Fidelity

Fidelity, also known as realism or authenticity (Meakim et al., 2013:S6), is a multidimensional concept forming a matrix which divides into three major dimensions, namely physical, psychological and conceptual (Paige & Morin, 2013:481). Table 2.3 shows that each dimension has levels of application that range from low to medium to high fidelity (Paige & Morin, 2013:485). Fidelity mimics clinical reality.

Table 2 3 Fidelity matrix (Paige & Morin, 2013:485)

Dimensions	Levels of application		
	Low	Medium	High
Physical: **Equipment & Environmental**			
Psychological: **Task & Functional**			
Conceptual:			

2.3.4.2.1 Physical equipment and environment

The physical dimension includes equipment and environmental features. Equipment can be characterized by the level of technology of the manikin that provides a tangible reality to students. Simulators are described as high, moderate or medium, and low fidelity in relation to the technology and technical features (Groom et al., 2014:339). The simulator fidelity should match the objectives of the simulation (Jeffries, 2007:28), making it as close to real life as possible (Przybyl & Evans, 2015:141). A study by Levett-Jones and colleagues (2011a:380) indicated that student knowledge acquisition scores were not influenced by manikin fidelity. An example of low physical dimension fidelity is partial task trainers or static manikins, used to practice simple techniques and procedures. High physical and environmental attributes include computerized full-body manikins which can respond in a realistic physiologic manner to the student's actions and the environment (Decker et al., 2008:75).

Nurse facilitators can use moulage in simulation to increase the realism and fidelity for the students (Oermann, 2015:84; Jeffries et al., 2015:292). Moulage includes the use of makeup, dress, wigs, false wounds, indwelling lines and catheters, and adding appropriate smells, for example, with burn wounds. Students experience the simulation session where appropriate moulage was used as more realistic and authentic, creating holistic learning (Oermann, 2015:84). Environmental aspects add to the reality of the simulation session by the appearance and layout of the setting in the form of visuals, smells, lighting and other props that represent the clinical setting.

2.3.4.2.2 Psychological dimension of fidelity

The psychological dimension comprises the student's engagement in and experience with the simulation, including task and functional aspects. Task attribute reflects the extent to which students must perform tasks to address the healthcare needs. Functional attributes reflect the extent to which the simulation facilitator or simulator reacts to the actions of the students in a realistic manner. Learner engagement levels rise when each of these attributes are optimal. The psychological dimension stimulates the students' emotions, values, beliefs, self-awareness and motivation (Dieckmann et al., 2007:185; Rudolph, Simon, Dufresne, & Raemer, 2006:54). By adding a family member in the scenario, or other simulated responses like talking, screaming, moans, and other expressions, the psychological dimension is enhanced.

2.3.4.2.3 Conceptual dimension of fidelity

The conceptual dimension of fidelity was firstly seen as the semantic mode of thinking by Uwe and Laucken, but later reworded as conceptual by Rudolph and friends (2006:49), and Dieckmann et al. (2007:185). For example, high conceptual fidelity is created when a patient simulator displays a drop in blood pressure and a reduction in pulse strength, to represent a patient in a state of shock. If the information offered to the student is interpretable as representing the concept of a shocked state, the simulation activity has high conceptual fidelity. Noticing deviations from normal and interpreting the observation is central to learning (Paige & Morin, 2013). High conceptual fidelity is created when the student has to notice the cue, relate it to declarative knowledge, interpret the significance thereof in the current situation and act appropriately to resolve the situation. Student learning and development of clinical judgment is only possible when the simulation scenario is planned and run to mimic all the dimensions of fidelity to create a truly realistic scenario.

2.3.4.3 Complexity

Complexity, or the level of difficulty of a simulation session, is also seen as problem solving within a scenario (Jeffries, 2007:28 ; Groom et al., 2014:340). According to Jeffries (2005:101), simulations range from simple to complex, with simple simulations involving decision environments containing low-level uncertainty, constructed with high or low levels of related information. Within simple simulations the information is easily available to students and their decision variables are highly predictable and stable. Complex decision environments have high levels of uncertainty although it is constructed with high or low levels of relevant information. The complexity can be influenced by the number of problems the patient has, the relationship of the problems to one another, and the clinical information that is available to the students (Jeffries, 2005:101).

The level of complexity of a simulation scenario needs to be based on the cognitive and behavioural level of the students, as well as course objectives (Salas & Burke, 2002:120; Wilson, Shepherd, Kelly, & Pitzner, 2005:56) because students will benefit more from mistakes they made during simulations that are appropriate to their level. Exposing students to simulations that are too complex, may lead to anxiety because they are unable to learn from the scenario and leave the students feeling uncertain and inadequate (Lanzara, 2014:113). Benner's theory, from novice to expert, has been linked to the levels of complexity (Bambini, Washburn, & Perkins, 2009:82; Larew et al., 2006:16).

Patient simulators have not been assigned to specific standardized levels to quantify complexity (Groom et al., 2014:340). Even though high-fidelity human patient simulators have significantly increased in authenticity, the human responses still have greater complexity and multiplicity (Dunnington, 2014:14). Humans are less predictable and sequential than current technology, and have psychological, emotional and spiritual domains, influencing their responses. Life is spontaneous, superior and provisional, which is currently unaccounted for within human simulator technology (Dunnington, 2014:20; Khalili, 2015:35).

2.3.4.4 Cues/Support

Cues have been defined as story/object relationships in a person's memory that allows rapid assessment of a situation and the formulation of a response (Wiggins, 2014:284; McCormack, Wiggins, Loveday, & Festa, 2014:1). Cues can be in the form of tactile, visual, auditory, and/or olfactory information, as well as in the form of clinical notes and diagnostic test results, patient responses or lack of response, statements from patients or others, or equipment available in the room and many more (Franklin et al., 2013:S21; Paige & Morin, 2013:e481). The purpose of cues is to assist students in their assessment and problem solving during a simulation scenario (Groom et al., 2014:340; Larew et al., 2006:17; Oermann, 2015:109), helping students to execute actions at the appropriate time (Grundgeiger, Sanderson, Beltran Orihuela, Thompson, Macdougall, nunnink, & Venkatesh, 2013:579). The context of a situation is represented by clinical data that trigger an individual's cognition and subject matter (Banning, 2008:181). In the researcher's opinion, cues are vital sensory stimulation components that enable students to notice, retrieve information, interpret and solve problems.

Paige and Morin (2013:481) listed two types of cues. Firstly conceptual cues which help the students to achieve the instructional objectives, and secondly reality cues which help the students to clarify any gaps in the fidelity of the simulation session (Adamson, 2015:284). According to Tanner's clinical judgment model (Tanner, 2006:208), students first notice, based on their expectation of a situation, which is made up of context, background and relationship. Only when students have noticed entirely all the necessary information can they interpret and respond appropriately. Within a simulation scenario, it is therefore vital that the necessary cues and support are in place to help the students to notice all the necessary information. Students interpret the information by using their declarative knowledge through the application of critical thinking in order to plan their actions (Burke & Mancuso, 2012:546), and demonstrate their best performance or act on deteriorating patients (Oermann, 2015:88; Endacott, Scholes, Cooper, Kinsman, & McConnell-Henry, 2010:2722). After students interpreted the cues within a simulation scenario and responded, they reflect-in-action according to how the patient responded to their actions (Tanner, 2006:208). Grundgeiger and partners (2013:587) suggest that visual cues can help nurses to remember a wide range of future care tasks, and suggest facilitators use different methods of providing cues to help participants notice the right moment to execute the appropriate action. Facilitators should also encourage students to create their personal cue strategies.

Cues prevent students from becoming stuck during the scenario (Swanson et al., 2011:83) but should not distract the participant from achieving the expected outcome (Franklin et al., 2013:S21). Providing information about the student's next step, or making a suggestion of an appropriate clinical judgment during the simulation session, helps the student progress through the activity. Some students prefer to solve problems by themselves with little to no assistance, whereas other students depend on facilitators for support and guidance with their thinking process (Paige & Morin, 2015a:258). Another purpose of cues is to provide students with the necessary orientation prior to a simulation session, because it prepares the students for the scenario, telling them what to expect (Halaas, Zink, Brooks, & Miller, 2007:2; Leighton, 2009:60). When students are orientated prior to a simulated learning experience, they show improved clinical performance (Harris, 2011:464).

With the initial designing of the simulation model by Jeffries in 2005, the concept “cues” was used (Jeffries, 2005:97), but was replaced in 2007 by the term “student support” during a review of the model (Jeffries, 2007:23).

In this study, students received support by means of the following actions:

- A Preceptor was present in the room with the students with their first high-fidelity simulation experience.
- From the second high-fidelity experience onward, the students have the option to call a “Time-out” session during the simulation scenario. Then a preceptor will enter the room to offer support in the role of a registered nurse, responding to their question or need appropriately. For example, to lock out a scheduled drug from the drug cupboard or providing assistance with a piece of equipment the students may be struggling with.
- The patient’s history would be available to the students inside the patient file, usually in the form of an Emergency room report, a report from the ambulance staff, or clinical records in the form of an admission sheet.
- Students were briefed prior to entering the simulation room, as well as inside the room. This includes a brief orientation as to the available documents for the specific scenario, equipment available in the room, as well as an introduction to and hand over of the patient.
- Laboratory results were available in the patient file.
- Appropriate moulage confirms the condition of the patient, for example the amount and type of burn wounds applied to the manikin, with singed nostrils and the smell of burnt hair in the room.
- The students received a debriefing session immediately following the simulation scenario.

2.3.4.5 Debriefing

Effective debriefing is essential to allow maximum student learning within simulation as a teaching and learning strategy. The competence of the debriefing facilitator determines the quality and quantity of learning that occurs. It is therefore essential that a trained and skilled facilitator lead the debriefing sessions (Decker et al., 2013:S27). Everyone who participated in the simulation scenario should participate actively during the debriefing session. Debriefing is seen as the most important feature of simulation-based learning (Issenberg et al., 2005:10; Decker et al., 2013:S27; Gardner, 2013:166; Levett-jones & Lapkin, 2014:58).

Students apply retrospective "Think Aloud" as a form of reflection-on-action to develop a comprehensive clinical judgment formation (Burbach, Barnason, & Thompson, 2015:6; Tanner, 2006:209). During the debriefing session, students can be given the opportunity to watch the recorded simulation scenario. Structured reflective review of the video material enhances the students' perspectives on the importance of cues as well as the nature of their decision-making (Endacott et al., 2010:2724). Students use different processes to identify cues, and it was found that four aspects of cue recognition were evident, namely: initial response, differential recognition of cues, accumulation of signs, and diversionary activity (Endacott et al., 2010:2725). Video reviews allow students a detailed investigation of cues recognized and acted on at different stages during simulated scenarios. Missed cues should be highlighted and explored (Endacott et al., 2010:2729).

2.3.4.5.1 Definition of debriefing

Debriefing is a discussion between the facilitator and the students, using reflection as an essential component (Dreifuerst, 2009:109; Shinnick, Woo, Horwich, & Steadman, 2011:e109). In other words, debriefing is reflection on action. In simulation-based education, debriefing is critical to learning (Fey & Jenkins, 2015:364), providing a platform for students to reflect on their simulation experience, ask questions in a safe environment (Kelly et al., 2016:313), as well as learn from their mistakes (Dufrene & Young, 2014:375).

Debriefing happens immediately at the end of a simulation session, before the students' feelings and thoughts are forgotten (Groom et al., 2014:341). It is recommended that debriefing occurs in a separate location from where the scenario happened (Jeffries, 2005:101; Jeffries, 2007:29) so that the focus of action can move to a focus of reflection (Arthur et al., 2013:1360).

Debriefing historically takes at least twice as long as the simulation scenario (Oermann, 2015:90). The average time it took for the researched high-fidelity simulation session was 20 minutes, and the average debriefing time was between 30 and 50 minutes. Because simulation debriefing requires a large amount of time, Dufrene and Young suggests that alternate methods of debriefing should be explored (2014:376). Student participation during debriefing varies due to the level of the students' comfort with their knowledge and the time a student needs to process information (Paige & Morin, 2015a:258).

2.3.4.5.2 Roles and responsibilities of the facilitator during debriefing

The successful debriefing facilitator must understand the debriefing process (Gardner, 2013:171), be able to guide the students to create new knowledge by means of reflective thinking (Fey et al., 2014:e254), and be competent in the debriefing process, and provide constructive formative feedback (Decker et al., 2013:27; Jeffries, 2005:98; Neill & Wotton, 2011:162). The effective facilitator maintains a genuine curiosity and respect for all the participants and is curious about the students' reasoning and concerns, engaging all participants, and encouraging them to speak up and ask questions. There needs to be a good balance between the facilitator talking, asking questions, allowing silence and letting the students talk (Gardner, 2013:171). Students need to feel supported, valued, respected and free to learn within the safe environment during the simulation and debriefing, (Fanning & Gaba, 2007:116; Fey et al., 2014:e254). Decker and colleagues identified five specific criteria that facilitators should adhere to while leading students to new interpretations by means of reflective thinking (Decker et al., 2013:S27). These five criteria include:

- Achieve competency in debriefing;
- Create a safe environment for students during debriefing;
- Identify the responsibilities of the facilitator during debriefing;
- Identify the structural elements of debriefing to provide optimal time required to achieve objectives; and
- Focus debriefing on the participant objectives and outcomes.

