THE PERCEPTIONS OF NURSING STUDENTS REGARDING THE INNOVATIVE TEACHING AND LEARNING STRATEGIES USED IN BIOLOGICAL AND NATURAL SCIENCES COURSES AT A NURSING COLLEGE

by

CONSTANCE NTSAMAENG RINGANE

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SUPERVISOR: PROF JM MATHIBE-NEKE

NOVEMBER 2021

DECLARATION

I declare that **THE PERCEPTIONS OF NURSING STUDENTS REGARDING INNOVATIVE TEACHING AND LEARNING STRATEGIES USED FOR BIOLOGICAL AND NATURAL SCIENCES COURSES AT A NURSING COLLEGE** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged using complete references.

I further declare that I submitted the thesis to originality-checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

15 April 2022

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SIGNATURE   **DATE**

Constance Ntsamaeng Ringane

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STUDENT NUMBER: 06474357
STUDENT: CONSTANCE NTSAMAENG RINGANE
DEGREE: MASTER OF ARTS
DEPARTMENT: HEALTH STUDIES, UNIVERSITY OF SOUTH AFRICA
SUPERVISOR: PROF JM MATHIBE-NEKE

ABSTRACT

Biological Nursing Sciences (BNS) is one of the fundamental subjects taught in the first year and second year of study in Nursing Education and training. Most students are struggling with the subject therefore, lecturers use different teaching and learning strategies to try and improve students' performance in the subject. The students were involved in Multiple Intelligence Approaches, Flipped classrooms, Jigsaw puzzles, and online teaching and learning methods. The purpose of the study was to explore the perceptions of the third- and fourth-year nursing students' regarding innovative teaching and learning strategies in the Biological and Natural Sciences course. The study was conducted at a Nursing College in Gauteng. The researcher used a non-experimental quantitative descriptive research design. The non-probability convenience sampling strategy was used to select the participants who met the inclusion criteria.

Data was collected using a self-administered questionnaire, consisting of closed-ended questions. The software programme, Statistical Package for the Social Sciences (SPSS) version 25 was used for data analysis. The findings revealed that the preferred method of teaching and learning were the jigsaw group discussion and multiple intelligence approach. However, Zoom as an e-learning teaching platform was found not to be a preferred strategy for teaching and learning. The findings also revealed that innovative teaching strategies motivate students to study and seek more information.

Key concepts

Biological and natural sciences; experience; innovative teaching and learning strategies; nursing students.

ACKNOWLEDGEMENTS

DEDICATION

I dedicate this study to my late father, Funny Mohlaoli (may his soul rest in peace), and Aslinah Nogoli Motloung who nurtured and supported me to be the person I am today.

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LIST OF ABBREVIATIONS

BNS   Biological and Natural Sciences

CBL   Case-Based learning

4IR   Fourth Industrial Revolution

GHWA   Global Health Workforce Alliance

HSREC   Human Sciences Research Ethics Review Committee

ICN   International Council of Nurses

ICT   Information communication and technology

ILO   International Labour Organization

MI   Multiple Intelligence

NEIs   Nursing Education Institutions

NLN   National League of Nursing

PPRC   Provincial Protocol Review Committee

RPL   Recognition of Prior Learning

SANC   South African Nursing Council

SANQF   South African National Qualifications Framework

SAQA   South African Qualifications Authority

SPSS   Statistical Package for the Social Sciences

STEM   Science, Technology, Engineering, and Mathematics

TBL   Team-Based Learning

UNESCO   United Nations, Educational, Scientific and Cultural Organisation

Unisa   University of South Africa

WHO   World Health Organization

CHAPTER 1

ORIENTATION TO THE STUDY

1.1   INTRODUCTION

This introductory chapter provides an overview and the purpose of this study. The chapter starts by presenting the background information about the research problem. This is followed by the purpose of the study. It then explains the research objectives and questions of the study. The research paradigm and research design used in this study are briefly outlined. Finally, the significance, scope and limitations of the study are explained.

1.2   BACKGROUND INFORMATION ABOUT THE RESEARCH PROBLEM

1.2.1 Source of the research problem

The knowledge and understanding of anatomy and physiology are important in nursing, especially in the clinical environment. Anatomy and Physiology must be taught and learned in such a way that students can integrate and apply anatomy and physiology to clinical competencies to ensure quality care (Parate, Bhusari & Anturlikar 2019:76). However, the student's performance in the subject has been unsatisfactory.

Nursing colleges offer a four-year programme leading to registration as a nurse (R.425) which consists of General Nursing Science, Psychiatry and Community Nursing and Midwifery. The Nursing Act, 33 of 2005 (South Africa 2005: s4(2)(f)), afforded the South African Nursing Council (SANC) full control of nursing practice as well as nursing education and training in the country. Therefore, SANC, as the regulatory body monitors the education and training standards of the nursing profession and accredits the Nursing Education Institutions (NEI) programmes leading to registration as a nurse (General, Psychiatric and Community) and Midwife (R.425 1985 paragraph 3(f)) and General Nurse (R.171) (South Africa 2005: s 31(1). The regulation was revised and passed by SANC in 1985, resulting in nursing colleges reaching a milestone where colleges became associated with universities (SANC 1985:2(a)).

The curricula for the different programmes prescribed Biological and Natural Sciences (BNS) as one of the compulsory modules for the courses (R.425, 1985 paragraph 2(c). (BNS) is one of the subjects taught during the first and second years of study in nursing (R.425, 1985, paragraph 3(f)). Human Anatomy and Physiology is an important subject in Nursing as it forms the foundation for other subjects such as General Nursing Science, Psychiatry and Midwifery. However, prior studies suggested that biosciences present a challenge and cause anxiety in nursing students (Montayre & Sparks 2017:217). It is crucial to evaluate the process by which students learn anatomy and physiology and to investigate the learning environment that best supports students' understanding of the human body's structure and function. As a result, numerous studies were carried out to identify the BNS contributing factors to poor performance (Mhlongo 2018:6; Ndwambi 2016:4), and the results showed that an inappropriate teaching strategy is one of the factors causing poor performance, which ultimately results in the course not being completed. A background in Anatomy and Physiology or Life Sciences in Grade 12 was not indicated as an admission requirement for the four-year programme. However, Ndwambi (2016:82) pointed out that students who had a foundation in the life sciences did higher on the BNS, indicating the need to make the life sciences a requirement for entrance to the nursing program.

Studies show that for many medical institutions, including nursing students BNS is still a challenge (Alshammari, Saguban, Pasay-an, Altheban & Al-Shammari 2017:60) According to Salvage-Jones, Hamill, Todorovic, Barton, and Johnston's study (2016:63), students' ability to learn the challenging and extensive Biosciences material presented a difficult situation.

Human anatomy and physiology, as well as microbiology and parasitology, are included in the biological and natural sciences. The course is known as Bioscience in other nations. The literature suggested that students drop out of training after their first year of study due to Anatomy and Physiology or Bioscience (Evensen, Brataas & Cui 2020:1; Langtree, Razak & Haffejee 2018:90; Montayre & Sparks 2017:12; Sprout 2018:13). (Evensen, Brataas & Cui 2020:1). According to research by Thompson, Thompson, and McConnell (2020:17), students view human anatomy and physiology as difficult, with low success rates and inadequate information acquisition. The study by Megaw and Zimanyi (2019:2) suggested that teaching biosciences using various teaching methods will enhance teacher-student interaction and that the rise in students' "active" learning rather than the

adoption of new teaching techniques was what led to the improvement in academic achievement. Similarly, Byusa, Kampire and Mwesigye 2020:28) recommended the use of learning approaches that stimulate student active participation and teacher involvement.

The nursing institution under study, implemented different teaching strategies to enhance student engagement to improve academic performance, hence the objectives of the study were to establish the nursing students' knowledge, understanding and attitude toward innovative teaching and learning strategies used in the BNS module and to determine which teaching strategies can motivate students to participate in the teaching and learning setting. However, Reinke (2019:449) pointed out that background knowledge, self-control abilities, and the teaching staff's expertise are other elements that must be considered to increase student engagement and performance.