A study by Fey and Jenkins found (2015:361) that most facilitators have not been assessed in their ability to debrief students, nor have they been trained in debriefing. In order to be successful in debriefing, the facilitator needs to carefully plan a session, prepare the students for the simulation and debriefing process, and actively develop, refine and maintain debriefing skills through reflective analysis of the challenges involved in debriefing (Ahmed, Sevdalis, Paige, Paragi-Gururaja, Nestel & Arora, 2012:523; Dufrene & Young, 2014). All facilitators conducting debriefing sessions need to have some facilitation and debriefing training as well as ongoing assessment of competence (Fey, Scrandis, Daniels, & Haut, 2014:e254).

2.3.4.5.3 Value of debriefing

Significant learning happens when deep insight is gained through reflection, using elements like critique, correction, evaluation of performance and discussion of the experience. The student's learning not only depends on his or her ability to engage in reflection during the debriefing, but also in a structured session with the opportunity to develop critical thinking, clinical decision making, clinical reasoning and clinical judgment skills (Dreifuerst, 2009:109-113; Mariani et al., 2013:148). Debriefing holds many benefits for students because students:

- develop self-efficiency and responsibility for their behaviour (Burke & Mancuso, 2012:543).
- learn the most and gain an in-depth understanding of the experience which leads to the retaining of knowledge (Levett-jones & Lapkin, 2014:e63; Wilkinson, Couldry, Phillips, & Buck, 2013:29; Groom et al., 2014:341; Wickers, 2010:83; Burke & Mancuso, 2012:547; Shinnick et al., 2011:110).
- develop self-regulation for their future practice and develop life-long learning practices (Ahmed et al., 2012:525; Burke & Mancuso, 2012:548).
- learn to process their feelings and reactions (Mariani et al., 2013:e147).
- review their knowledge and technical skills and identify their learning needs (Mariani et al., 2013:e147).
- develop self-confidence, enhance learning and supports the transfer of knowledge, skills and attitudes which promote best practices and safe, quality patient care (Decker et al., 2013:S27).

- gain emotional readiness for clinical setting (Gardner, 2013:168; Oermann, 2015:90).
- develop reasoning skills (Decker et al., 2013:S27).

2.3.4.5.4 The debriefing process

During debriefing, the facilitator helps the participants to explore their experience and thoughts related to their decisions during the simulation session, assisting them to reason about their actions, and thereby promoting reflective thinking (Decker et al., 2013:S27). The facilitator leads the participants to identify their positive actions, their actions that could be changed to improve patient outcomes, actions that met the learning objectives and also which learning objectives were not met (Oermann, 2015:90). The students judge their own performance according to the overall performance of the group, the feedback from group members, and the scenario outcomes (Burke & Mancuso, 2012:547; Rauen, 2001:99; Jeffries, 2005:101; Jeffries, 2007:29).)

During the debriefing, the students can identify the cues that directed their clinical decisions, articulate the rationale for their actions, evaluate how the patient-centred care affected their priorities of nursing actions, identify their mistakes, and discuss how to correct their actions (Burke & Mancuso, 2012:547; Lasater, 2007:502).

Students and lecturers use the reflective learning process to re-examine the simulation encounter, fostering the development of clinical reasoning and judgment skills. Different models for debriefing have been developed which lecturers and facilitators can choose from to use during their debriefing sessions.

Dreifuerst (2010:8) advocates structured debriefing because it stimulates higher-order judgment and reasoning, and accomplishes meaningful learning through clinical reasoning. The structured debriefing strategy called Debriefing for Meaningful Learning (DML) positively influenced the development of clinical reasoning skills in undergraduate students (Dreifuerst, 2010:8; Mariani et al., 2013:148; Forneris, Neal, Tiffany, Kuehn, Meyer, Blazovich, Holland, & Smerillo, 2015:308). DML has six components, namely engage, evaluate, explore, explain, elaborate and extend, which give structure to the debriefing process. Students can use the reflection-in-action, reflection-on-action and reflection-beyond-action comfortably to understand clinical reasoning and thinking like a nurse (Mariani et al., 2013:148).

2.3.5 Outcomes

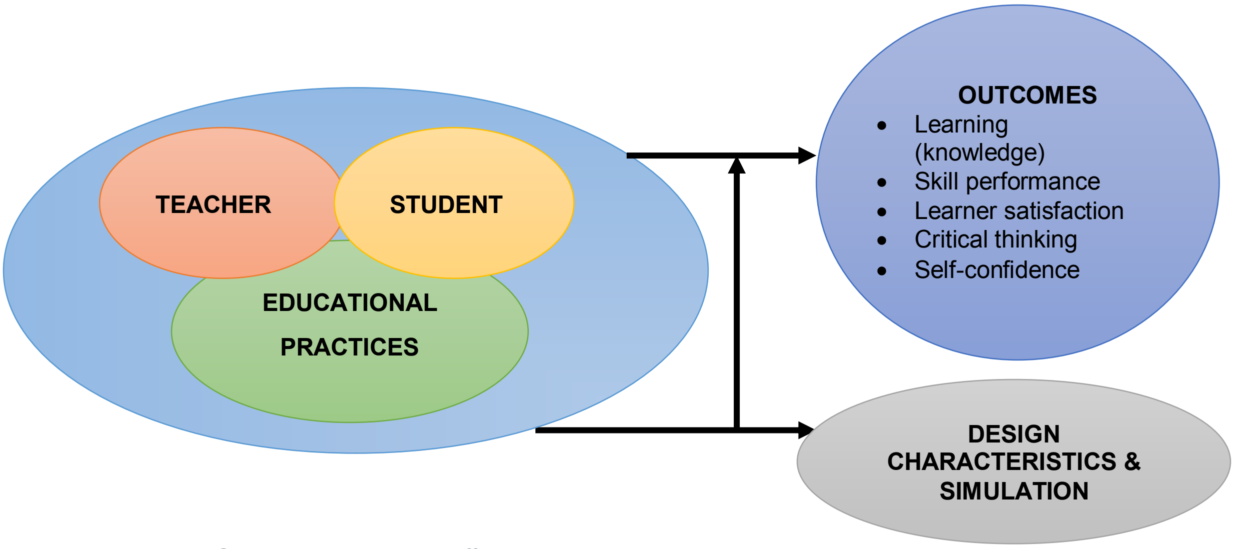

Figure 2 8 Simulation model by Jeffries (2005:97)

Various authors on educational practices are in agreement that planning of a learning activity starts with determining the goal or outcomes (Ahn & Kim, 2015a:707; Decker, Anderson, Boese, Epps, McCarthy, Motola, Palaganas, Perry, Puga & Scolaro, 2015:294; Jeffries, 2005:98; Jeffries, 2007:25; Paige & Morin, 2015b:15). Therefore Finks' "Design down and implement up" model is relevant (Botma et al., 2014:19). Simulation education gives students the opportunity to become competent and improve their performance by learning to notice, relate what they see to current knowledge, apply clinical reasoning and develop clinical judgment.

Within the simulation model, module and simulation activity outcomes are associated with undergraduate and graduate nursing knowledge, skill performance, learner satisfaction, critical thinking and self-confidence (Jeffries, 2005:97; Swanson et al., 2011:e83). According to the model all the preceding factors influence the outcome of the simulation experience (Swanson et al., 2011:e82). Simulation and student outcomes are influenced by the diversity of nurse facilitators, students and educational practices (Foronda, Alhusen, Budhathoki, Lanb, Tinsley, Macwilliams, Daniels, Babtiste, Reese, & Bauman, 2015:384).

Outcomes are separated into three areas, namely the participant, patient, and system outcomes (Jeffries et al., 2015:293). Literature has mostly focused on the following three participant outcomes:

- Reaction (including satisfaction and self-confidence)
- Learning (cognitive, psychomotor and affective skills)
- Behaviour (learning transfer to the clinical setting)

Evolving literature exists that covers the outcomes of patients or care recipients and system outcomes of simulation (Jeffries et al., 2015:293). The outcomes will be discussed according to the focus in literature instead of how the Jeffries model lists it.

2.3.5.1 Reaction

Students' reactions to simulation training has been measured by means of student satisfaction and self-confidence in various studies (Franklin, Burns, & Lee, 2014:1298; Levett-Jones, McCoy, et al., 2011:705; Valizadeh et al., 2013:157).

2.3.5.1.1 Student Satisfaction

Students experience satisfaction when they feel an educational activity provided a relevant good learning experience. Overall, students are very satisfied with simulation as a learning experience, feeling they could "think on their feet" and "apply critical thinking skills" (Jeffries, 2005:102). Student satisfaction increased significantly when integrated simulation training is used in comparison with other instructional techniques (Raines, 2011:28; Lapkin et al., 2010:e221; Tiffen, Graf, & Corbridge, 2009:e116).

Learning outcomes and learner satisfaction are found to be dependent upon support from the lecturers as well as feedback during the simulation session (Raines, 2011:36). Clear objectives and student support are two of the design elements that were found to significantly contribute to and predict the level of student satisfaction and confidence (Adamson, 2015:285; Raines, 2011:77-81; Smith & Roehrs, 2009:77). The opportunity to practice and make mistakes in a safe environment (Przybyl & Evans, 2015:146) and small student groups with allocated roles promotes student confidence and satisfaction (Thidemann & Söderhamn, 2013:1603). Satisfaction and confidence are considered to be interdependent within a conceptual and statistical simulation research framework (Franklin et al., 2014:1303). However, the effectiveness of simulation cannot only be measured by research documenting outcomes such as skill performance, student satisfaction, critical thinking or self-confidence (Adamson, 2015:288). Reaction research such as satisfaction and confidence measures low-level evaluation metrics within simulation research (Adamson, 2015:282). Still, high-fidelity simulation education is found to be more effective than for example a paper-and-pencil case study, promoting self-confidence and satisfaction (Adamson, 2015:282; Jeffries & Rizzolo, 2006:10).

Various measurement tools have been used in nursing simulation studies to determine the effect of simulation learning on self-confidence. One example is an eight-item Self-Confidence in Learning Using Simulation Scale tool which measured self-reported levels of confidence in students (Lapkin et al., 2010:e215). The scale ranged from 1 (completely lacking in confidence) to 4 (very confident). Another C-scale self-report tool for measuring self-confidence during performance of psychomotor skills was developed by Ms. Susan Erin Grundy in 1993, using five statements on a five-point scale (1: procedure without confidence, 5: procedure with full confidence) (Valizadeh et al., 2013:159). In addition to these two tools, The National League of Nursing developed questionnaires based on the simulation model of Jeffries in 2005, namely the Simulation Design Scale (SDS) and the Student Satisfaction and Self-Confidence in Learning Scale (SCLS) (Zhu & Wu, 2016:129). The SDS and SCLS questionnaires are both Likert-style scales with the satisfaction subscale reported with a Cronbach's alpha of .94 and .87 for the self-confidence subscale (Franklin et al., 2014:1299). Omer (2016:132) used a combination of the NLN Students Satisfaction and Self-Confidence assessment tools with a clinical teaching subscale section of a multidimensional instrument developed by Dennison and El-Masri. In most studies, pretests and posttests are used to evaluate self-confidence as a learning outcome, with 5-point scales ranging from 1 (not confident) to 5 (very confident) (Jeffries & Rizzolo, 2006:5; O'Donnell, Decker, Howard, Levett-Jones, & Miller, 2016:379; Smith & Roehrs, 2009:76). Nursing students who experienced a variety of interactive and immersive educational approaches reported perceived increased self-confidence and self-efficacy levels (O'Donnell et al., 2016:379) thus motivating the continued use of questionnaires to measure these reactions for quality assessment and program evaluation purposes.

2.3.5.1.2 Self-confidence

Self-confidence is the belief in oneself and your own abilities (Meakim et al., 2013:S5). Studies have shown that simulation education improves self-confidence (Franklin et al., 2014:1298; Jeffries, 2005:102; Valizadeh et al., 2013:157-163). An increase in self-confidence was reported by nurses after they experienced simulation, providing them with confidence in caring for patients in the clinical setting (Fong, 2013:152). As with student satisfaction, self-confidence are measured by Student Satisfaction and Self-Confidence in Learning Scale (SCLS) (Zhu & Wu, 2016:129; Smith & Roehrs, 2009:76).

Nursing students' satisfaction and self-confidence significantly relates to their perception of the design factors of a simulation scenario (Smith & Roehrs, 2009:78); therefore nurse facilitators need to carefully design any high-fidelity simulation scenario (Smith & Roehrs, 2009:77). Self-confidence can improve after performing problem-solving tasks based on learning objectives, creating a positive relation between the simulation design and learning outcomes (Ahn & Kim, 2015b:711; Jeffries et al., 2008:321).

2.3.5.2 Learning

Simulation as a learning experience supports constructivism as a learning theory as well as Kolb's experiential learning theory. The constructivist theory will first be explained and linked to simulation. Thereafter the association of simulation and Kolb's theory will be described.

Constructivism is an active learner enabler, a process of discovery (Meakim et al., 2013:S5), which is based on individuals who construct new knowledge while interacting with their environment by means of a discovery process which is personally relevant (Biggs, 1996:347; Meakim et al., 2013:S5; Oermann, 2015:72). Constructivism principles of learning challenge students to work together in a team and become self-directed, lifelong learners (Oermann, 2015:72), enhancing higher-order thinking and critical problem solving skills (Botma, 2014:2).

Botma and partners (2013:3) summarized four principles of Constructivism:

- Learners construct their own knowledge while actively taking part in the learning process;

- Cognition is an adaptive process;
- Making sense is a subjective process which does not mean it's a true representation of reality; and
- Social, cultural, language and biological/neurological processes influence knowing (Yilmaz, 2008:165).