1.2.2 Background to the research problem

To care for patients and families, nurses need to possess clinical knowledge and abilities. To address the dynamics of healthcare, there is an urgent and continual need for reform in nursing education (Caputi 2017:112). Because of this, nursing education institutes are required to train nurses who can work as competent healthcare providers. Docherty, Warkentin, Borgen, Garthe, Fischer, and Najjar (2018:470) contend that nursing education must change to engage students in their studies and employ strategies that enhance learning outcomes. Halverson and Graham (2019:146) note that the literature identifies several advantages of creative approaches, including the facilitation of simpler interaction, communication, and motivation in the classroom, clinical setting, and skills laboratory. Additionally, they advise nurse educators to employ a variety of instructional strategies to retain more students in higher education settings. According to the World Health Organization's (WHO) framework, nursing or midwifery schools should demonstrate the use of transformative changes in teaching and learning methods, such as adult education, self-directed learning, e-learning, and clinical simulation (World Health Organization [WHO] 2017:25). According to the World Health Organization (WHO) (2016), changes are being made to nursing education globally to improve the delivery of healthcare, strengthen the nursing and midwifery workforce, and elevate nurses' professional stature. Therefore, there is a need for innovative and transformative strategies in education, to overcome nursing education challenges. In a position

statement, the National League of Nursing (NLN) called for new approaches to reforming education and suggested that nurse educators use a variety of facilitation techniques in the classroom, simulation lab, and clinical context (Caputi 2017:112). According to Mtshali and Zwane (2019:3), who referenced the Lancet Commission and the Global Health Workforce Alliance (GHWA), report that, particularly in Africa, professional education has usually lagged with the pace of healthcare concerns. Therefore, nursing education must continue to prioritize generating nurses with the requisite competencies in order to increase the number of nurses in the profession and raise the quality of healthcare systems. According to a different study, Bvumbwe and Mtshali (2018:3) recommended that nurse educators and administrators should implement efficient and new teaching and learning strategies as student populations and learning styles continue to rise because of technological advancements, which are important for preparing students for future careers in Sub-Saharan Africa. This recommendation necessitates a shift in the mindset of the way the teaching of nurses is conducted.

The challenge for nurse educators, according to Bowles (2016:16), is to produce nurses who can meet the varied requirements of the community, collaborate, and deliver safe and competent care. As a result, innovation in nursing education motivates nurse educators to uncover innovative approaches that can help students foster their creativity and active learning abilities (Bvumbwe & Mtshali 2018:3).

Maintaining current medical knowledge and technology was a difficulty for nursing practice in Lebanon (Fawaz, Hamdan-Mansour & Tassi 2018:109). Due to these difficulties, the curriculum was changed to better suit the clinical setting. Nursing education had to shift from traditional classroom training to clinical instruction delivered online while assisting students in gaining more advanced technological experiences.

According to Ngema (2017:1), to improve academic achievement, students must actively participate in and be involved in employing a variety of tactics throughout teaching and learning. It was also found that nursing students had a hard time adjusting to the usage of various teaching methods in higher education. and this may be because most postgraduate nursing students have backgrounds in traditional teaching techniques. Because of this, many countries are working to improve their health professional education systems, including nursing education. According to Mahasneh, Shoqirat, Singh, and Hawks (2021:5), there is a growing trend in teaching and learning methods in

Jordan, ranging from visual to simulation-based learning. This shows that each student is different and processes information differently, which impacts the outcomes of any educational or training activity.

Traditional teaching methods and learning modalities are still the norm in nursing school, and because they don't encourage nursing students to think critically, students are not trained to be future nurses who make reliable clinical decisions (Mthiyane & Habedi 2018:2).

To ensure the quality of the programs offered, organizations like the International Council of Nurses (ICN) (1986, 1997) and the WHO (2009) recommended that public nursing colleges be relocated and incorporated into the Department of Higher Education and Training. These recommendations are in line with the integration of nursing education into higher education (Mtshali & Zwane 2019:3). The South African educational system was impacted by the inclusion of nursing education in higher education. To ensure that nursing education and training are in line with patient and community requirements, the South African National Nursing Summit was conducted (Mtshali & Zwane) (2019:2). Nursing institutions are required to develop and revise a curriculum and new teaching, learning, and evaluation methodologies in keeping with the national and provincial priorities (Department of Health 2013), as stated in the Strategic Plan for Nurse Education, Training, and Practice (2012/13-2016/17). (Department of Health 2013). According to Mthiyane & Habedi (2018:2), traditional teaching strategies and learning preferences are still widely used in nursing education. These tactics don't encourage critical thinking in nursing students; thus they won't equip future nurses with the skills necessary to make sound medical decisions.

According to Chicca and Shellenbarger (2018:180), Generation Z students are now enrolling in nursing programs and joining the workforce. The World Wide Web's (www) public availability in the early 1990s and the explosion of mobile technologies, such as smartphones, have an impact on Generation Z students. Learning that is self-directed or individualized may need to replace teacher-distributed material in the classroom. This will let students engage in and participate in effective learning activities (Chicca & Shellenbarger 2018:184). Therefore, educators must design learning environments that enable students to use active teaching-learning techniques and experiential learning if they are to hold the attention of Generation Z students. Technology integration will allow

for constant and productive engagement with students during facilitation (Chicca & Shellenbarger 2018:184).

Following the Bologna Declaration in 1999, which moved students' educational responsibilities to universities and colleges, the nursing curricula in Europe underwent significant changes. As a result, nursing education was elevated to the bachelor's degree level (Bianchi, Bernardi, Perilli, Cipollone, Di Biasi & Macchiarelli 2020:2358). As a result, the first year of the study saw the inclusion of Biosciences into the nursing degree curriculum. Bianchi et al. (2020:2358) reported that students had difficulty understanding the material and doing well on the test. Nursing students were introduced to and showed appreciation for the introduction of digital technology in the anatomy course. According to the research of Bianchi et al. (2020:2358), utilizing more innovative strategies rather than didactic teaching techniques can improve capabilities.

Study habits are one of the most important learning elements that have a significant impact on students' academic success, according to Ebele and Olofu (2017:583). However, according to a study by Berková, Boruvková, Frendlovská, Krpálek and Melas (2020: 494), mentors who were involved in teaching challenging material had an impact on students' learning patterns. This implies that both the teacher and the student must modify the study habits to fit the teaching methods.

The Multiple Intelligence (MI) theory has been around for a while, ever since Gardner first introduced it in 1983, and nothing is known about teaching biology in a differentiated curriculum employing MI in a blended learning setting (Finkenthal (2019:17). Finkenthal (2019:20) emphasized that, with the right encouragement, the majority of people can develop all eight intelligences to a respectable level of performance. Gardner's Multiple Intelligences include logical mathematics, verbal-linguistic, bodily-kinaesthetic, musical-rhythmic, visual-spatial, verbal-linguistic, and naturalistic. As a result, when various techniques are employed, educators can boost the intelligence of each student. To use a variety of presentation and evaluation formats, educators must grasp the various forms of intelligence that students possess. It should be noted that previous studies related to innovative teaching strategies focused more on technology and individual intelligence have not been given great attention, which served as the inspiration for the current study. Research findings by Mahasneh et al (2021:9) found that while some students are eager

to learn through words as verbal learners, some students prefer picture-based learning or a kinaesthetic strategy, and also highlighted that learning is enhanced when students and teachers have similar learning preferences.

The worldwide COVID-19 pandemic over the past few years promoted technology mediated learning as a method of choice in the education system. The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2019) claimed that as of April 20, 2020, 1.5 billion students attending schools and colleges in 191 countries had been impacted by the pandemic, (Tadesse and Muluye 2020:157). To stop the disease's spread and lower the number of COVID-19 cases, the South African government enacted a rigorous nationwide lockdown. The lockdown and social isolation of the institutions resulted in a total shutdown and a decrease in student face-to-face or contact sessions (Ali 2020:17). The majority of countries were required to use blended learning or online facilitation for teaching and learning (Dziuban, Graham, Moskal, Norberg & Sicilia 2018:1). Consequently, institutions of higher learning should give substantial thought to integrating teaching and learning techniques (Mahaye 2020:10).

The present COVID-19 epidemic, the Net Generation's entrance into our institutions of higher learning, and the widespread lockdown during that pandemic all contributed to the intrinsic drive for this work. According to Dr Blade, Minister for Higher Education, Science, and Technology Nzimande (Daily Maverick 2021:2) Student performance in the remote mode outperformed that of the conventional contact sessions.