Constructivism as learning theory underpins simulation, because simulation scenarios are structured so that students can actively get involved through manipulation of materials and social interactions, influencing cognition (Kuiper et al., 2008:2). This approach addresses Jeffries' first aspect of educational practice within active learning. Through simulation, students experience new learning opportunities which they need to make meaning of. It is only through the combination of the student's interaction during the high-fidelity simulation and debriefing that the aims of constructivism are met (Neill & Wotton, 2011:e162).

With the help of the facilitator during the debriefing session, students can internalize the new information, with the end result of new meaningful knowledge, which is the essence of the constructivist theory (Levin, 2010:214). During post simulation debriefing, the facilitator encourages students to use prior knowledge and combine it with the student's new experience to develop mental interpretations (Wotton, Davis, Button, & Kelton, 2010:633). Levin (2010:215) supports constructivism and evidence-based practice, as an effective approach for facilitating learning and bridging the gap between theory and practice (Botma et al., 2013:5).

Kolb's theoretical framework of experiential learning, as seen in **Figure 2.5**, forms an important part of the educational foundation of simulation-based education. Adults learn through first-hand experience, processing the information and integrating lessons into their existing world view (Gardner, 2013:168). Students enter the learning cycle by actively engaging in a concrete simulation experience, followed by reflective observation where they observe their actions on video during the debriefing period. It is also during the debriefing period that students get the opportunity to discuss, conceptualize, and make sense of their actions and the scenario, gaining insight and understanding. The last stage of the cycle is when the students apply what they have learned in simulation in a similar or different context, experimenting with their learned skills and approaches. The implication is that students should be offered the opportunity to apply the new knowledge in a similar or different context (Gardner, 2013:168).

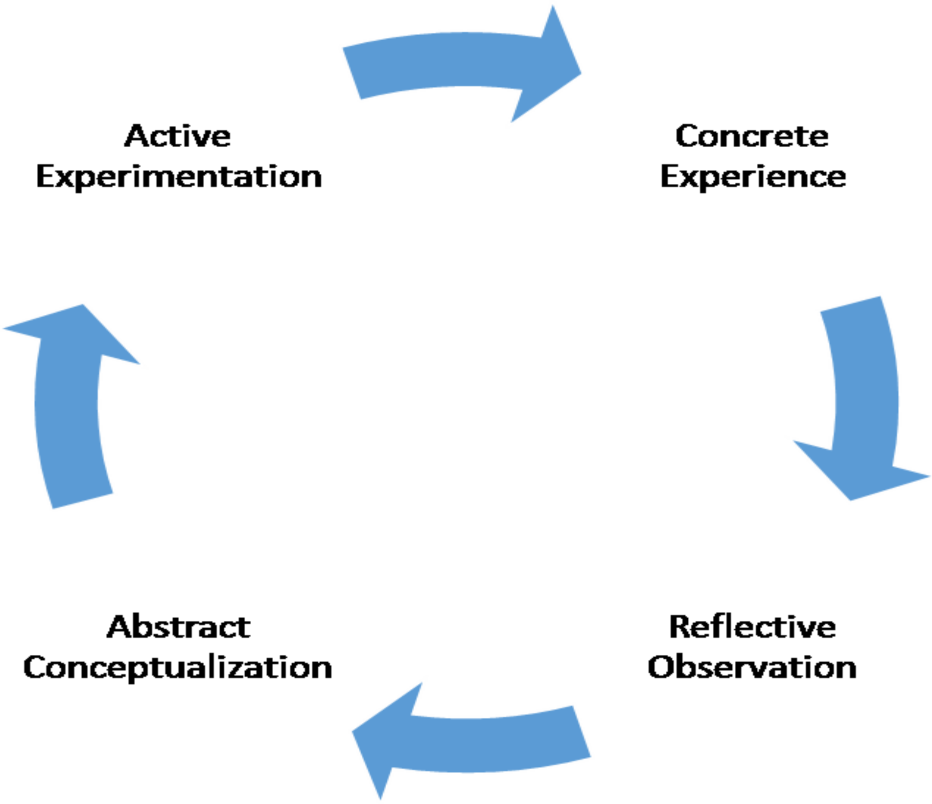

Figure 2 9 Kolb's learning cycle (Kolb & Kolb, 2009:299)

Reflection forms part of Kolb's experiential-learning cycle (Gardner, 2013:168; Kolb & Kolb, 2005:195) and of simulation-based education through reflective practice, reflection-in-action and reflection-on-action (Kelly et al., 2016:317). It includes all four stages of the cycle, namely: a concrete experience, reflective observation, abstract conceptualization and active experimentation (Gardner, 2013:168; Kelly et al., 2016:317). As a conclusion, debriefing contributes to cognitive development.

When students are able to access, apply and transform existing knowledge within a situation which enables them to create new knowledge, we say transfer of learning has taken place (Botma, 2014a:1; Levin, 2010:214). Hix (2013:26,27) links transfer of learning with the combination of knowledge and problem solving. Simulation cultivates transfer of learning, and should be used by facilitators more frequently as a teaching and learning technique (Botma, 2014a:4), linking past experiences to current issues (Hix, 2013:25). Many factors can influence transfer of learning and ultimately the student's work capacity, like the educational design or work environment.

The socialization experience with other learners, as well as realistic clinical scenarios in the simulation learning process, are found to have a significant effect on the transfer of learning (Bux, 2009). Research suggests that relevant and applicable real-life situations motivate adults to learn facts (Aura, Jordan, Saano, Tossavainen, & Turunen, 2016:229). Students need to be supported (Hix, 2013:29), motivated and engaged into a learning experience, enjoying the application of their knowledge, for transfer of knowledge to take place (Clapper, 2010:e10). Working within a group allows students to discuss facts with their peers, deepening their learning experience while solving a problem (Mayer, Dale, Fraccastoro, & Moss, 2011:79). So the transfer of learning is advanced by planning the design of a simulation scenario, ensuring a realistic representation, giving students the chance to work through the scenario together, and using previous experience and knowledge. Learning includes the development of cognitive skills, psychomotor skills, and affective skills.

2.3.5.2.1 Cognitive skills development

Students identified that learning to respond quickly to patient demands is an important skill to possess and that being given their simulation scenario, only minutes before meeting the patient, helps them to develop this (Mills et al., 2014:14). Through participating in simulation, students learn to Seek solutions for challenging situations, make decisions based on sound judgments, as well as develop critical thinking skills in a safe environment (Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010:e221; Park, Cleary, Mcmillan, Murphy, Conway, & Griffiths, 2013:43). The evidence to support the development of critical thinking skills and clinical reasoning through simulation training is still lacking and the exposure to simulation does not garuantee the desired learning outcomes are met (Lapkin et al., 2010:e221; Park et al., 2013:43).

Simulation, an effective experiential learning method, has gained popularity because of the enhancement of students' critical thinking ability when integrated into a curriculum (Cant & Cooper, 2009:12; Fisher & King, 2013:2385; Hall, 2014:1; Park et al., 2013:41-43). Critical thinking is not an independent skill, and develops within the knowledge domain (Park et al., 2013:42). A combination of high-fidelity simulation and clinical experience has been found to have a significant positive effect on a students' critical thinking skills (Bevan et al., 2015:784; Hall, 2014:4), but the process by which it develops is still slightly unclear (Shelestak, Meyers, Jarzembak, & Bradley, 2015:185).

2.3.5.2.2 Psychomotor skills development

A simulation experience is an ideal setting for students to develop psychomotor skills without risking any harm to patients. Using simulation as a mode of teaching leads to the development and acquisition of skills without the risk of harming patients (Gaba, 2013:5; Jeffries, 2005:102; Onello & Regan, 2013:2). Simulation-based educational interventions have an immensely progressive impact on the psychomotor domain and is not influenced by the fidelity level of the simulation (Kim, Park, & Shin, 2016:1) and students' confidence levels directly correlate with their improved psychomotor skills (O'Donnell et al., 2016:378). High-fidelity simulation provides students with an opportunity to develop clinical skills and competencies (Chen et al., 2015:2444).

Students feel they can identify the gaps in their skills practice while watching themselves after the simulation scenario (Mills, Langtree, Usher, Henry, Chamberlain-salaun, & Mason, 2014:15) and improve on patient safety competencies given experience in multi-patient simulation situations (Ironside et al., 2009:337). Feedback from students confirms that the application of clinical skills in practice during simulation improves patient care delivery and their ability to apply theoretical knowledge (Bevan, Joy, Keeley, & Brown, 2015:785) and to continuously identify the threats to patient safety while engaging in an interdisciplinary culture of safety (Ironside et al., 2009:332).

2.3.5.2.3 Affective skills development

Patient centred nursing care, working as team players, and communication are examples of affective skills. The different types and levels of simulation training have been proven to improve cognitive and affective outcomes (Kim et al., 2016:7), providing students with a fuller picture of their cognitive, affective and psychomotor abilities (Adamson, 2016:81). Within the affective domain, students develop professional attitudes, beliefs and values, which is an essential standard of nursing practice (Kardong-Edgren, Adamson, & Fitzgerald, 2010:e26; Lioce et al., 2015a:S4 Oermann, 2015:144). An example of an affective learning outcome is a written reflection report about what went well and what did not go well during a patient experience (Oermann, 2015:157), like how to be a good team player or work collaboratively. Affective skills develop along a continuum of stages linked to internal personal and professional development (Lioce et al., 2015a:S4).

2.3.5.3 Critical Thinking

Simulation education uses common problems which are frequently encountered in the practical setting, which offer critical thinking opportunities applied within the team of professionals (Titzer et al., 2012:e332). Knowledge is integrated from all disciplines in order to identify the specific problem, relate the underlining theory, plan the care and understand possible consequences of treatment or omission of treatment (Botma, 2014:1). It is during the debriefing sessions that students reflect on their actions and what happened during the inter-professional simulation session. During the debriefing process, the students critically review and discuss their actions and decisions within the simulation, reflecting on their cognitive strategy, thereby stimulating metacognition (Dreifuerst, 2010:46; Park et al., 2013:45). One of the purposes of debriefing is to improve a student's critical thinking ability, clinical judgment and clinical performance within specific situations (Wickers, 2010:e84).

In a country where nurses are the heartbeat of the healthcare system, it is crucial for all nurses to have the ability of good clinical judgment skills, comprising of critical thinking and clinical reasoning (Botma, 2014:4). Critical thinking activities consist of defining a problem, judging the credibility of the information, making accurate interpretations, and making reasonable worthy judgments (Chang, Chang, Kuo, Yang, & Chou, 2011:3224). **Figure 2.10** shows that critical thinking underpins the whole thinking process, as the student needs to continuously relate foundational knowledge to assessment findings and patient responses. It is also believed that critical thinking skills help students to make informed decisions, develop appropriate nursing actions and increase their ability to manage complex patient scenarios effectively (Spurr et al., 2010:352). Students suggest to have a portion of their clinical hours replaced by simulations due to the increased critical thinking abilities they felt developed through taking part in simulation scenarios (Mahoney et al., 2013:653).

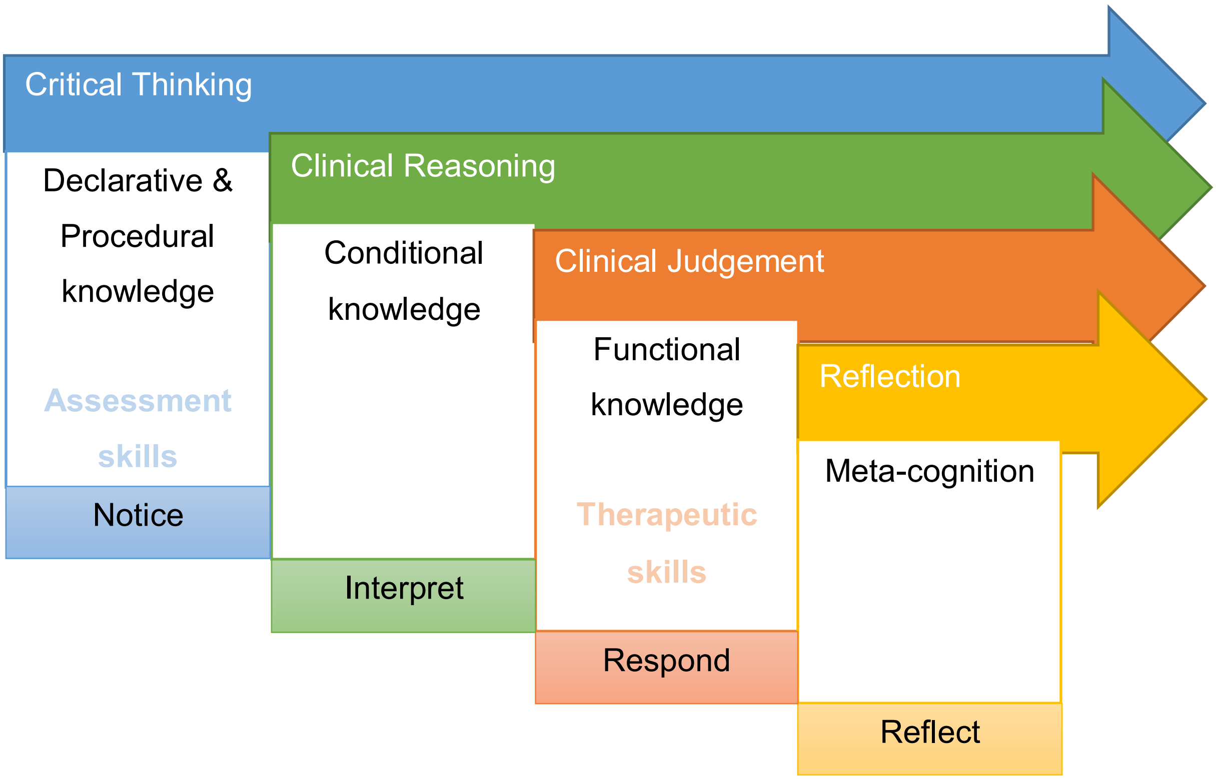

Figure 2 10 Critical thinking organization chart

Students need declarative and procedural knowledge from various disciplines to notice deviations. As can be seen in **Figure 2.6**, functional knowledge enables students to interpret findings and relate them to theory, principles and pathophysiology. Clinical reasoning occurs within a specific context and enables the student to prioritise care needs and come to a diagnosis. Functional knowledge or clinical judgment is when students in collaboration with the patient decide on the best treatment options and implement the interventions. Reflection during debriefing guides the students to think about their reasoning, why they have missed some cues and why they acted in a certain manner. This thinking about your thinking is called metacognition, in other words, reflective thinking, or the awareness and understanding of your cognitive processes (Mariani, Cantrell, Meakim, Prieto & Dreifuerst, 2013a:e148).