Bezerra (2020:147) highlights the need to use a non-face-to-face model inspired by the COVID-19 epidemic to show the necessity of integrating distant technologies into the classroom. As a result, there is a chance to broaden the discussion on the application of remote techniques in health education by exploring the compatibility of online learning with other, already-used teaching strategies. This suggests that it is important to comprehend the diverse attitudes and perspectives that students have about the various teaching and learning methodologies. Similarly, Staykova, Von Stewart, and Staykov supported the employment of both traditional and innovative strategies methods to promote active learning in the classroom (2017:152 According to Mhlanga and Moloi (2020:9), students in higher education are using the cyberspace more frequently, and the impact of the fourth Industrial Revolution (4IR) has a part to play in encouraging teachers and students to seek out information and knowledge from a variety of sources outside of

the classroom. A powerful combination of different delivery methods, instructional models, and learning preferences obtained through successful communication should be employed to change teaching and learning situation.

To practice modern nursing after finishing their school and training, students need to have excellent reflective, rational skills and the ability to resolve challenges and crisis in the clinical environment (Docherty et al 2018:474). The relationship between BNS and pathophysiology must therefore be understood by students in training for it to be applied to pathophysiological processes and so improve competency skills. Anatomy and physiology are thought to be difficult and challenging subject in medical education, according to the literature, yet it is typically regarded as the foundation of medical sciences (Singh, Bharatha, Sa, Adams & Majumder 2019:1). According to Singh et al. (2019:8), applying practical information and using teaching methods that are relevant to students has promoted student collaboration and cooperation. These strategies include small group interactions, use of scenarios and allowing students to look for information and prepare before coming to the class for discussions. As a result, additional research has shown the value of diverse teaching and learning techniques for enhancing Anatomy and Physiology performance (Singh et al 2019:9).

1.3   DESCRIPTION OF THE RESEARCH PROBLEM

Nursing Colleges in Gauteng have been confronted with the difficulty of unsatisfactory BNS performance as demonstrated by the 2016 BNS 100 (first year) and BNS 200 (second year) summative results (Ndwambi 2016:4).In a study conducted by Mhlongo (2018:140), about students' poor academic performance in BNS at KwaZulu-Natal Province, the following strategies were recommended to improve students' academic performance: (peer group teaching), poems, songs, storytelling, and visuals; a skills laboratory for visualisation of models; anatomy quizzes and puzzles.

Biological and Natural Science (BNS) is a subject included within the R.25 nursing programme and is a building block of all nursing science modules. According to a study by Ndwambi (2016:72), students at Gauteng College of Nursing did poorly on this module. The study also found more evidence that some of the instructional methods used by educators were out-of-date and ineffective.

The study by Dano (2017:34) suggested that nursing students' visual, auditory, reading and writing, and kinaesthetic approach in learning be investigated, to improve academic success. It also explained that advanced teaching strategies are to be used to overcome the study-related challenges in the subject. The nursing institution under study is experiencing challenges related to student performance in the subject (Ndwambi 2016:4). In addition to the amount of content, difficulties could be made worse by what seems to be a mismatch between teaching techniques and learning styles. To improve nursing students' interest in the BNS subject, educators have adopted multiple intelligence (MI) approaches and cutting-edge teaching techniques like the flipped classroom, the jigsaw model, and online instruction. During facilitation, student participation was not as anticipated. Challenges were also met during the COVID-19 pandemic where online teaching was used and not all students were able to participate. During content facilitation, there was an element of reluctance by students to participate in the innovative teaching strategies which led to poor academic performance in BNS, as evidenced by the failure rate of 95% in the BNS Test 3 and 48% in the final examination in 2018. Thus, leading to the question "what are the students' knowledge and attitudes towards innovative teaching strategies and what are the different learning strategies that can motivate them to study?

1.4 DEFINITION OF CONCEPTS

1.4.1 Biological and Natural Sciences (BNS)

Biological and Natural Sciences (BNS) is a course undertaken by students in the medical field, comprising Anatomy, Physiology, and Microbiology. 'Anatomy' refers to the internal and external structures of the body and their physical relationships, whereas 'Physiology' refers to the study of the functions of those structures (Tortora & Derrickson 2018:1). BNS is a fundamental subject/course in the four-year Diploma Programme in Nursing offered at nursing colleges in South Africa (SANC 2016).

1.4.2 Experiences

Experience is defined as the fact or state of having been influenced by or learning from something that occurs or influences an individual directly (Cambridge Dictionary 2018). For this study, "experience" refers to the condition in which students have been impacted by or have learned about creative teaching techniques during the teaching and learning of BNS.

1.4.3 Innovative teaching and learning strategies

Innovation is a novel, useful method of doing something (Serdyukov 2017:10). Similarly, Sharma (2017:13) defined "innovation" as an active strategy for incorporating new methods to improve positive thinking, knowledge, skills, and attitude into fresh, original ideas. For this study, "innovation teaching and learning strategies" are new approaches, techniques, or learning processes that, when applied to a class of students, resulting in an improvement in the standard of learning. Innovation in education aims to raise learning standards and strengthen the educational system.

1.4.5 Nursing student

A nursing student is a person who is registered at an accredited institution for a four-year nursing programme to qualify as a General Nurse (General, Psychiatry and Community) and Midwifery (Gazette R.425, as amended on 22 February 1985) (SANC 1985). The third- and fourth-year student nurses registered for a Diploma in Nursing, leading to registration as a Nurse (General, Psychiatric and Community) and Midwifery are referred to as nursing students in this study.

1.5 PURPOSE OF THE STUDY

The purpose of the study was to explore the perceptions of third and fourth-year nursing students regarding innovative teaching and learning strategies used in the BNS course.

1.6   RESEARCH OBJECTIVES AND QUESTIONS

1.6.1 Research objectives

- To establish the nursing students' knowledge, understanding and attitude toward innovative teaching and learning strategies used in the BNS module.
- To determine the teaching strategies that motivate nursing students to participate in the innovative teaching and learning environment.

1.6.2 Research questions

- What are the nursing students' knowledge, understanding and attitude toward innovative teaching and learning strategies used in the BNS module?
- What are the teaching strategies that motivate nursing students to participate in the innovative teaching and learning environment?

1.7   RESEARCH PARADIGM

A paradigm is a perspective on how the world works or a general assessment of its challenges (Polit & Beck 2017:9). A paradigm is defined by Kivunja and Kuyine (2017:26) as a researcher's abstract view of how the world is interpreted. Literature indicates that broad paradigms like positivism, constructivism, transformational, and pragmatism paradigms have been used to conduct the research (Polit & Beck 2017:9). To ascertain the world as it is, the researcher employed a quantitative research design, o positivist paradigm. A sizable representative sample of students was chosen, and information was gathered using a questionnaire with both closed-ended questions. The use of quantitative research was appropriate because statistical measurements and data collection involved numbers. To maintain fairness and objectivity, the researcher was not involved in the data collection process.

1.8   RESEARCH DESIGN AND METHOD

1.8.1 Study approach and design

Quantitative research, as described by Polit and Beck (2017:273), is the systematic analysis of phenomena through the collection of measurable data and the application of statistical and computational methods. To explore the perceptions of nursing students regarding innovative teaching and learning strategies, the researcher employed a non-experimental quantitative descriptive research approach.

1.8.1.1   *Study setting*

A study setting is defined by Polit and Beck (2017:744) as the actual location and circumstances of data collection in a study. The study was carried out at the Gauteng College of Nursing where, throughout their second year of study, third- and fourth-year students participated in innovative teaching and learning strategies during their second year of study.

1.8.1.2   *Study population*

The total set of individuals or objects that the researcher is interested in is referred to as the research population (Polit & Beck 2017:273). The term "target population" describes the total group that a researcher is interested in and that the study's findings would apply to generally (Polit & Beck 2012:744). The nursing students enrolled in the R.425 program at the Gauteng College of Nursing who met the inclusion criteria made up the research target group for this study. They were in their third and fourth years of study.

1.8.1.3   *Sampling and sample size*

Sampling refers to the process of choosing a subset of the population to represent the entire population (Polit & Beck 2017:290). The researcher employed a large sample size and a non-probability convenience sampling approach in this investigation. 146 third-year

and 153 fourth-year students who experienced the different teaching and learning strategies made up the sample.

1.8.1.4   Data collection method and procedure

Quantitative data were collected using a questionnaire (Annexure H), where students who were exposed to different teaching strategies completed the instrument themselves. Structured questions consisted of closed-ended questions.

Data were collected in the two auditoriums of the institution during the time allocated by the principal and respective lecturers. One venue was occupied by 146 third year and the other by 153 fourth-year students. Two hundred and ninety-nine (299) questionnaires in total were distributed and 288 were returned.

1.8.1.5   Data analysis method

Quantitative data analysis is the statistical management of numerical data to describe events or gauge the strength and consistency of links between them (Polit & Beck 2017:290). Data in this study were analysed using descriptive analysis. Statistical Package for the Social Sciences (SPSS) version 28 was used to analyze the data after transforming it into a legible, numeric format in a spreadsheet.

1.8.2   Ensuring rigour

The rigour of research procedures can be seen and communicated through reliability and validity (Taherdoost 2016:32). Taherdoost (2016:32) claims that reliability refers to the extent to which a given test, technique, or tool, such as a questionnaire, can provide identical findings under various conditions, or repeatability assuming no other changes have been made. If a repeat measurement taken using the same scale or test such as a questionnaire under the same conditions yields the same result, it is considered to be dependable (Polit & Beck 2017:160). The researcher compiled the questionnaire using the Likert-type of the summated rating scale, from 1 to 5 to ensure high internal consistency reliability. The steps to be followed throughout the study were documented so that other researchers could follow the same steps should they wish to conduct a similar study in another nursing college.

The validity, according to Mohajan (2017:60), is concerned with what an instrument measure and how successfully it does so. Validity refers to "measuring what is intended to be measured" and explains how well the data collected corresponds to the actual area under study (Taherdoost 2016:29) The researcher chose a sample that was representative of the population to whom the researcher sought to generalize the findings to increase external validity. There were a lot of students in the sample who had exposure to creative teaching methods, thus generalization might be conceivable. The researcher made sure the instrument's items seemed relevant and logical to achieve face validity. A dichotomous scale was utilized with the categorical alternatives "Yes" and "No," which represented a positive and negative item accordingly, to ensure that the language used was unambiguous and that the terminology was obvious.

The content validity of a new survey tool is assessed to make sure it includes all the necessary items and omits that are unnecessary for a certain construct domain. (Taherdoost 2016:30). The researcher made sure that the questionnaire's content was centred on information relating to innovative teaching and learning strategies and did away with the lecturer method to ensure content validity.

1.8.3 Ethical considerations

A system of moral principles called ethics is concerned with how closely research practices comply with their social, legal, and professional obligations to study participants. (Polit & Beck 2017:727).

Permission to conduct the study was requested from The Research and Ethics Committee of the Department of Health Studies, at UNISA (Annexure A). Permission was also sought from the Gauteng Department of Health (Annexure B) and Management of the College (Annexure D) where the study was conducted. In this study, the researcher ensured that the participants are provided with the relevant information so that they can make informed decisions before signing a consent form. Informed consent is the ethical principle of voluntary participation and protecting the participants from harm (Polit & Beck 2017:731) and was obtained in writing from the participants (Annexure G). The purpose of the study was explained to the participants. They were informed that their participation

in the study was voluntary and that they are under no obligation to participate. The participants were informed that they have the right to withdraw from the study at any time during data collection without penalty or discrimination (Annexure F).

Individuals have the right to privacy, anonymity, and secrecy. They can choose when, how much, and in general what situations they want to share or not share their personal information with others (Polit & Beck 2017:147). Participants have the right to anonymity and were reassured that the data collected will be kept confidential. The questionnaire was designed to achieve anonymity by the fact that their names were not appearing on the questionnaire.

The findings of the completed study were not linked to any of the individuals who took part in the study (Polit & Beck 2017:148). The questionnaire aggregated data was kept in a closed cupboard with the boxes sealed for twenty-four hours, as per the researcher's instructions. No unauthorised persons could access the information. Thereafter the sorting and coding of responses were done.

1.9   SIGNIFICANCE OF THE STUDY

The study's conclusions will help BNS lecturers make improvements to the way the material is presented. Nurse educators will be able to identify challenges related to adaptation to the use of innovative teaching strategies with the aid of student nurses' experiences with those strategies. By purchasing the necessary technological equipment, the study will help to put in place the strategies for assisting nursing institutions in the implementation of various instructional strategies.

1.10   SCOPE AND LIMITATIONS

The main limitation of the study is that the population and sample were limited to one campus of the Gauteng Colleges. Other campuses did not implement innovative teaching and learning strategies in the facilitation of Biological and Natural Sciences (BNS). Therefore, the findings might not be generalised to other nursing colleges or provinces. A similar study in other Gauteng colleges may produce different findings.

1.11 STRUCTURE OF THE DISSERTATION

Chapter 1: Orientation to the study

Chapter 2: Literature review

Chapter 3: Research design and method

Chapter 4: Analysis, presentation and description of the research findings

Chapter 5: Limitations, conclusions, and recommendations

1.12 CONCLUSION

In Chapter 1, the introduction and background of the study were presented. The chapter outlined the research problem, purpose, objectives, research design, the significance of the study as well as scope and limitations. The study was out to explore the perceptions of third and fourth-year nursing students regarding innovative teaching and learning strategies used in the BNS course.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, an overview of the literature that the researcher reviewed is shared. The purpose of the literature review in this study was to familiarise and widen the researcher's knowledge based on trends and developments in innovative teaching and learning strategies. The chapter aimed at summarising what is known and identify gaps in student nurses' perceptions and attitudes toward teaching strategies in Biological and Natural Sciences (BNS). The following concepts were read, analysed, and synthesised, the nursing student of today, Biological and Natural sciences, factors contributing to poor academic performance in BNS, teaching and learning strategies which included flipped classroom, jigsaw puzzle, online teaching and learning and multiple intelligences (MI) learning approach in nursing education. Lastly, the focus is on students' motivation to learn.

The electronic database search such as CINAHL EBSCOhost, Eric, Google Scholar, MEDLINE, Medscape, NINR, Nursing Research, ProQuest, and PubMed, were used for this literature review. The researcher reviewed international, national, and regional literature about nursing students.

2.2 NURSING STUDENTS OF TODAY

According to the South African National Qualification Framework (SANQF), graduates must be able to demonstrate their nursing and midwifery practice competencies (South Africa 2008). According to Rao (2019:176), Nursing has long embraced innovation and suggested that the use of more creative methodologies like web-based teaching and other cooperative learning strategies by Nursing Education Institutions, will assist students in achieving competency skills. This suggests that through students' active participation, learning should result in behavioural change in the cognitive, emotional, and psychomotor domains (SANC 1985: paragraph 2).

According to SANC (1985), R.425, paragraph 4, for a candidate to be admitted to the nursing programme one must have at least a senior certificate or an equivalent certificate that gives admission to formal post-secondary education. The regulation does not specify the age limit thus no restrictions were made however most of the students who have registered for the programs are post-secondary students between the ages of 18 and 21. Students are also accepted into the program in South Africa through the recognition of prior learning (RPL) procedure. Through the process of "recognition of prior learning," non-formal or informal learning is evaluated and certified in relation to the standards for credit and access in the formal education and training system (South African Qualifications Authority [SAQA] 2013:5). The RPL method is applied in nursing colleges by providing auxiliary and enrolled nurses who do not meet the formal entry standard with an access route to a diploma in the nursing program. These nurses are permitted to contest the RPL procedure, but to enrol in the program, they must earn credits in a certain module, including BNS.

2.2.1 Millenniums and Generation Z

Anyone born between 1981 and 1996, often known as Generation X or Y, is considered a millennial. Anyone born after 1997 is a member of the new Generation Z. (Dimock 2019:1; Hampton & Keys 2017:111). Students in the millennial generation have been characterized as technologically savvy, accustomed to accessing a wide variety of information, multitasking, and eager for a great deal of stimulation in the classroom (Dimock 2019:1; Mohr & Mohr 2017:9; Vo 2020:152). The study also showed that younger generations, while digitally aware, typically lack creativity. As a result, educators must take into account these traits while developing pedagogical techniques that can engage students in learning through the use of various teaching modalities (Vo 2020:15). Additionally, according to Ferszt, Dugas, McGrane, and Calderelli (2017:275), Generation Z is adept at using the iPod, Google, and instant messaging services like WhatsApp, Twitter, Instagram, and Facebook, whereas Millennials prefer to work and solve problems in groups while using technology to help them (Ferszt et al 2017:275; Mohr & Mohr 2017:9).9).

2.2.2 Recognition of prior learning (RPL)

Many RPL nursing students are adults who have not taken any formal classes in a while (Mothokoa & Maritz 2018:3). The majority of RPL students, according to Browning (2020:32), were educated in rote-learning environments and need support in the form of skills, knowledge, and direction from instructors and mentors. To balance the demands of school, these students must receive support in their learning environment to balance educational demands. Studies show that RPL students, who are adult learners, must work through a variety of responsibilities, including balancing their family, career, and educational obligations (Mothokoa & Maritz 2018:105). To help students who are admitted to the R.425 program through the RPL procedure to become autonomous learners, collaborative and cooperative teaching and learning methods that are adapted to each student's ability must be used (Brenner 2021:64).