Clinical reasoning includes both cognition and metacognition (Lapkin et al., 2010:e207). Learning that occurs through metacognition is transformative in nature, because it influences behaviour in similar situations in the future, promoting anticipatory control (Burke, Mancuso, & Ed, 2012:543). Careful selection of simulation complexity and structure to match learning objectives supports the development of metacognition (Burke & Mancuso, 2012:543).

2.4 Conclusion

Simulation education in nursing programs continues to develop and is gaining popularity for profession-related training, due to the level of engagement and motivation of students (Wesiak et al., 2014:13). Using simulation to train nurses, decreases patient adverse events, patient mortality, and length of stay (Przybyl et al., 2015:145). This is due to an increase in knowledge, confidence, communication skills and critical thinking skills, because the nurses had an opportunity to practice and make mistakes in a safe environment, rather than on a patient (Przybyl et al., 2015:145; Wilson, 2011:5). Well-designed simulations correlate with perceptions of increased self-confidence, critical thinking, and learning outcomes (Ahn & Kim, 2015b:706,711). Nursing students suggest having longer, more frequent simulation sessions (Mills, West, Langtree, Usher, Henry, Chamberlain-Salaun, et al., 2014:15), taking into account the vulnerabilities of the learner population (Gaba, 2013:6). Wilson suggests further inspection of the interrelationships between the design characteristics to benefit nurse facilitators when planning simulation scenarios (Wilson, 2011:89). Simulation design awareness improves instructional delivery and develop the facilitator’s skill in simulation pedagogy (J. B. Paige & Morin, 2015b:11). This quantitative study added to the existing body of literature on simulation as a teaching and learning strategy by evaluating design characteristics of high-fidelity simulation.

CHAPTER 3
METHODOLOGY

3.1 Introduction

We know that simulation integrates clinical skills, content knowledge, teamwork, inter-professional communication, physical assessment, nursing therapeutics and critical thinking (Levett-Jones, McCoy, Lapkin, Noble, Hoffman, Dempsey, Arthur & Roche, 2011:706). In order to reach these competencies through the use of simulation, the School of Nursing (SoN) at the University of the Free State has been using simulation as a teaching and learning strategy in the undergraduate and postgraduate programs since 2010. Using simulation has been a growing experience and the question arises whether the simulations done at the SoN comply with the standards set out for quality simulation experiences on an international level.

In 2005, Pamela Jeffries published “A Framework for Designing, Implementing, and Evaluating Simulations Used as Teaching Strategies in Nursing.” which conceptualized practices concerning the planning and running of simulations as a teaching tool (Jeffries, 2005:97). The aim of the study is to describe the instructional design of high-fidelity simulation from the third year Nursing students’ perspective in the School of Nursing regarding design characteristics and criteria of the Jeffries simulation model. The methodology chapter describes the practical execution of the research process followed in the study and includes the aim, objectives, design, data-gathering technique and questionnaire, data analysis, validity and reliability as well as related ethical considerations.

3.2 Aim

The aim of the study is to describe the instructional design of high-fidelity simulation from the third year Nursing students’ perspective in the School of Nursing regarding design characteristics and criteria of the Jeffries simulation model.

3.3 Objectives

The objectives of this study are to describe the:

- Adherence of the University of the Free State School of Nursing's instructional design to the design characteristics of Jeffries' simulation model.
- Third year undergraduate students' perspective of the importance of each element of the design characteristics of Jeffries' simulation model.
- Associations between the importance and adherence of the design characteristics.

3.4 Research design

The research design is the overall plan for addressing a research question and the strategies involved to enhance the study's integrity (Polit & Beck, 2014:390). A quantitative, descriptive, cross-sectional research design was used in this study to determine the evaluation of the design characteristics of a high-fidelity simulation scenario by third year undergraduate students. The students completed a questionnaire immediately after completing the simulation session, evaluating the five design characteristics.

3.4.1 Quantitative Research

The quantitative element of research paradigms refer to the ability of research to quantify or measure its findings (Ellis, 2013:11). Quantitative research is a systematic and objective process that uses numerical data from a selected subgroup of a population to simplify the findings that are being studied (Maree, Creswell, Ebersohn, Eloff, Ferreira, Ivankova, Jannsen, Nieuwenhuis, Pietersen, Clark & van der Westhuizen, 2012:145; Polit & Beck, 2014:45). The quantitative approach developed from a logical positivism philosophy and functions on strict rules of logic, truth, laws, axioms and predictions (Grove, Burns, & Gray, 2013:24).

Quantitative research aims to generate knowledge in nursing science and provide evidence for nursing practice, education and management (Botma, Greeff, Mulaudzi, & Wright, 2010:82). The research focus on a small number of concepts and the researcher does not participate in the data gathering but is at a distance (Botma et al., 2010:82).

A formal, objective, systematic process was used to obtain numerical data and information, typical of the quantitative research method (Grove, Gray, & Burns, 2015:19). This study is quantitative in nature because a Likert scale was used and each response was quantified: 1 = not important; 5 = very important. Within this study, the researcher described the different variables (design characteristics) and the importance of each variable with relation to a high-fidelity simulation scenario.

3.4.2 Descriptive Research

Descriptive research is classed as a non-experimental design with the purpose to observe, describe and document aspects accurately of a situation as it naturally occurs (Grove, Gray, & Burns, 2015:20; Polit & Beck, 2014:379). There is no treatment or intervention within the proposed study, and the researcher will be a bystander who will be collecting the data only (Polit & Beck, 2014:47), making this a non-experimental study.

A descriptive design can be used to develop theories, identify problems in current practice or judge current practice, or identify trends of illnesses (Grove et al., 2015:212). Within this research study, the different design characteristics are described and their differences examined within a single simulation scenario.

3.4.3 Cross-sectional studies

Cross-sectional studies examine groups at one point in time (Polit & Beck, 2014:162), which can be used to determine if a particular problem exists, and at what level, within a group of participants (De Vos, Strydom, Fouchè, & Deport, 2011:156). It is used to find out the prevalence of an exposure in a given group of people (Ellis, 2013:84) and aimed at careful measurement that could define a single reality.

Within this study the researcher describes the design characteristics of the simulation design from a student's' point of view of a single simulation experience.

3.5 Measurement Tool

The researcher used the National League of Nurses (NLN) Simulation Design Scale to describe the design characteristics of the simulation design from a student's point of view. The 20 item Simulation Design Scale (SDS) instrument evaluates the five design characteristics of Jeffries' simulation model (Jeffries, 2005:97). It is a self-report instrument using 5-point Likert scales and provides the option for participants to select 1 for "strongly disagree with the statement" or "not important" as a response, up to 5 for "strongly agree with the statement" or "very important" (Jeffries, 2007:94).

The SDS questionnaire was downloaded from the NLN webpage after written permission was gained by the researcher. Please see Appendix C for this instrument. The standardized questionnaire was written and tested in English and has not been translated or tested in Afrikaans. Therefore it was presented to the group only in English.

The five design characteristics from the simulation model can be paired with the five aspects of the simulation design scale instrument. Refer to **Table 3.1** for the matching of these items. A description of each item follows. The design features include: objectives, support, problem solving, feedback and fidelity. The first part of the instrument asks about the presence of these design features and the second part about the importance of each feature to the student.

Table 3 1 Comparison between aspects of the simulation model and the questionnaire.

	Design characteristics and simulation from Jeffries' simulation model	NLN simulation design scale questionnaire	Question no
1	Objectives	Objectives and information	1, 2, 3, 4, 5
2	Fidelity	Fidelity (Realism)	19, 20
3	Complexity	Problem solving	10, 11, 12, 13, 14
4	Cues	Support	6, 7, 8, 9
5	Debriefing	Feedback/Guided Reflection	15, 16, 17, 18

1. As part of evaluating the objectives, the researcher needs to keep in mind the students' need of information about the activity, the process involved, the amount of time they have to spent, role expectations and outcome expectancies

(Ironside, Jeffries, & Martin, 2009:335; Jeffries, 2005:100; Sittner, Aebersold, Paige, Graham, Schram, Decker, & Lioce, 2015:296).

2. The simulation session needs to mimic the clinical environment as realistically as possible. This also adds to validity (Groom, Henderson, & Sittner, 2014:339; Jeffries, 2005:100; Przybyl, Androwich, & Evans, 2015:138).
3. Simulation sessions range from simple to complex and it is necessary to look at the information available to the students, the level of uncertainty, as well as the level of the decision-making environment. There could be a patient with problems related with one another, but with irrelevant clinical information; (Groom et al., 2014:340; Jeffries, 2005:101; Park, Cleary, McMillan, Murphy, Conway, & Griffiths, 2013:45).
4. The support during a simulation session can be present in the form of a preceptor or designated person who can provide information to the students about the step in the simulation process they are busy with or approaching. They could also ask leading questions to the students to stimulate their thinking process (Groom et al., 2014:340; Jeffries, 2005:101; Zhu & Wu, 2016:132).
5. Debriefing is a valuable tool in simulation where positive aspects about the simulation are enforced, reflective learning is stimulated, and it allows the students to link theory with practice and research. Students learn to think critically and discuss their inter-professional behaviour (Jeffries, 2005:101; Smith & Roehrs, 2009:75; Swanson, Nicholson, Boese, Cram, Stineman, & Tew, 2011:e82).

Simulation has developed and grown within nursing education, changing simulation literature continuously. The development of evaluation instruments, theories to guide simulation, frameworks to guide simulation design and the use of simulation as a teaching strategy, can now be found in the literature (Adamson, 2015:281; Jeffries, 2005:97; Kardong-Edgren, Adamson, & Fitzgerald, 2010:e25; Larew, Lessans, Spunt, Foster, & Covington, 2006:16; Lisko & O'Dell, 2010:106).

3.5.1 Reliability of the SDS

Reliability refers to the consistency or repeatability of a measure or an instrument, e.g. a questionnaire (Grove et al., 2015:287) and it is the consistency with which an instrument measures the attribute (Polit & Beck, 2014:202; Polit, 2010:217). High reliability is obtained when the measure or instrument will give the same results if the research is repeated on the same sample (Grove et al., 2015:287; Maree et al., 2012:147). Reliability displays accuracy, precision, homogeneity, stability and equivalence of a measurement method (Grove et al., 2013:389).

Internal consistency reliability is the most widely used in nursing research to assess an important source of measurement error in scales and the sampling of items (Polit & Beck, 2014:203). Internal consistency is evaluated by calculating Cronbach's alpha, also called coefficient alpha. The higher the coefficient, the more accurate the measure, and it can range from 0.00 to 1.00. The Cronbach alpha coefficient test is most commonly used to measure the reliability of scales with multiple items (Grove et al., 2015:289). The SDS questionnaire has a reported Cronbach's alpha of 0.92 for the presence of all five features, and 0.96 for the importance of the features (Ahn & Kim, 2015:708; Jeffries & Rizzolo, 2006:2; NLN Website, 2017: online), which makes this questionnaire internally consistent and reliable.

3.5.2 Validity of the SDS

A measure or instrument is said to be valid if it measures what it is supposed to measure (Ellis, 2013:74; Maree et al., 2012:147; Polit & Beck, 2014:205). The word validity implies truth, strength and value, and it is believed that measurement validity is similar to integrity, character or quality (Grove et al., 2013:393). Face validity is the extent to which an instrument looks as though it measures what it means to measure (Polit & Beck, 2014:380). When looking at the simulation design scale questionnaire, it appears to ask the exact questions relating to the simulation model.

There are three kinds of validity, namely content validity, criterion-related validity and construct validity. Content validity aids in ensuring adequate content coverage, to see if an instrument has an appropriate sample of items for the construct being measured (Polit & Beck, 2014:205). Content validity of the SDS questionnaire was accomplished by a review of 10 experts in medical/surgical nursing (Ahn & Kim, 2015:708; Jeffries & Rizzolo, 2006:2). Often experts are asked to evaluate the content validity of an instrument, because an instrument's content validity is based on judgment (Polit & Beck, 2014:205). Researchers can calculate a content validity index (CVI) which specifies the degree of expert agreement. However, the researcher was unable to find data on the CVI criterion-related validity or construct validity.

Criterion-related validity is used to examine the relationship between scores of an instrument and an external criterion (Polit & Beck, 2014:206). Criterion-related validity is not used in this study because the researcher does not compare the results with an external criterion.