The expectations and attitudes of college students can be influenced by generational variations, including how they approach learning and how they view the roles of teachers in both teaching and learning. The majority of nurse educators come from the Baby-Boomer age when organized lectures were the main teaching style in nursing (Mohr & Mohr 2017:9). Studies have shown that Generation Z is more varied and technologically savvy than previous generations (Hampton, Welsh, and Wiggins 2020:112), and they have access to streaming services like Netflix and YouTube for watching videos on their smartphones.

Since higher education is still dominated by a curriculum that uses teacher-centered and lecturer textbook reading methodologies, teaching millennials and Generation Z with the RPL students in the same class can be difficult (Chicca, and Shellenbarger 2018:181) However, Vizcaya-Moreno and Pérez-Caveras (2020:9) noted that nurse educators who are prepared to create learning settings and teaching practices that promote quality and happiness for today's students may find it enjoyable to use cell phones and videos. Nurse educators must use instructional approaches that encourage and involve students in being active learners to ensure critical thinking (Seibert 2021:86). According to Chicca, and Shellenbarger (2018:184) numerous studies have sought to explain or study the traits of Generation Z, but less research has been done on how these traits relate to academic performance.

2.3   BIOLOGICAL AND NATURAL SCIENCES

In South Africa, The South African Nursing Council (SANC) has legislated Biological and Natural Sciences (BNS) which include Anatomy, Physiology, Chemistry, Biophysics, Microbiology, and Parasitology in the four-year undergraduate nursing programme (SANC 1985; SANC 2013). According to Tortora and Derrickson (2018:2), anatomy deals with the physical links between the body's internal and external structures, whereas physiology is the study of how those structures function. The concept of Biological and Natural Science is referred to as Life Sciences or Biosciences in other institutions within and outside South Africa. Throughout this study 'Biosciences' will be referred to as 'Biological and Natural Sciences (BNS). This course is a required component of nursing curricula around the world, and it gives nurses the framework they need to comprehend the biological mechanisms that underpin complex systems (Brown, Bowmar, White & Power 2017:491). Hull, Wilson, Hopp, Schaefer, and Jackson (2016) pointed out that little is known about the Life Sciences as a precondition to enter the nursing profession, which may have an impact on the subject's academic performance despite the relevance of BNS in Health Sciences. Although there is little and conflicting research to support it, Mosebi (2019:76) and Mhlongo (2018:83) emphasized that students who studied biology or life science at the school level scored better in BNS than those who did not.

2.4   FACTORS CONTRIBUTING TO ACADEMIC PERFORMANCE

According to Gordon, Hudson, Plenderleith, Fisher, and Craft (2017:27), Undergraduate nursing students in their final year who successfully completed the Bioscience component of their education found the Bioscience content to be challenging and the learning process to be challenging. This supports research showing that students found biology to be difficult (Bingen, Steindal, Krumsvik & Tveit 2019:53). The existing curriculum has to be changed, according to Gordon et al (2017:27), in order to link Bioscience subjects with clinical practice. However, nothing was mentioned in the execution of different teaching and learning strategies for the subject.

To determine indicators of students' performance and variables affecting students' academic performance in higher education institutions, numerous studies have been carried out. According to Mthimunye and Daniels (2019:200), environmental, academic,

and psychosocial factors can all be related to academic performance and achievement in higher education. Similarly, Slominski, Grindberg, and Momsen (2019:121) said, academic difficulties can be divided into three categories: the nature of the discipline, teaching strategies, and student-related problems. According to a study by Brown et al (2017:491), the BNS course has created a significant challenge in undergraduate nursing education because of its high conceptual nature and the significant cognitive effort needed to absorb the information, according to a study by Brown et al (2017:491). Similarly, Bakon, Christensen, and Craft (2016:13), Ukljek, Jurea, Bile, and Reek (2017:36) identified psychological, socioeconomic, and occupational problems, class size, motivation, concentration, teaching methods, lecturer perspectives, students' prior knowledge, and lack of confidence as factors that contribute to poor academic performance. Additionally, the literature indicates that BNS is commonly acknowledged as a challenging course with a high failure rate and academic exclusions (Clifton & McKillup 2016:27; Montayre & Sparks 2017:219; Owens & Moroney 2017:37; Slominski et al 2019:121).

Several factors have been highlighted by Vitali, Blackmore, Mortazavi, and Anderton (2020:290), such as students' involvement in STEM topics throughout secondary school. Students who studied STEM topics in secondary school have been found to have a higher likelihood of succeeding in BNS than students who did not study STEM subjects (Baharin, Kamarudin & Manaf 2018:811; Vitali et al 2020:290; Vo, Zhu & Diep 2017:28 The best option would be to teach science, technology, engineering, and math (STEM) coursework at the high school level, which necessitates both good reading and arithmetic skills to absorb a huge amount of knowledge (Baharin et al 2018:812). Students should study science in high school, according to Salvage-Jones et al (2016:69), so they can enter postsecondary institutions with a foundational knowledge of the subject.

In the study conducted by Vitali et al (2020:290), it was discovered that students considered the transition from high school to an institution of higher learning as stressful, which had an impact on their academic performance in the first year of study.

Mthimunye and Daniels (2019:210) highlighted that age has been identified as a factor in academic achievement and performance, particularly for RPL students who are often older than other students. According to Yousafzai and Jamil (2019:858), the findings support previous research showing that academic performance suffers as one ages and

that younger students do better. Younger students may need a more interesting approach to maintain their attention and interest in the subject (Anderton, Chiu & Aulfrey 2016:201). Younger pupils may need a more interesting approach to maintain their attention and interest in the subject (Anderton, Chiu & Aulfrey 2016:201).

One notable problem cited by Salvage-Jones et al (2016:69). was the mismatch between the learning preferences of nursing students and the methods used in their education. For instance, the use of passive learning strategies such as viewing and listening to science lectures or finishing science modules. Among these problems the types of assessments used by the educators have not received enough attention or have not been acknowledged as a cause of students' poor performance in BNS. If these difficulties are not overcome, BNS will continue to be an issue for medical and nursing students, leading to a low level of interest in their studies, poor academic performance, and a high percentage of academic exclusions.

2.5   STUDENTS' PARTICIPATION

As stated by Dong, Hwang, Shadiev & Chen (2017:157) in the definition of student engagement, students are active and involved in the classroom and while doing so, the student's mind is also engaged with the lesson's material (Sahni 2019:4). There has been a rise in the amount of literature on teaching and learning tactics in recent years, and various techniques have been shown to boost students' involvement in academic courses (Jordan & Duckett 2018:6; Sahni 2019:9; Stevens & Nies 2018.31). There has been a rise in the amount of literature on teaching and learning tactics in recent years, and various techniques have been shown to boost students' involvement in academic courses (Jordan & Duckett 2018:6; Sahni 2019:9; Stevens & Nies 2018.31). According to Brown et al. (2017:494), flipped classrooms encourage student participation and a greater comprehension of the course material. Technology is receiving more attention as a tool to encourage interaction between the teacher/lecturer and the students in the classroom setting (Alvarez-Bell, Wirtz & Bian 2017:128; Bedenlier, Bond, Buntins, Zawacki-Richter & Kerres 2020:133). This technology allows students to request to move away from the lecture when necessary (Dong et al 2017:157). Burke and Fedorek (2017:12) and Sahni (2019:14) revealed that technology-driven classrooms can result in better student engagement and participation, which can be used to establish whether blended learning improves student engagement. Given this reality, the blended learning strategy needs to

be understood and promoted in higher education. While most students would prefer an interesting lecture format, some students claim they will prefer traditional lectures (Brown et al. (2017:494). Additionally, according to Brown et al. (2017:494), student engagement has been found to differ based on the kind and level of physiology course, with a lower-level course having the lowest overall engagement scores. To stimulate student participation, might require a different strategy. According to Cassum and Gul's research (2017:101), encouraging students to ask questions and share ideas with others in the classroom increases involvement and fosters critical thinking. There is currently a shortage of information on nursing students' course involvement and the connection between student participation, student happiness, and academic success, which points to the need for additional research (Brown et al 2017:494).