Construct validity is concerned with assessing research quality and is most often linked to measurement (Polit & Beck, 2014:206). “What is the instrument *really* measuring?” Construct validity is mainly used to measure traits or feelings such as grief or satisfaction (Wood & Ross-Kerr, 2011:208). The process of developing construct validity for an instrument takes years of scientific work, examining the fit between the conceptual and operational definitions of variables (Grove et al., 2015:227).

A study done by Franklin, Burns, and Lee (2014:1303) where psychometric properties of the Simulation Design Scale (SDS) Questionnaire were studied among a sample of 2200 surveys, completed by novice nurses, included item analysis, confirmatory and discordant validity, and internal consistency. Results from this study support the use of not only the SDS Questionnaire, but also of the Self-confidence in Learning Scale (SCLS) and Educational Practices Questionnaire (EPQ) which has been used widely in simulation research, which ensures judgments made in studies about simulation are valid and reliable.

3.6 Pilot Study

After ethics approval was obtained for the proposed study, the researcher presented the questionnaire to a group of five post graduate Intensive Care Nursing students. These five students were requested to complete the questionnaire voluntarily immediately after they completed a high-fidelity simulation session. They were asked to comment on the clarity of the statements and to give feedback regarding any suggestions about possible changes to the questionnaire. The researcher used this opportunity to ensure the questions are clear enough, easy to understand and that the students can relate all the questions to a simulation scenario. The electronic questionnaire was tested within the Blackboard™ system within the pilot study. The researcher made notes of the duration the students took to complete the questionnaire. The average amount of time the students took to complete the questionnaire was about 15 minutes. No changes needed to be made to the questionnaire and the instructions were clear.

3.7 Population & Sampling

The population represents the entire set of individuals having a common characteristic, sometimes also called the universe (Polit & Beck, 2014:387). The population in this study is identified as all the third year undergraduate Nursing students (46 students) who undergo simulation during their Nursing programme at the University of the Free State. Participation in the simulation was compulsory as it was a scheduled learning experience, but completion of the questionnaire was voluntary. All the third year students were invited to complete the questionnaire, therefore complete collection sampling (Cowen, Manion, & Morrison, 2011:158), also known as comprehensive sampling (McMillan & Schumacher, 2010:327) was used, because every participant in a group was examined.

Sampling needs to comply with three broad aspects, namely composition, representativeness, and size of the sample (Laher, 2016:319). The sample composition for this study focuses on the whole of the third year group of students because they experienced an equal simulation scenario on the same day. The number of participants is representative of the total group of third year students, because 30 students out of the 35 students who performed simulation on the day, completed the questionnaire. There is no sample rule as to how big a sample should be, and it is suggested that within quantitative studies, the sample size needs to be representative of the group (Laher, 2016:320).

3.8 Data collection

Firstly, the researcher obtained approval from the then Ethics Committee of the Faculty of Health Sciences (now Health Sciences Research Ethics Committee) to perform this study. Permission from the Head of the Nursing School, the Dean of the Faculty, the Student Dean as well as the Vice Rector Academia was obtained before the research commenced.

The third year Nursing students received information regarding the content from the researcher verbally and by means of an information leaflet (see Appendix D) during a contact session. Opportunity was given to the students to ask questions regarding their participation in the research. The information leaflet included the purpose of the research and benefits of the study. It explained how the data would be collected, by means of a questionnaire immediately after the simulation experience. The information leaflet also included the selection criteria for the study and the responsibilities of the participants as well as of the researcher. It reminded the students that they would receive no remuneration and that participation is voluntary, with no retribution if they decided to withdraw at any time during the study. The students had time to think about their participation from the day after receiving the information until the day they completed the questionnaire. By completing the questionnaire, the participants consented to participate in the study. Information was provided on how the data was stored and that it is anonymous, meaning that the students' personal details would not appear on their answer sheets (Botma et al., 2010:14), thereby ensuring confidentiality. The information leaflet included the researcher's credentials and contact details, as well as how the research findings could contribute towards the improvement of simulation in the School of Nursing.

The questionnaire was electronically distributed by the centre for teaching and learning's software on the University's Blackboard™ platform. The questionnaire was loaded on Blackboard by technical staff working at the centre for teaching and learning. The students could access the questionnaire by clicking on a link that was created for the questionnaire on Blackboard™, which was active only on the day the data were collected.

The students completed the survey voluntarily immediately after completion of the high-fidelity simulation and debriefing session. Each group of students was escorted to a classroom in the same building where the simulation sessions ran, by an impartial member of staff. Any student could have left the building at this point if they preferred not to participate in the survey. Remaining students accessed Blackboard™ on a computer in the classroom and clicked on the link to the survey. Assistance was available from the staff member present in case any of the students had problems accessing the link and survey. Support staff from the centre for teaching and learning was available to assist over the phone.

Completion was voluntary and anonymous. All data were anonymous thus no identifiable information appeared on the document that was saved and sent to the researcher and the biostatistician. The electronic results were saved on the researcher's external hard drive and computer, which is password-protected. The computer has Mozilla Firefox® software installed to protect the software and it is locked to a desk by a cable which is code-protected. Only the researcher has access to the code. The computer is kept in a single office which door is locked when unoccupied, and the building is protected by an alarm system. The results were downloaded from Blackboard™ by the staff at teaching and learning, saved in an electronic file, and emailed to the researcher's University email address. The researcher could then email the data to the biostatistician for data analysis.

3.9 Analysis

Descriptive statistics, namely frequencies and percentages for categorical data and means and standard deviations or medians and percentiles for continuous data was calculated. The association between the adherence and importance of design characteristics was calculated by means of 95% confidence intervals for percentage, mean or median differences. The analysis was done by a biostatistician at the Department Biostatistics, Faculty of Health Sciences.

3.10 Ethical considerations

Various codes of ethics have been developed in response to human rights violations (Polit & Beck, 2014:81). The National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research published the Belmont Report in April 1979 (Botma et al., 2010:342; Polit & Beck, 2014:81). In this report, the ethical principles for the protection of people in research projects are highlighted, and focus is given to the following three aspects: respect for people, beneficence and justice. The basic principles of confidentiality, respect for people, beneficence and justice must be honoured (Botma et al., 2010:277). These important aspects will be discussed below.

3.10.1 Confidentiality

Certain confidentiality procedures must be in place to protect the participant's right to privacy (Polit & Beck, 2014:88). Anonymity is when the researcher cannot link the data with the participants (Polit & Beck, 2014:89). Anonymity was maintained by not letting the students fill in any identifiable information on the questionnaires. Confidentiality implies that only the persons involved with the study have access to the records, which are otherwise locked away safely (Wood & Ross-Kerr, 2011:237). Confidentiality was ensured by limiting access to data to the supervisor and the biostatistician. The report that was created by the staff at the centre for teaching and learning did not include any names or student numbers of the students involved.

3.10.2 Beneficence

According to Botma et al., (2010:20), "the principle of beneficence is grounded in the premises that a person has the right to be protected from harm and discomfort and one should do good and above all no harm." They talk about the risk/benefit ratio and that benefits actually mean "hoped-for-benefits", whereas risks are connected to future occurrence. Beneficence is the right to life (Standing, 2014:159) and doing good to others (Wood & Ross-Kerr, 2011:240), and above all, do no harm (Grove et al., 2015:98). Non-maleficence is the freedom from torture and degrading treatment (Standing, 2014:159). Care was taken to treat the participants with respect and not to harm them in any way. Students had the opportunity to withdraw from taking part in the study at any point.

Psychosocial benefits for the participating students include a potential improvement of their self-esteem and a feeling of personal growth. The School of Nursing will gain in an increased research output and have the opportunity to improve the simulation experiences of students. The school may also receive an amount of money from the government for the research done and also for research published.

3.10.3 Respect for persons

Respect for people was assured by obtaining consent from the students prior to participating in the study. Approval for the research was obtained from the School of Nursing's' management, the Dean from the Health Sciences Faculty, as well as the

Ethics Committee of the Health Sciences Faculty. The students had the freedom to participate or not participate in the study and they were treated as autonomous agents with the right to self-determination and freedom to participate or not, which confirm that the principle of respect for persons was followed. In other words, the students were not coerced in any way to participate in the study (Wood & Ross-Kerr, 2011:234).

3.10.4 Justice

According to Moule, Aveyard and Goodman (2009:101), the principle of justice means that the students who participate should be treated in a fair manner, by not giving preference to, or not being discriminatory with some participants over others. This means the students must have an equal chance to participate in the study. The interests of the participants should come before those of the researcher. The students must receive a contact number where they can lodge a complaint if they feel their rights have been violated. The appropriate professional assistance should be arranged and these costs must be covered by the researcher (Botma et al., 2010:20).

Within this study, the students had equal chances to participate immediately after their simulation session and debriefing ended. Whole sampling was done, therefore all had an equal chance to participate.

3.10.5 Informed Consent

Consent is the prospective subject's promise to partake in a research project as a subject (Grove et al., 2015:111) and includes four elements: disclosure of important study information to the participants, comprehension of this information by the participant, competence of the participant to give his/her consent, and voluntary consent to partake in the study (Grove et al., 2015:111; Grove et al., 2013:180). To achieve these important elements, the researcher applied the following actions:

- Information provided to the students indicated that the study was to be conducted and that they are being asked to participate in the study.
- The researcher stated the purpose of the research study.
- The reason for the study and why they were chosen as the research subjects were explained to the students.

- A description was given to the students of the procedure to be followed during the study.
- A description of the risks involved was provided.
- The benefits were explained to the students.
- Students were assured that their answers are anonymous and confidential.
- Any questions the students had were answered.
- The students were made aware that their participation is voluntary and that they can withdraw at any point without penalty.
- By completing the questionnaire, the students consented to participate in the study, without signing a written consent form.

According to Wood & Ross-Kerr, (2011:233), the information research subjects need includes the nature, duration and purpose of the research study; the methods of how data is collected; how the data will be used; any potential harm or discomforts; the benefits of the study; the results of participating in the study; as well as the alternatives available for the subjects.

On the information leaflet the students received, the researcher informed the students about the contact details of the secretariat of the Ethics Committee in case they want to lodge a complaint or feel their rights have been violated. No extra costs were incurred for the research because the simulation session formed part of the students' educational roster and the simulation staff present were adequately enough to accompany the students to the computer room after their debriefing ended.

The researcher had a contact session ten days before the data gathering with the students during class time, where all the necessary information about the research study was shared with the students as listed above. Time and opportunity for questions was provided during the contact session and written information was handed out to the students. The students had time to think about the information and read the information leaflet again to help them decide about their participation in the study. Please see Appendix D for this information leaflet.

3.10.6 Rigor of the Study

Rigor refers to the processes followed to maintain the quality of the research project (Laher, 2016:317), and is present in a study when the researcher applies discipline, adheres to detail, and works with strict accuracy and precision (Grove et al., 2015:36). Rigor and credibility of a study include the consistency and quality of the data collection process, the quality of the data analysis, and the transparency of the data analysis (Ellis, 2013:46).

Rigor within a quantitative research study includes the following:

- How well the research idea has been developed
- How concise and objective the design and analytic techniques are
- How meticulously the rules have been adhered to and applied to all decisions (Laher, 2016:317)

Rigor was ensured in this study by the honesty of data collection and analysis, the application of ethical principles and the prevention of participants influencing each other. Validity and reliability of the questionnaire has been demonstrated earlier in this chapter, and forms part of the ethical principles which needed to be adhered to. The validity and reliability of a study are central to a rigorous quantitative study (Laher, 2016:318). The learning outcomes were integrated into the simulation scenario the students completed, ensuring curriculum and classroom alignment, which increases the rigor of the study (Oermann, 2015:61). Other aspects of the study which contributed positively to the rigor include the use of a standardized simulation scenario and the use of high-quality debriefing methods, as suggested by Forneris and colleagues (Forneris, Neal, Tiffany, Kuehn, Meyer, Blazovich, Holland, & Smerillo, 2015:309).

3.11 Summary

After describing the research process of this study, including the aim, objectives, design, data-gathering technique and questionnaire, data analysis, validity, reliability and ethical considerations, the researcher can now progress to discuss the results of the study. In chapter four, the results of the gathered data will be presented, discussed and analysed.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Introduction

Quantitative data were gathered through this non-experimental, descriptive study to evaluate the design of a high-fidelity simulation session, from the perspectives of third year undergraduate nursing students. The students completed the internationally standardized questionnaire online on BlackBoard©, the student portal at the University. A technical staff member for BlackBoard© converted the answers into a Microsoft Excel Worksheet file and emailed the anonymous results to the researcher. Spam data were deleted from the document to ensure only answers remained in the document. The cleansed datasheet was sent to the biostatistician who performed the analysis. The final analysis was printed on paper and handed back to the researcher.

Descriptive statistics namely frequencies and percentages for categorical data and medians and percentiles for continuous data were calculated. The association between the adherence and importance of design characteristics will be described by means of 95% confidence intervals for the median differences for paired data. The descriptive statistics was analyzed non-parametrically because the questions were categorical and the sample small. Means, Standard deviations and Median scores were calculated just to enable the researcher to compare the data with similar international studies. The analysis was done by a biostatistician from the Department Biostatistics.

The demographic data will first be discussed, followed by the results and discussions of the five design characteristics, namely objectives, fidelity, problem solving (complexity), support (cues), and debriefing. This study investigates the perceptions third year nursing students have of the five design characteristics of a high-fidelity simulation session. The results could be used to adjust simulation design to possibly improve simulation learning in undergraduate students.