2.6   TEACHING AND LEARNING STRATEGIES

Teaching and learning in BNS have undergone a significant change to be beneficial for different types of students as well as innovation in teaching and learning and to keep up with the advancement of technology. The traditional teaching approach is considered a "teacher-centered way of communication," where the student serves as a passive recipient of the information and the instructor serves as the only source of knowledge (Anderton et al 2016:202). It is assumed that the teaching method has some bearing on performance (Caputi 2017:110) and previous studies have reported that implementing active learning strategies improves student learning (Hull et al. 2016:40). A learner-centered strategy, according to Sturges, Maurer, Allen, Gatch, and Shankar (2016:27), will improve information retention. According to Vitali et al. (2020:292), student participation influenced their academic performance and professional abilities drastically (Lateef & Mhlongo 2019:24). Therefore, educators must engage in multiple learning styles, and create a conducive environment for meaningful learning which can lead to academic success.

2.6.1 Innovative teaching and learning strategies

Serdyukov (2017:8) define innovation as a new concept or method introduced to a person or group, and the adoption of the idea results in a change. Innovation in education, according to Caputi (2017:112), is the novel methodological approach, teaching facilitation method, including a process to acquire new knowledge and skills that, when put into practice, results in a major shift in teaching and learning.

According to Kalyani and Rajasekaran (2018:23), innovative teaching is defined as the teacher's creativity and individuality in changing the way they teach to increase student engagement. Sharma (2017:10) lists some innovative teaching techniques, such as idea mapping on the web, the flipped classroom, jigsaw puzzles, gaming, debate role-play case studies, and online instruction. The flipped classroom jigsaw puzzle, online instruction, Zoom technology, mobile learning, as well as the multiple intelligences approach will all be covered in this study.

2.6.1.1 Flipped classroom

Dehghanzadeh and Jafaraghaee (2018:151) define a flipped classroom as a "teaching style that substitutes individual learning with a group." A flipped classroom is regarded as an inverted classroom or a blended learning method where learning materials are made available to students to study on their own the during class the students are involved in group discussions among the groups, according to Sajid, Laheji, Abothenain, Salam, AlJayar, and Obeidat (2016:281). The phrase "flipped classroom" was used by the researcher. Critical thinking development for nursing students is the main goal of nursing education (Carvalho, Azevedo, Cruz, Mafra, Rego, Vitor, Santos, Cogo & Junior 2017:103). According to several research, a flipped classroom does foster critical thinking and is a reliable indicator of successful academic performance (Dehghanzadeh & Jafaraghaee 2018:151; Tan, Yue & Fu 2017:192).

The study by Tan et al (2017:192) compared the motivation, adaptability, and success rate of students in a flipped classroom, traditional learning, and e-learning. The findings were in line with earlier research suggesting that a flipped classroom benefits students by giving them enough time to process information before it can be facilitated (Choi, Lee, Bae, Kang, Choi, Tate, and Yang 2020:1044; Le Roux & Nagel 2018:28; Tran 2018:97;

Zhai, Gu, Liu, Liang, and Tsai 2017:198), and by giving them better opportunities to engage in high-level cognitive processing compared to traditional (Sajid et al 2016:281) thereby promoting retention of content.

In the study on flipped classrooms for anatomy and physiology, Megaw and Zimanyi (2019:27) discovered that academic performance improved when flipped classrooms were implemented, and it was sustained in the following years focusing primarily on active learning. Therefore, it was determined that adding an active learning component but not necessarily a flipped classroom, improves students' engagement and academic achievement (Zimanyi, Emtage & Megaw 2019:33). A study by Choi et al (2020:1046) found that using flipped classrooms to teach material on respiratory system assessment was both practical and well-liked by undergraduate nursing students.

2.6.1.2 Jigsaw puzzle (group discussion)

Elliot Aronson developed the jigsaw group discussion cooperative learning model in 1970 at the Universities of Texas and California (Guerrero, Arabia, Taala, Arabia, Cordero & Arabia 2019:1) in an effort to increase student engagement and boost academic performance (Abd El Aliem, Sabry & Mohy El-Deen 2019:361; Shahri, Matlabi, Esmaeili & Kianmehr 2017:529). This model's creation of homegroups and expectation groups is one of its traits (Karacop 2017:420). Students are divided into smaller groups in the home group, with each group concentrating on a particular facet of the subject to be discussed. By teaching their element to the other groups, they can better comprehend their element. After forming an expert group to share their knowledge on the topic at a certain time, the members of the home will reconvene in their original groups to share what they had learnt with the other group members (Saputra, Joyoatmojo, Wardani & Sangka 2019:1077). Eventually, all of the learning objectives are completed, and the entire class has learned about every component of the "Jigsaw." The educator is responsible for overseeing the procedure, providing a summary of the material covered, and leading debriefing sessions for the research.

The jigsaw method is founded on the idea that learning progresses most effectively when the subject of study is also taught to others through peer tutoring, per the literature (Sanaie, Vasli, Sedighi & Sedighi 2019:40). According to several studies, using a jigsaw technique sparks students' interest in the lessons and learning process, enhances

student relationships, motivates learning achievement, boosts self-confidence and self-esteem, fosters teamwork, and improves interpersonal communication (Karacop 2017:421; Karimi Moonaghi & Bagheri 2017:40; Melinamani, Francis, George, Pushpa & Vergheese 2017:2; Sanaie et al 2019:40; Shahri et al 2017:530). Jigsaw group work has more support nowadays, according to Guerrero et al (2019:2), since it promotes students to listen and share information, which boosts learning outcomes and performance.

Despite all the benefits of using a jigsaw approach, Karimi et al. (2017:38) emphasize that there is a chance that students will communicate inaccurate material if the teacher is not there. If the teacher does not keep an eye on the students or has insufficient control over them, the group might debate inaccurate information. The jigsaw approach can be time-consuming, according to Abd El Aliem et al (2019:370), who advise the educator to prepare the method well and effectively. To execute the jigsaw group discussion approach with the students successfully and appropriately, preparation depends on the teacher's critical thinking on specific learning outcomes (Saputra et al 2019:1077). Given the importance of engaging students in learning and creating a conducive environment for active learning, the jigsaw technique is advised for use in theoretical nursing courses as well as the teaching of clinical skills. Unfortunately, despite the strategy's many benefits for kids' learning, not all teachers are aware of it (Karimi et al 2017:40).

2.6.1.3 Online teaching

The ongoing COVID-19 pandemic, which emerged at the end of 2019, presented difficulties for global public health and educational institutions. These issues pushed education institutions including nursing institutes in many countries to start offering online teaching (Chen, Peng, Yin, Rong, Yang & Cong 2020:2). Since it occurs over an internet connection, online learning is often referred to as e-learning. (Abuatiq, Fike, Davis, Boren, and Menke 2017:80).). It is defined as instruction delivered via a digital device with the goal of enhancing learning. (Ferri, Grifoni, and Guzzo, 2020:2). E-learning, as defined by Abuatiq et al. (2017:81), is a method of education that uses information and communication technologies (ICTs) to simplify teaching and learning. This platform supports effective management and communication between students and between students and teachers, and it can be used in a traditional classroom or partially online (Gyampoh, Ayitey, Fosu-Ayarkwah, Ntow, Akossah, Gavor and Vlachopoulos 2020:511). The use of online learning has altered how people interact with one another (Gómez-

Ramirez, Valencia-Arias & Duque 2019:142), and the accessibility of mobile devices has a helpful or adverse impact on students' learning processes when new learning opportunities, like utilizing various online platforms, are developed to enhance learning outcomes. Although Gyampoh et al. (2020:518) and Boczkowska, Bakalarski, Sviatoslav and Leszczyski (2018:5) believe that teaching and learning are more effective when some content is taught through online learning and the other part is facilitated using the traditional face-to-face mode, Talidong (2020:201) advocates for the use of online learning at colleges during the post-COVID-19 period. It is advised that more work needs to be done to improve e-learning (Boczkowska et al 2018:5).

Incorporating modern technology into the classroom to replace in-person instruction is a recent trend that has been affecting higher education institutions (HEIs) for some time. (Kopp, Gröblinger & Adams 2019:1448). The phrase "sum of digital procedures necessary to produce a change process that enables HEIs to successfully affect the use of technology" was used to define digital transformation. (Kopp et al 2019:1449). The literature suggests that digital competencies like change, pace, technology, competencies, and financing are essential for teaching and learning with the development of technology-enhanced teaching and learning in HEIs (Bond, Marn, Dolch, Bedenlier, & Zawacki-Richter 2018:5; Essel, Vlachopoulos, Adom, & Tachie-Menson 2021:515; Hodges, Moore, Lockee, Bond & Jewett 2021:37). Adedoyin and Soykan (2020:5) stated that teachers and students who lack digital proficiency may lag behind in the use of online teaching and learning. Lack of digital literacy was another barrier to employing more technological education in the teaching, according to Gyampoh et al (2020:511). Students want direction and assistance when using digital tools for learning (Bond et al 2018:7).