The students received information regarding the patient at the beginning of the simulation session in the form of a hand-over of patient details, including history of events, current health status as well as the simulation objectives. The students had the opportunity to ask questions if anything was unclear from the handover. The students were orientated with regard to their immediate surroundings within an acute care setting, including patient documentation, the lay-out of the room, emergency equipment, telephone, and nursing care items they may need. The facilitator reminded the students of the "Time Out" option if they need to ask for assistance from a senior member of staff. During "time out", the students hold up their hands to make a "T" sign during the simulation, after which a registered nurse would enter the room to offer assistance. Facilitators observing the students from the control room would notice the "time out" sign and send in a member of staff in uniform to assist the students. The facilitator adds to the fidelity of the scenario. All staff members participating in the simulation session were present when planning the scenario, and had a briefing session immediately before the simulation sessions started. This is to ensure consistency of support and a clear picture of the outcomes the students need to reach. Each member of staff had the list of outcomes and a detailed list of specific goals to use during the debriefing session. Please see the lists discussed later in this chapter under 4.2.2.1 and 4.2.2.4.

4.2 Results

Four demographic data questions, and another three questions related to the experience and preparation of the students, were added to the existing questionnaire by the researcher. Please see the complete questionnaire in **Addendum A**. The 20-item Simulation Design Scale (SDS) instrument which was designed by the National League for Nursing (NLN), aimed at evaluating the five design characteristics of Jeffries' simulation model (Ahn & Kim, 2015:707).

4.2.1 Demographic profile of respondents

The total participant sample was representative of the third year undergraduate population registered for their third year modules at a South African University Baccalaureate program in nursing. The sample consisted of 30 (*n* = 30) female nursing students, with a median age of 21, and ranged from 20 to 36, causing the data to be skew. Fifty-three percent of students self-reported as Caucasian, 20% as Sotho, and 10% as Tswana, 6.7 % as Swazi, 6.7 % as Xhosa and 3.3% as Northern Sotho. All questions were answered by all students, unless otherwise indicated by the n-score. Please see Figure 4.1 for the ethnic distribution of the respondents.

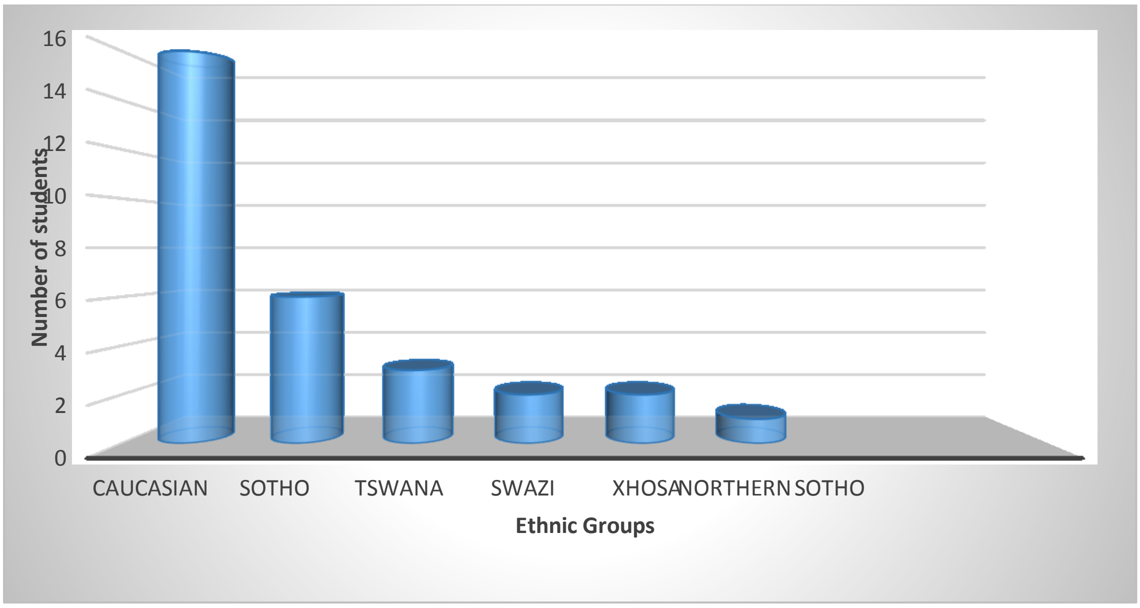

Figure 4 1 Ethnic distribution of respondents

As we can see from Figure 4.1, just over half of the students who completed the questionnaire see themselves as Caucasian. Of the 30 students, 26 have not encountered a patient with burn wounds before, but feel that the preparation they had during theoretical classes addressed all the pertinent issues with regard to a patient with burns. Nearly all the students (93%) confirmed that they had the necessary psychomotor skills to treat the patient within the simulation session.

The results of the five design elements will be discussed now. Each category comprises between two and five questions. With each question, the student first had to evaluate that specific design aspect. Secondly, the students had to rate the importance of that specific aspect within any simulation design. The students completed the questionnaire immediately after they completed the simulation session, having the experience fresh in their minds.

4.2.2 Design Characteristics

The results are provided per category with a concurrent literature support and discussion. The Lickert scale questionnaire consists of two sections, where the students firstly evaluated an item, and secondly rated the importance of the same item. When the students evaluated each item within the design aspects, they rated it between one and five, as laid out in Table 4.1.

Table 4 1 Evaluation Rating System

Use the following rating system when assessing the simulation design elements:	
1	Strongly Disagree with the statement
2	Disagree with the statement
3	Undecided – you neither agree nor disagree with the statement
4	Agree with the statement
5	Strongly Agree with the statement
NA	Not applicable; the statement does not pertain to the simulation activity performed.

Secondly, the students rated the importance of each design aspect to them personally, using the scale as laid out in Table 4.2 below. With both sections, when a student did not answer a specific item, a score of zero was allocated. Therefore, n remained at 30, even though the total number of students who answered a question may have been 28 or 29. The total numbers of students who answered each question are noted in all the tables.

Table 4 2 Rating scale for the importance of each design aspect

Rate each item based upon how important that item is to you.	
1	Not Important
2	Somewhat Important
3	Neutral
4	Important
5	Very Important

The median is the midpoint or middle case in a distribution of values for interval, ratio and ordinal variables; it splits the distribution into two halves after the data have been ordered from the smallest to the largest value and calculates the mean of the two values on either side of the midpoint (Botma, Greeff, Mulaudzi, & Wright, 2010:154). The median is not affected by outliers because it takes the value at the mid-point.

4.2.2.1 Objectives and information

Objectives should match the students' knowledge and level of experience, and be appropriate for the role expected of them during the scenario (Shearer & Davidhizar, 2003:274). Objectives should be written clearly to guide the students' learning, helping students achieve the outcomes (Jeffries, 2005:100). The objectives and purpose of the simulation should be shared with the participants before they enter the simulation room, as objectives still form a pillar of education (Groom, Henderson, & Sittner, 2014:339). Simulation aims to achieve the same outcome for all groups of students by setting clear objectives and appropriate cues. Objectives should encompass cognitive, psychomotor and affective domain outcomes. Orientating students prior to their simulated clinical experience provides them with information to review and prepares them for what they may encounter in the scenario (Groom et al., 2014:341).

Through setting appropriate objectives and providing the necessary information, a simulation session aims to support and create effective learning by means of constructive alignment (Biggs, Medland, & Vardi, 2003:1; Botma, Van Rensburg, Coetzee, & Heyns, 2015:1; Reaburn, Muldoon, Bookallil, & Strategy, 2009:821). Aligning simulation scenario outcomes with the foundational (declarative and procedural) knowledge creates the ideal situation for students to transfer theoretical knowledge into practice and thereby building conditional and functional knowledge. Students can demonstrate competence by applying their knowledge and skills while partaking in a simulated situation (Botma et al., 2015:4).

Cues regarding objectives were added to the scenario to help the students identify the patients' needs and to guide their actions. The objectives were communicated to the students at the start of the simulation as part of the orientation, formulated as follows:

- Assess the extent and location of the patient's burn injuries
- Assess and manage his airway and breathing
- Assess and manage his circulation
- Identify possible complications that might develop in this patient
- Administer medication as prescribed
- Communicate effectively within the interdisciplinary team, namely the fellow nursing students, registered nurses and treating doctor
- Record and report all actions

All the necessary information the students needed for the scenario was available in the patients' file. For example, a Rule of Nine chart was added in the file to assist in the calculation of percentage burn wounds. The students could also allocate the Parkland formula in the notes to use when calculating intravenous fluid administration. Equipment and sundries were available in the patient's room, for example fluid bags for intravenous fluid therapy. As Table 4.3 demonstrates, the students indicated they knew what was expected of them in the simulation scenario and their objectives were clear.

Most students scored objectives and information as a 4 or 5, as seen in Table 4.3. These high ratings imply that students received enough information and understood the objectives before the simulation to direct them during the exercise. The students indicated that sufficient information and cues were provided during the simulation that enabled them to solve the problem. Results from this study show that nearly all the students (93.2%) indicated the importance of the objectives and information within a simulation scenario, giving this a mean score of 4.38. The overwhelming positive response (Mean of 4.19) regarding the importance of objectives and information is aligned with literature stating that students should not only know the "what" but also

Table 4 3 Response frequency per question- Objectives and Information

Item	1	2	3	4	5	n=	1	2	3	4	5	n=
	Evaluation						Importance					
Objectives and Information												
1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.	1	2	1	10	16	n= 30	-	-	1	12	15	n= 28
2. I clearly understood the purpose and objectives of the simulation.	-	-	2	12	16	n= 30	-	-	2	13	15	n= 30
3. The simulation provided enough information in a clear matter for me to problem-solve the simulation.	2	1	-	15	12	n= 30	-	1	1	12	16	n= 30
4. There was enough information provided to me during the simulation.	-	3	2	11	14	n= 30	-	1	1	11	17	n= 30
5. The cues were appropriate and geared to promote my - understanding.	-	-	4	15	9	n= 28	-	-	3	13	14	n= 30
Total	**3**	**6**	**9**	**63**	**67**	**148**	**0**	**2**	**8**	**61**	**77**	**148**
Combined total negative, neutral and positive	**9 (6%)**		**9 (6%)**	**130 (88%)**			**2 (1.4%)**		**8 (5.4%)**	**138 (93.2%)**		
Mean score	**4.19**					**150**	**4.38**					**150**
Standard Deviation	**0.67**						**0.57**					
Median	**4.40**						**4.40**					

know "how" to use the knowledge. Similar results are seen in a study done by Fong (2013:103) where higher Diploma nursing students rated the importance of the objectives in a high-fidelity scenario relatively high at a Mean score of 4.26. Tosterud, Hedlin and Hall-Lord (2013:267) found that students evaluated the objectives of a high-fidelity simulation scenario at a slightly lower mean score of 3.63.

4.2.2.2 Support

Students need to feel supported and guided throughout a simulation scenario. Support can be in the form of suggestions on appropriate clinical judgements, including obvious signs and symptoms related to a specific problem, complication or need, or even have a lecturer present within the scenario to provide cues when students are stuck (Ahn & Kim, 2015:707; Groom et al., 2014:340). Within a supportive simulation environment, students feel safe to ask "stupid" questions and share their thoughts about what they may not understand (Tosterud et al., 2013:269). Student support (cues) can be provided in different forms but has not been stipulated clearly in literature (Jeffries, 2005:98). Within the simulation framework, the word "cues" was replaced by "support" in the 2007 version (Groom et al., 2014:339). Literature reviews confirm the students' need for support in the form of orientation before a simulation session (Groom et al., 2014:341).

Support was available in various forms during the simulation session. At the beginning of the scenario, patient information was handed over to the students, orientating them with regard to the condition of the patient, as well as expected nursing interventions. During the scenario the patient reported pain and a feeling of "pins and needles" in his one hand to prompt the students to investigate the appropriate limb. The students had to make a connection between the limb observations and theory to recognise the possibility of the development of compartment syndrome. Students had the opportunity to demonstrate "time out" by means of a show of hands, after which a lecturer went into the room to assist by asking prompting questions, leading the students and letting them discover the answer or solution. The patient's notes contained clinical data and information to assist in clinical evaluation and planning of care. A "rule of nine" burns chart as well as a Parkland Formula is provided in the notes to assist the students in calculating the percentage of burn wounds as well as the fluid to be administered.

The results in Table 4.4 indicate that the students primarily evaluated receiving support as positive. A mean score of 4.38 presented for the evaluation section, and a very similar mean score of 4.45 was found when the students rated the importance of support. The results show that nearly all the students (93%) indicated that their need for support was recognized, offered in a timely manner, supported in their learning process, and supported by a facilitator during the simulation session.

A study done by Fong (2013:104) reported a similar mean score of 4.25 when students evaluated the importance of support. Another high mean score of 4.25 was found in a study by Franklin, Burns and Lee (2014:1301) when students evaluated support in a high-fidelity simulation session. A study done by Tosterud, Hedelin and Hall-Lord (2013:267) found a surprising lower mean score of 3.81 when students (n=29) evaluated the importance of support in a high-fidelity simulation session, but no explanation was provided of the possible reason for this low score.

4.2.2.3 Problem Solving

During the simulation scenario, students have the opportunity to solve problems independently as well as in groups. The problems set out in the scenario are based on their level of knowledge, experience and preparation according to the outcomes of the specific topic. The aim of the exercise was not to create a very complex or confusing experience, but rather a straight forward scenario with low-level uncertainty and a high level of relevant information. Such an approach provides an opportunity to learn problem solving within clinical situations (Groom et al., 2014:340).