2.6.1.4 Zoom technology

Zoom technology, which uses videoconferencing so that content can be discussed with teachers and students can see each other, is one of the modern software-based conference room options (Guzacheva 2020:457). Brennan (2020:2) and Busa, Agusriandi, Elihami, and Mutmainnah (2020:743) claim that COVID-19 forced educators to switch from old methods of teaching to using technology like Zoom and Microsoft Teams. Zoom was used by educators to improve their instruction and increase the learning chances for medical students (Guzacheva 2020:458). With an easy cloud

platform for conferencing, communication, and webinars across mobile devices, it also aided in connecting students and educators.

Zoom technology is an excellent tool for collaboration between the teacher and students regardless of distance, according to research findings by Busa et al (2020:743) and Guzacheva (2020:458), and it improves the learning outcomes for medical students. However, this technology had drawbacks, such as limiting student attendance because it could only hold 100 students at once.

2.6.1.5   Mobile-learning

Information and communication technology (ICT) of many different types plays a important role in society, including education. The majority of educational institutions use cutting-edge technologies to support instructors in managing and providing information to students, facilitating access to academic resources, and exchanging knowledge and communication with them (Thajeen & Siriwan 2021:63). and exchange knowledge and communication with students. Mobile learning (m-learning), according to Gómez-Ramirez (et al. 2019:142), is a subset of e-learning and a method of instruction that utilizes mobile devices like smartphones, tablets, and laptop computers while being conducted entirely online. Mobile learning makes use of digital tools like WhatsApp texting, streaming videos, Zoom video conferencing, Skype, FaceTime, and other approaches. Studies have shown that Generation Z students prefer the m-learning teaching platform because it enables them to virtually engage at anytime and anywhere (Schwartz, McDonald, Vahabzadeh & Cotes 2018:76). (Leigh, Vasilica, Dron, Gawthorpe, Burns, Kennedy, Kennedy, Warburton & Croughan 2020:566).

Despite the focus on mobile learning, there is still much to learn about how mobile technology is incorporated into instructional techniques. Mi & Meerasa (2016.57) state that although certain educational institutions still forbid cell phones, this limitation only applies to the classrooms and not outside the classroom where students can use their phones. It is more vital for the mobile technology generations at higher education institutions to use phones than laptops (Mi & Meerasa 2016.57). According to Jin, Montilus, Moore, and Conley (2020:498), the subject matter and characteristics of the

learning activity a student is participating in, have a major influence on whether to use mobile technology.

According to the literature, to facilitate mobile learning, a teacher must create strategies that encourage student participation, cooperative learning, and the provision of feedback from peers and educators (Alsharida, Hammood & Al-Emran 2021:147; Gómez-Ramirez et al 2019:142; Leigh et al 2020:566).

- **WhatsApp platform**

Today's teaching and learning are significantly impacted by WhatsApp, which is viewed as a free communication messenger app or social network that can be downloaded for free (Mi & Meerasa 2016.50). This social network cleared the door for teacher and student collaboration and communication for teaching and learning objectives (Singh, Singh, Abdullah, Moneyam, Ismail, Tek, Karupayah, Chenderan, Singh & Singh 2020:47). The teacher and the student can share films, photos, and video conferences by using the WhatsApp platform. Singh et al. (2020:51) highlighted that teachers agreed that the internet and technology have a major influence in the instructional process and can be improved through careful planning and implementation of instruction to increase students' mastery of content and skills; however, nothing was highlighted about students' test scores.

According to studies, WhatsApp can be an effective tool for cooperation, interaction and collaboration during the teaching and learning process (Nuuyoma, Mhlope and Chihururu 2020:105). Similar to this, Tayyib, Khedr, Fawzi, Eldin, and Lindsay (2019:17) indicated that WhatsApp was a useful medium for combining theory and clinical practice and facilitating group learning, which made learning easier. According to studies, using WhatsApp can help students' attitudes and academic performance in nursing students (Jin et al. 2020:498; Singh et al. 2020:47; Sharma, Sharma, Sharma & Sharma 2021:12). (Binti Ab Latif 2020:10; Sunasee 2020:3176). But according to Nuuyoma et al. (2020:112), it's important to teach students how to manage the drawbacks of WhatsApp platforms, like disruptions in the classroom and addiction to mobile devices.

There isn't much study on the use of m-learning in higher education in South Africa, despite the fact that there is a wealth of research on nursing education in other nations. This study is significant because it gives a detailed description of how nursing students use mobile learning tools like Zoom technology and WhatsApp, and the data will help nursing educators and school officials understand how students feel about using m-learning in the classroom.

Because attending classes on campus is frequently challenging for nurses due to their work schedules, family obligations, and other duties, online education has been considered an approach that increases the cost-effectiveness, flexibility, and accessibility of nursing education (Xu 2016:57). However, Salvage-Jones et al. (2016:60) highlighted that various teaching and learning styles have an equal impact on exam results after conducting a study on a teaching method among undergraduate nursing students in anatomy and physiology. Salvage-Jones et al (2016:69) emphasized the difficulty of teaching biosciences to undergraduate nursing students as well as the fact that interventions may not always provide the desired results.

Salvage-Jones et al (2016:69) emphasized the difficulty of teaching biosciences to undergraduate nursing students as well as the fact that interventions may not always provide the desired results. According to Evensen et al. (2020:3), this suggests that the fundamental problems with this area of learning have not been resolved, and more interventions may be required to better prepare students and comprehend how they perceive this challenging BNS course.

2.6.1.6   Multiple intelligences (MI)

Literature and studies suggest that the concept of individualized learning cannot be ignored and is supported by Rossouw in the Theory of Well-Regulated Freedom, which allows students to support their innate capacity to learn through websites. The education system is undergoing a radical change and expanding daily, affecting teaching and learning (Dishon 2018:115).

Since teaching and learning methods are so important in the academic setting, it is important to recognize that students gain information and process it in different ways (Magulod 2019:182). Additionally, diverse teaching and learning styles result from how students respond to the educator's chosen method of instruction. The Multiple Intelligence

approach and the visual, aural, written/read, and kinaesthetic (VARK) teaching model will be discussed as learning styles. According to Covaci (2019:7), learning style is a "dominant idea wherein the student's subject-related knowledge, emotional response, and learning orientation are combined." The qualities, advantages, and preferred ways in how people receive, and process information were described by other authors as "learning styles" (Chetty, Handayani, Sahabudin, Ali, Hamzah, Rahman & Kasim 2019:610; Magulod 2019:184). It also refers to the idea that each person has a unique approach or set of tactics for learning (Quinn, Smith, Kalmar & Burgoon 2018:358). Because they help lecturers better understand their students and create and deploy practical teaching methods and procedures, learning styles are helpful (Quinn et al 2018:358).

The significance of modifying teaching strategies to meet individualised differences in learning has been recognized by lecturers as a result of their increased awareness of individual differences in learning, which gave rise to the research issue. The visual, aural, written/read, and kinaesthetic (VARK) teaching style is a preferred instructional strategy in educational literature (Chetty et al 2019:612; Magulod 2019:186; Martinez & Tuesca 2019:79). Despite the prevalence of learning styles and inventories like the VARK, Mirza and Khurshid (2020:360) argue that it is crucial to understand that there is no proof to back up the claim that adapting activities to a student's learning style increases learning.

The multiple intelligences (MI) theory, which Gardner created in 1983, contends that everyone is gifted with multiple intelligences that are independent of one another and that everyone has various learning styles. As a result, it offers a theoretical framework for identifying the various skills and talents of the learner. The MI hypothesis postulates that although a student might not be particularly gifted in language or mathematics, they might know other fields like music, geography, or interpersonal skills (Katowa- Mukwato, Chapima, Nambala-Sianchapa & Mwiinga-Kalusopa 2017:84).