Scenario outcomes were based on theory, covered in three theoretical sessions, covering all aspects of burn wounds and treatment thereof. During the theory sessions, students had the opportunity to practice burn wound pathophysiology, classification, emergency treatment and ongoing treatment, both nursing and medical. Fluid resuscitation and the calculation of the extent (percentage body surface and severity) of burn wounds was also explained and applied to various paper-based cases. The students had the necessary theoretical basis to be able to independently solve all the problems within the simulation scenario, either alone or within their group. Having designed the scenario to the specific level of knowledge and skills as covered during the class, the students would be able to assess and treat the patient after prioritizing the care.

Table 4 4 Response frequency per question- Support (cues)

Item	1	2	3	4	5	n=	1	2	3	4	5	n=
	Evaluation						Importance					
Support												
6. Support was offered in a timely manner.	-	-	1	12	16	n= 29	-	1	1	14	14	n= 30
7. My need for help was recognized.	-	1	1	13	15	n= 30	-	2	-	12	16	n= 30
8. I felt supported by the teacher's assistance during the simulation.	-	2	2	12	14	n= 30	-	2	-	11	17	n= 30
9. I was supported in the learning process.	-	-	2	11	17	n= 30	-	1	-	9	20	n= 30
Total	**0**	**3**	**6**	**48**	**66**	**119**	**0**	**6**	**1**	**46**	**67**	**120**
Combined total negative, neutral and positive	**3 (2%)**		**6 (5%)**	**114 (93%)**			**6 (5%)**		**1 (1%)**	**113 (94%)**		
Mean score	**4.38**					**120**	**4.45**					**120**
Standard Deviation	**0.65**						**0.61**					
Median	**4.50**						**4.38**					

Table 4 5 Response frequency per question- Problem solving (complexity)

Item	1	2	3	4	5	n=	1	2	3	4	5	n=
	Evaluation						Importance					
Problem Solving												
10.Independent problem-solving was facilitated.	-	-	-	16	13	n= 29	-	-	2	11	16	n= 29
11.I was encouraged to explore all possibilities of the simulation.	1	-	1	14	13	n= 29	-	1	1	14	14	n= 30
12.The simulation was designed for my specific level of knowledge and skills.	-	1	-	14	15	n= 30	-	-	1	10	18	n= 29
13.The simulation allowed me the opportunity to prioritize nursing assessments and care.	-	-	-	14	16	n= 30	-	1	1	10	17	n= 29
14.The simulation provided me an opportunity to goal set for my patient.	-	-	1	14	15	n= 30	-	-	2	12	16	n= 30
Total	**1**	**1**	**2**	**72**	**72**	**148**	**0**	**2**	**7**	**57**	**81**	**147**
Combined total negative, neutral and positive	**2 (1.5%)**		**2(1.5%)**	**144 (97%)**			**2 (1.5%)**		**7 (4.5%)**	**138 (94%)**		
Mean score	**4.38**					**150**	**4.38**					**150**
Standard Deviation	**0.49**						**0.52**					
Median	**4.30**						**4.20**					

The students evaluated the session's problem solving between 4 and 5 and rated the importance of it mostly with a 5, giving it an overall highest score of importance between all five objectives, with a mean score of 4.38. With a high (97%) score when evaluating the problem-solving items, the students indicated they had the opportunity to prioritize their nursing assessment, care and set goals for the patient. The students indicated they received a simulation session designed at the appropriate level of knowledge and skills which they possess. Comparing this mean score of 4.38 with other studies, it is slightly higher than the mean score of 4.28 found by Fong (2013:104), as well as the mean score of 3.76 found in a study by Tosterud and colleagues (2013:267). Ahn and Kim (2015:710) found that their students rated problem solving between 3.16 and 3.54, which could mean the students hoped for more during their simulation session.

4.2.2.4 Feedback/Guided Reflection

Debriefing is a valuable learning tool (Lapkin & Levett-Jones, 2011:3544), using the reflective learning process and knowledge synthesis (Beischel, 2013:239). During guided reflection students can think critically and discuss their professional behaviour and actions (Dieckmann, Gaba, & Rall, 2007:185). Feedback was provided in a timely manner, immediately at the end of the scenario, in the form of a debriefing session. Video recorded footage of the students' performance was played back to each individual group, giving them the opportunity to view and analyse their behaviour and actions. The facilitator then gave every student an opportunity to express their thoughts about the simulation session, discussing the important aspects concerning the scenario and related outcomes. To assist the facilitators in addressing all the important aspects, a list of pointers is provided as a guide for the debriefing session. It looked as follows:

- Observations: vitals and limb observations, also pain assessment for pain medication
- Nasal cannula – change to face mask to give humidified oxygen: this improves oxygenation. Also think about flushing out Carbon monoxide using a high flow of humidified oxygen
- Sterile Drapes on wounds to prevent infection/contamination
- Wound assessment: percentage (Parkland), and also the depth of the wounds

- Fluid resuscitation calculations
- Complications of circumferential burns to right arm. Do neurovascular observations often, elevate hand and arm, notify senior staff or doctor
- Level of consciousness observe (hypoxia, dehydration)
- Nasogastric tube: drain acids from stomach, for feeding later when the patient is stabilized. Patient could develop a paralytic ileus; acids can aspirate into burned lungs
- Airway will swell from inhalation burns, most probably be intubated and ventilated soon after admission

The facilitator led the discussion, guiding the students and redirecting them back to the set outcomes, building their knowledge to a higher level. Facilitators need to be trained in performing meaningful and respectful feedback (Paige & Morin, 2015:18) to be able to offer the necessary support through guided reflection (Ahn & Kim, 2015:708).

During evaluation of the debriefing, the students scored it mostly between 4 and 5. As seen in Table 4.6, the majority of students (94%) agreed or strongly agreed with the evaluation statements regarding feedback. The results indicate that they received constructive feedback in a timely manner, that they could analyse their own performance, and that they could build knowledge to another level. The mean score in this study when evaluating feedback is slightly higher at 4.55, indicating the students rate the importance of feedback very high. Various studies indicate that students evaluate feedback as an important part of simulation design. Ahn and Kim found a mean score of 4.35 for feedback (2015:709), and in study by Fong, the mean score was found to reach 4.48 (2013:103). Raines (2011:63) had a very high mean score of 4.9 when the students rated the importance of feedback.

Table 4 6 Response frequency per question- Feedback/Guided Reflection

Item	1	2	3	4	5	n=	1	2	3	4	5	n=
	Evaluation						Importance					
Feedback/Guided Reflection												
15.Feedback provided was constructive.	1	-	1	10	17	n= 29	-	-	1	8	21	n= 30
16.Feedback was provided in a timely manner.	1	-	1	12	16	n= 30	-	-	1	7	20	n= 28
17.The simulation allowed me to analyse my own behaviour and actions.	1	-	1	14	13	n= 29	-	-	1	11	18	n= 30
18.There was an opportunity after the simulation to obtain guidance/feedback from the teacher in order to build knowledge to another level.	1	-	-	8	20	n= 29	-	-	1	10	19	n= 30
Total	**4**	**0**	**3**	**44**	**66**	**117**	**0**	**0**	**4**	**36**	**78**	**118**
Combined total negative, neutral and positive	**4 (3.4%)**		**3 (2.6%)**	**110 (94%)**			**0 (0%)**		**4 (3%)**	**114 (97%)**		
Mean score	**4.33**					**120**	**4.55**					**120**
Standard Deviation	**0.84**						**0.54**					
Median	**4.37**						**4.75**					

4.2.2.5 Fidelity/Realism

A simulation session needs to mimic a real life clinical setting, including the immediate surroundings, clinical signs and symptoms of the patient, expected outcomes and reaction of the patient to treatment during the scenario. In order to maintain authenticity, the person controlling and running the simulated learning experience has to adapt the "patients'" reactions according to the student's actions. Authenticity within a simulation scenario can enhance the learning experience of the students, and can be improved by adding an unpredictable nature of a clinical setting or the use of actors (Pike & O'Donnell, 2010:409). When students perceive a simulation experience as less real, it runs a risk of forming a barrier to knowledge acquisition (Foronda, Liu, & Bauman, 2013:e410).

Although human patient simulators have considerably increased in authenticity, it could still present sequential and predictable when compared with real patients (Dunnington, 2014:15). Therefore, a philosophical and theoretical examination of a real clinical scenario could assist in creating a natural and authentic simulation scenario (Dunnington, 2014:21). Clinical practitioners were consulted in a study by Nevin, Neill and Mulkerrins (2014:156) to help create a realistic scenario, ensuring an authentic experience, while the students wore their full clinical uniform, adding to the realism. The researcher ensured realism within the simulation scenario by including the following aspects for each group of students:

- The "patient" had burn wounds over his body exactly as explained in the documentation, with attention to making the wounds look real between each group. For example, glycerine spray or fake blood and blisters were re-applied where needed.
- Burned clothes positioned on the bed still touching the patient.
- In between sessions, hair was burnt in the room, stimulating all the students' sense of smell.
- Nostrils and mouth of patient coloured black, representing inhalation burn wounds.
- Urine in catheter bag appear concentrated, correlating with a volume depleted patient.

- The students wore their usual clinical uniform, as well as the Registered nurses who assisted the students during the scenario.
- The patient file contained complete documents that look exactly the same as in the clinical setting where the students are placed at.
- The patient documentation was complete, including the Paramedic's report of the team who transported the patient from the scene to the hospital.
- A trolley with sterile drapes and gowns was present in the room, including face masks.

Results pertaining to fidelity or realism show that students rated it between 4 and 5, indicating that the scenario resembled a real-life situation with real-life factors, situations and variables built into the simulation. The students rated the importance of fidelity mostly at the highest score of 5, indicating their firm view of the importance of a very realistic scenario, producing a mean score of 4.48. Similar results are seen in other studies where students rated realism very high, producing high mean scores of 4.56 (Fong, 2013:103), and 4.8 (Raines, 2011:63).

The students rated the importance of debriefing at the highest mean score of all five categories, sitting at 4.55, with fidelity following closely on 4.48 and support at 4.45. With their evaluation of the five design characteristics, problem solving and support is in a tie at third place with a mean score of 4.38, with objectives at 4.32. From this we see that the students considered the scenario to be at the right level, with adequate available support constructed into the session to help them perform the tasks expected of them. The students rated the importance of debriefing the highest at a mean score of 4.55, with fidelity second at 4.48, and support following closely with a score of 4.45.

During the data analysis the students' responses were analysed with respect to the differences between the evaluation and importance of the different design characteristics, as seen in table 4.8. The median differences shown were calculated by subtracting the importance value from the evaluation value. The Objective variable of -1.0 indicates that the students assigned a slightly greater score for importance than that of the evaluation, but this was not statistically significant as the confidence interval included the value 0. For all the other variables, the median of zero indicates no statistically significant difference between the evaluation and importance values were found.

Table 4 7 Response frequency per question- Fidelity/Realism

Item	1	2	3	4	5	n=	1	2	3	4	5	n=
	Evaluation						Importance					
Fidelity/Realism												
19. The scenario resembled a real-life situation.	1	-	3	14	12	n=30	-	-	1	10	19	n=30
20. Real life factors, situations, and variables were built into the simulation scenario.	-	1	2	16	11	n=30	-	-	2	10	17	n= 29
Total	**1**	**1**	**5**	**30**	**23**	**60**	**0**	**0**	**3**	**20**	**36**	**59**
Combined total negative, neutral and positive	**2 (3.3%)**		**5 (8.3%)**	**53 (88.4%)**			**0 (0%)**		**3 (5%)**	**56 (95%)**		
Mean score	**4.22**					**60**	**4.48**					**60**
Standard Deviation	**0.77**						**0.72**					
Median	**4.00**						**5.00**					

Table 4 8 Median difference results between evaluation and importance of each variable

Variable	Median differences
Objective	-0.2
Fidelity	0
Problem Solving (Complex)	0
Support (Cues)	0
Feedback (Debrief)	0

Table 4 9 Confidence interval for the median difference for paired data

Variable	Confidence interval (CI) for paired data
Differential Objective	[-0.4 ; 0.2]
Differential Fidelity	[-0.5; 0]
Differential Problem Solving (Complex)	[-0.2; 0.2]
Differential Support (Cues)	[0; 0.25]
Differential Feedback (Debrief)	[-0.25; 0]

There is a 95% confidence interval for the median difference for paired data, as seen in table 4.9. Confidence interval (CI) is used with probability sampling and is the range of values within which a population parameter is estimated with 95% certainty (Maree et al., 2012:201). Confidence intervals measure the reliability of results by determining how well the sample result reflects the true value for the whole population (Botma et al., 2010:169). With a 95% confidence interval you have a 5% chance of being wrong; it is a level of significance for how willing you are to be wrong. The conclusion from the 95% CI confirms a small sample group. The CI result, as seen in table 4.9, indicates that there are no significant differences between assess and rating, indicating that the students experienced a simulation session which was designed to the level they expected it to be.

4.3 Summary

The relationship between the adherence and importance of the design characteristics was described by means of 95% confidence intervals for the median differences for paired data. The results confirm the importance of each design characteristic within a high-fidelity simulation session. From this study we can see that the students could identify all five design characteristics within their high-fidelity scenario, and identified debriefing and fidelity as the two most important design aspects. Support followed as third most important aspect. Similar results were found in a study done by Raines, when students rated feedback and problem solving with the highest mean scores, with fidelity in third place (2011:74). The study by Fong (Fong, 2013a) indicates that students rated the importance of problem solving and objectives the highest. Ahn and Kim suggest that simulations need to be designed and implemented carefully, providing students with a more positive perception of the design features, to ensure better learning outcomes (2015:706).

CHAPTER 5
RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

5.1 Recommendations

Simulation learning opportunities need to be designed to integrate theory and practice, to deliver the best possible outcome. Simulation forces students to actively engage with the learning material, which in the long run supports the retention of knowledge. Students feel motivated to learn and apply their knowledge and skills in practice, promoting transfer of learning (Botma, 2014:4). When students present with a more positive perception of the design features of a simulation, the outcomes improve, therefore simulation scenarios need to be designed and implemented with more differentiation to achieve a positive perception (Ahn & Kim, 2015:706). According to Madison, a significant research gap still exists related to Jeffries' simulation framework, with regards to the manner in which the design characteristics are used (2015:107). More research is also needed to determine the most suitable type of simulation design to suit a student's level, creating a more effective simulation program (Ahn & Kim, 2015:711).

Simulation design needs to be standardized to meet simulation objectives. Through standardizing simulation design characteristics, it will continue to support simulation's ability to improve clinical judgment skills of undergraduate baccalaureate nursing students (Madison, 2015:108). Most simulation research has focussed on the outcomes (Smith & Roehrs, 2009:74) rather than the process of simulation. Simulation as a learning strategy has changed the paradigm of health care professionals' education (Groom et al., 2014:343). This study may have been strengthened by the fact that the original 2005 National League of Nursing/Jeffries Simulation Framework (NLN/JSF), as well as the update in 2012, was designed for use within high-fidelity human patient simulators, ensuring the evaluation of the design elements is relevant in this study. Evidence exists which supports the use of the Simulation Design Scale questionnaire as a valid and reliable questionnaire, giving researchers greater confidence in their research results (Franklin, Burns, & Lee, 2014:1303). The effort to standardize simulation design concepts while aiming to meet simulation objectives, supports the ability to build and improve clinical judgment of undergraduate baccalaureate nursing students (Madison, 2015:108).

After all the students participated in the simulation session, the facilitators have a debriefing session for themselves, led by the lecturer who also taught the theoretical content. During this debriefing session the simulation session outcomes are reviewed, along with the overall design of the scenario, aiming to improve the design so that student learning can be optimised. Facilitators and students gain from this and it is found to be an essential part of the debriefing cycle, adding to quality learning experiences of the students through simulation.

5.2 Limitations

The findings of this study propose that the design of a high-fidelity simulation scenario specifically of a burn wound patient, is done in accordance with the expectations of the students who underwent the simulation. However, there are some limitations in the study, namely the small sample size of students who participated, which limited the ability to generalize study results, and restricted insight into the design standards of the high-fidelity simulation scenario. Future studies should include replication to ensure a larger sample of students.

Also, the study focussed mainly on only the design characteristics of the simulation framework. Experts agreed that the Simulation Design Characteristics construct serves as a fundamental guiding foundation when designing simulation scenarios, but that the components and subcomponents remain undefined and unmeasured, suggesting that researchers would significantly further the simulation science by better defining the terms and methods they use and report (Groom, Henderson, & Sittner, 2014:343).

The simulation model was developed in the United States, where different teaching models are applied within nursing programs, and different simulation possibilities exist than that of the South African context. Students are exposed to different clinical settings, including a whole different nursing culture. This could propose a possible difference in the planning approach during the developing and running stage of a simulation scenario. I have seen an advantage in improving the design of a simulation scenario when the lecturer who teaches the theory and practical component of a theme is involved in planning and executing the simulation. This is because the lecturer gains better insight into the extent of which the students understand and apply their new knowledge and skills, not only within the simulation session but also during the debriefing sessions.

5.3 Conclusion

This was the first study to evaluate design characteristics of high-fidelity simulation at the School of Nursing at the University of the Free State, setting a bench mark for any further evaluations to possibly follow. The findings of this study reveal that third year nursing students identified all five design characteristics within a high-fidelity simulation scenario, namely objectives and information, problem solving, support, fidelity and debriefing, as set out within Jeffries' simulation model (Jeffries, 2005:97). This matches up with the aim of the study: for third year nursing students to describe the instructional design of high-fidelity simulation.

Within this research study, each section of the simulation model was described in detail, with special attention to the design characteristics. When the students evaluated the five characteristics, they indicated that they recognised each characteristic in the burn wound simulation session. Also, they rated the presence of each characteristic to be very high, indicating overwhelmingly positive feedback scores. The aim of the study was met when the students had the opportunity to evaluate the design characteristics of a high-fidelity simulation scenario from their perspective.

As seen in chapter four, the results reveal the highest scores for support and problem solving, followed shortly by debriefing when they assessed the scenario. This confirms the simulation scenario was designed according the specific level of knowledge and skills, providing an opportunity for the students to set patient goals, prioritise their nursing assessment and –care, and perform problem solving. Also, the results confirm the students' needs for help and support were met in a timely manner, and indicate the students felt supported during the scenario as well as within the learning process. The high assessment score for feedback indicates the student experienced constructive feedback in a timely manner, which allowed them to analyze their own behaviour and build knowledge to a new level with the assistance of a facilitator. In a study done by Fong, students perceived debriefing and fidelity as the most important design features in a high-fidelity scenario (2013:127). It is agreed upon that effective debriefing forms an essential part of simulation, guiding and creating learning opportunities (Paige, Arora, Fernandez, & Seymour, 2015:130).

It is safe to say that firstly, the results from this study confirm that the University of the Free State School of Nursing adhere to the instructional design characteristics of Jeffries' simulation model. Secondly, it provides the perspective from the third year undergraduate students with regards to the importance of each design element of Jeffries' simulation model. Thirdly, the results indicate associations between the importance and adherence of the design characteristics.

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ADDENDUM A

LETTER FROM ETHICS COMMITTEE

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

UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE

[redacted]

IRB nr 00006240
REC Reference nr 230408-011
IORG0005187
FWA00012784

22 July 2015

Ms L Botha
School of Nursing
UFS

Dear Ms L Botha

ECUFS 45/2015
PROJECT TITLE: INSTRUCTIONAL DESIGN OF HIGH FIDELITY SIMULATION IN A SCHOOL OF NURSING: DESCRIPTION OF 3RD YEAR STUDENTS' PERSPECTIVE.

1. You are hereby kindly informed that, at the meeting held on 21 July 2015, the Ethics Committee approved the above project after all conditions were met.

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

3. 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.

4. Kindly use the ECUFS NR as reference in correspondence to the Ethics Committee Secretariat.

5. The Ethics Committee functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the Ethics Committee of the Faculty of Health Sciences.

Yours faithfully

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

ADDENDUM B

QUESTIONNAIRE

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE
SCHOOL OF NURSING
SKOOL VIR VERPLEEGKUNDE

For Office Use Only

Dear Student

Please complete the questions below as part of this study.
Information will be used for research purposes only.
Please write your answer on the line provided, or mark the appropriate box with a X. **1-2**

Demographic data

1. Indicate your Gender: **3**

Male	
Female	

2. State your Age in years: ___________________________________ **4-5**

3. Indicate your Ethnic group: **6**

Afrikaans	English	Ndebele	Northern Sotho	Sotho	Swazi
Tsonga	**Tswana**	**Venda**	**Xhosa**	**Zulu**	

4. Indicate your study year: _____________________________ **7**

5. Have you encountered a similar situation before where you had to treat a patient who sustained burn wounds? ___________________________ **8**

6. Indicate if the theoretical classes addressed all the pertinent issues relevant to the simulation: **9**

Yes	
No	

7. The clinical laboratories sessions equipped you with the necessary psychomotor skills to treat the patient in the simulation: **10**

Yes	
No	

Simulation Design Scale (Student Version)

In order to measure if the best simulation design elements were implemented in your simulation, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions. Make a **cross (X)** in the column (1-5) to mark your answer.	**For Office Use Only**

Use the following rating system when assessing the simulation design elements:

1. – Strongly Disagree with the statement
2. – Disagree with the statement
3. – Undecided – you neither agree or disagree with the statement
4. – Agree with the statement
5. – Strongly Agree with the statement

NA – Not applicable; the statement does not pertain to the simulation activity performed.

Rate each item based upon how important that item is **to you**.

1. – Not Important
2. – Somewhat Important
3. – Neutral
4. – Important
5. – Very Important

Item	1	2	3	4	5	NA	1	2	3	4	5			**11-12**
Objectives and Information														
1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.														**13-14**
2. I clearly understood the purpose and objectives of the simulation.														**15-16**
3. The simulation provided enough information in a clear matter for me to problem-solve the simulation.														**17-18**
4. There was enough information provided to me during the simulation.														**19-20**
5. The cues were appropriate and geared to promote my understanding.														**21-22**
Support														
6. Support was offered in a timely manner.														**23-24**
7. My need for help was recognized.														**25-26**
8. I felt supported by the teacher's assistance during the simulation.														**27-28**
9. I was supported in the learning process.														**29-30**

Revised December 22, 2004

Simulation Design Scale (Student Version)

Use the following rating system when assessing the simulation design elements:

1. – Strongly Disagree with the statement
2. – Disagree with the statement
3. – Undecided – you neither agree or disagree with the statement
4. – Agree with the statement
5. – Strongly Agree with the statement

NA – Not applicable; the statement does not pertain to the simulation activity performed.

Rate each item based upon how important that item is **to you**.

1. – Not Important
2. – Somewhat Important
3. – Neutral
4. – Important
5. – Very Important

Item	1	2	3	4	5	NA	1	2	3	4	5			For Office Use Only
Problem Solving														
10. Independent problem-solving was facilitated.														31-32
11. I was encouraged to explore all possibilities of the simulation.														33-34
12. The simulation was designed for my specific level of knowledge and skills.														35-36
13. The simulation allowed me the opportunity to prioritize nursing assessments and care.														37-38
14. The simulation provided me an opportunity to goal set for my patient.														39-40
Feedback/Guided Reflection														
15. Feedback provided was constructive.														41-42
16. Feedback was provided in a timely manner.														43-44
17. The simulation allowed me to analyse my own behaviour and actions.														45-46
18. There was an opportunity after the simulation to obtain guidance/feedback from the teacher in order to build knowledge to another level.														47-48
Fidelity (Realism)														
19. The scenario resembled a real-life situation.														49-50
20. Real-life factors, situations, and variables were built into the simulation scenario.														51-52

		53

Any further suggestions on how we can improve our simulation design?

 Page 2 of 2 Revised December 22, 2004

ADDENDUM C

NLN APPROVAL LETTER

National League for Nursing

July 2, 2015

Lorette Botha
Junior Lecturer: School of Nursing
University of the Free State
PO Box 339
Republic of South Africa

Dear Lorette Botha,

It is my pleasure to grant you permission to use the "Educational Practices Questionnaire,"
"Simulation Design Scale" and "Student Satisfaction and Self-Confidence in Learning" NLN/Laerdal Research Tools. (I typically send all 3 tools together).

In granting permission to use the instruments, it is understood that the following caveats will
be respected:

1. It is the sole responsibility of (you) the researcher to determine whether the NLN questionnaire is appropriate to her or his particular study.

2. Modifications to a survey may affect the reliability and/or validity of results. Any modifications made to a survey are the sole responsibility of the researcher.

3. When published or printed, any research findings produced using an NLN survey must
be properly cited. If the content of the NLN survey was modified in any way, this must also

be clearly indicated in the text, footnotes and endnotes of all materials where findings are published or printed.

I am pleased that materials developed by the National League for Nursing are seen as valuable, and I am pleased that we are able to grant permission for the use of the "Educational Practices Questionnaire," "Simulation Design Scale" and "Student Satisfaction and Self- Confidence in Learning" instruments for your important work to advance the science of nursing education.

Regards,

M. Elaine Tagliareni, EdD, RN, CNE, FAAN
Chief Program Officer

ADDENDUM D

STUDENT INFORMATION LEAFLET

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE
SCHOOL OF NURSING
SKOOL VIR VERPLEEGKUNDE

Information leaflet: third year nursing students

Ethics committee number: ECUFS 45/2015

You have been asked to participate in a 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 and/or presented at a meeting or congress.

The study is concerned about evaluating the design of high-fidelity simulation sessions by third year nursing students and how they experience this type of training.

Benefits of the study include:

- Evaluate the standard of high-fidelity simulation design at the School of Nursing at UFS and
- To make adjustments according to the results of the evaluation to improve on the quality of high-fidelity simulation
- To give third year students the opportunity to help improve their learning experience regarding the use of high-fidelity simulation

The data will be collected in the form of a single questionnaire, consisting of 20 questions, filled in once by the third year nursing students, after a high-fidelity simulation session during April 2015. It will take approximately 10 – 15 minutes to complete the questionnaire and only third year students may participate after they completed the same high-fidelity simulation session.

How will you as third year student be protected during this study?

- Your names will not appear on the forms to keep it confidential.

- You may withdraw at any time during the study with no retribution.
- There is no remuneration involved and no known risks in participating.
- Participation is voluntarily to all third year students of 2015, with no retribution if anyone refuses to participate.

The researcher requests the students to be honest when answering the questionnaire.

The researcher intends to use the information collected purely for the research purpose of the study and the findings will be published within the research project. The data will be stored in the researcher's office on a computer and an external hard drive for fifteen years.

You have time to consider your participation from the date you receive this information leaflet until the day they fill in the questionnaire.

Thank you for considering participating in this study.

……………………………………..

The Researcher:

Mrs. L Botha

Contact details of researcher if you have any questions:

- office number: 051 4019762
- email: BothaL4@ufs.ac.za

Secretariat of the Ethics Committee contact details:

- office number: 051 4052812