According to Gardner (1983), MI is the capacity to solve issues and shows that everyone can demonstrate all facets of intelligence, named as bodily- kinaesthetic, interpersonal, intrapersonal, logical-mathematical, musical- rhythmic, visual-spatial and verbal-linguistic (Cavas & Cavas 2020:405; Hall, Quinn & Gollnick 2018:321) and are explained as follows:

- *Bodily/Kinaesthetic intelligence* is the capacity to direct one's physical motions, including balance, coordination, flexibility, speed, and speed. It allows one to utilize their body to communicate their thoughts and feelings and find solutions to issues. People with bodily kinaesthesia learn by doing. Interpersonal Intelligence is the ability to detect and respond appropriately to another person's feelings, motivations, and desires.

- *Intrapersonal Intelligence* is Self-awareness, recognizing parallels and differences with others, and inner peace.

- *Logical-Mathematical Intelligence* comprises mathematical and scientific abilities. Individuals who excel in this intelligence use numbers successfully and reason well. The individual will be able to solve problems and an educational method will cultivate students' thinking and new approaches to learning.

- Mathematical and scientific aptitudes are included in logical-mathematical intelligence. People with high levels of this intellect are good at using numbers and reasoning. The person will have problem-solving skills, and a teaching strategy will foster students' innovative thinking and new methods of learning.

- Verbal/linguistic intelligence is the capacity to utilize language to communicate and comprehend complex meanings through word choice and language use. People with highly developed linguistic intelligence like poetry, word games, reading, writing, and speaking.

- The capacity to quickly comprehend the visual world is a component of visual/spatial intelligence. People with this intelligence skilfully correlate spatial information graphically and have fully formed mental representations. Students can learn about nursing problems, actively seek answers, and develop observation, picture thinking, and practical ability by being exposed to visual/sensory stimulation of images and settings. (Shearer, B., 2018:2).

According to Chavan and Dumbre (2021:719), who agree with other studies that each method of teaching students has benefits and weaknesses, students with different

intelligences can learn more about the subject matter they are studying (Kumara, Priyangika & Sudusinghe 2020:16; Parvari, Strider, Burchell & Ready 2017:16).

Nursing students' inability to learn, recall, apply, and integrate bioscience into clinical practice has raised some concerns. According to a study by Bakon et al. (2016:13) having a clear understanding of the visual environment is a requirement for visual/spatial intelligence. People with high intellect are adept at graphically correlating spatial information and possess well-formed mental representations. The discovery of nursing issues, the active pursuit of solutions, and the development of observational, image-thinking, and practical skills can all be facilitated by visual/sensory stimulation of images and scenarios. According to a study by Jardinico III, Goki, Mendoza, Semellano, and Sumagaysay (2017:32), when children were divided into groups based on their age, gender, and grade level, there was no noticeable difference in their primary learning styles. On the other hand, Kumara et al. (2020:17) discovered that using different forms of multiple intelligences had a substantial impact on students' academic achievement.

For the content and educational experiences being taught to students to meet their learning preferences, lecturers must be aware of and comprehend the various learning styles and habits of the students. Students may perform poorly if learning and teaching methods are not compatible (Chetty et al 2019:612).

According to studies, instructors are aware of the various intelligences and learning preferences that kids have (Kumara et al 2020:17; Rohaniyah 2017:19; Sun & Gao 2020:602). To provide content in a way that best suits the students' actual intelligence or capacities, the lecturer may find it helpful to employ the MI approach to better understand the students' talents and interests.

The question arose whether applying MI approaches may boost students' desire to learn or whether they view MI as a strategy that can improve academic achievement.

2.7   STUDENTS' MOTIVATION TO LEARN

The word "motivation" comes from the word "motive," which refers to a need, desire, or internal drive (Velmurugan & Sankar 2017:204). It outlines the aspects that affect a person's decision to engage in an activity, including how strongly they will pursue it and how long they are willing to continue doing so (Daumiller, Stupnisky & Janke 2020:204).Described as a "persuasive feeling that always delivers positivity to students

to perform a task or activity to the end and succeed in it no matter how difficult it is," motivation was defined by Gopalan, Bakar, Zulkifli, Alwi, and Mat (2017:1).

According to Gopalan et al. (2017:1), past studies have found that a student's motivation level affects how engaged and helpful they are in a learning setting (Acevedo 2018:763; Saracho 2019:21). Students who are engaged and highly driven would naturally engage in tasks without anticipating any external benefits, but lowly motivated students need external encouragement in the form of prizes for good grades to persuade them to engage in activities.

2.7.1 Intrinsic and extrinsic motivation

Cook & Artino (2016:1010) note that several factors, including challenge, inquisitiveness, power, unreal, competitiveness, cooperation, and acknowledgment, are essential for fostering intrinsic drive. To maintain motivation in education, one needs the strength of character and a positive outlook. According to the study done by Karlen, Suter, Hirt, and Merki (2019:101757), as well as Kuvaas, Buch, Weibel, Dysvik, and Nerstad (2017:244), intrinsic motivation is important for kids to succeed academically. An individual's intrinsic motivation can encourage them to engage in academic pursuits and help them recall the information they learn A reward (Ryan & Deci 2020:74), a compulsion (Li, Bhutto, Xuhui, Maitlo, Zafar & Bhutto 2020:25), or a penalty are examples of extrinsic motivation (Locke & Schattke 2019:277). Both intrinsic and extrinsic motivation are required in the learning process, as stated by Gopalan et al (2017:3) because learning is a complicated process and motivation is its hard rock. This shows that to overcome the difficulties associated with teaching and learning strategies and comprehend the procedures used in teaching and learning, instructors as well as students must be extremely motivated.

Research has shown that classroom instruction directly affects how well students understand science courses due to factors including their opinions regarding science and willingness to study about and engage in science-related fields. (Chapman, Ward, Tiwari, Weimer, Duran, Guerra & Sale 2017:184; Granjeiro 2019:553; Vitali et al 2020:290). The kind of instruction or approach utilized, the resources available in the teaching and learning environment, or even a student's ability to understand the vocabulary used when learning about anatomy or physiology can have an impact on these factors and affect their interest in the subject (Chapman et al 2017:184).

2.8 CONCLUSION

This chapter discussed the literature based on the nursing student of today including the Millenniums and Generation Z, Biological and Natural Sciences, factors contributing to poor academic performance in BNS, teaching and learning strategies which includes flipped classroom and students' participation, jigsaw puzzle, online teaching and learning as well as the multiple intelligences (MI) as a learning approach used in education. The intrinsic and extrinsic students' motivation to learn was also discussed.

CHAPTER 3

RESEARCH DESIGN AND METHOD

3.1   INTRODUCTION

Chapter 3 discusses the method used in the study to achieve the objectives and to provide answers to the research questions. This chapter further presents the research design, population, sampling, data collection, and analysis. The internal and external validity is also described.

3.2   RESEARCH DESIGN

A research design offers the study's framework. De Vos, Strydom, Fouché, and Delport (2017:142) emphasize that a research design entails a decision about the topic to be studied, which population to choose, how they are sampled, and the research methods to be used. They go on to say that it is further explained by how data is collected and analyzed to support the expected outcome. Research design, according to Dannels (2018:402), is "a plan that provides all aspects included in the study so that the findings are reliable, unaffected by bias, and can be generalized." There are three types of research designs: mixed methods, qualitative, and quantitative (Gray, Grove & Sutherland 2017:683; Ott, Thomas and Fernando 2018:109; Polit & Beck 2017:735). In this study, the researcher used the quantitative research design. The positivist concept that there is reality, and that each phenomenon has an underlying cause that needs to be studied forms the philosophical foundation of the quantitative design field (Hodge 2021:14; Polit & Beck 2017:9). A large sample is desired for potential result generalization. According to De Vos et al. 2017:144; Gray et al. 2017:201 and Polit and Beck (2017:185), positivists provide quantitative data. Different writers categorize quantitative research designs as descriptive, correlational, quasi-experimental, experimental, and non-experimental research (De Vos et al 2017:144; Gray et al 2017:201; Polit & Beck 2017:185).

According to Polit and Beck (2017:9), the goal of quantitative research is to use numerical data to test hypotheses, establish detailed information, and ascertain the relationship

between the variables or collected data and the observation. Consequently, the researcher chose in this study the quantitative research design to employ statistical results to gather precise and relevant information about the student's experiences with teaching and learning methodologies.

Various authors classify quantitative research designs into descriptive research, correlational, quasi-experimental, experimental, and non-experimental research (De Vos et al 2017:144; Gray et al 2017:201). In this study, the researcher employed a quantitative descriptive research design, where the different teaching and learning methods and the characteristics of the nursing students were measured without any intervention.

3.3   RESEARCH METHOD

The way a study is carried out within a specific design is known as the research method, according to Gray et al (2017:683). Research methods are procedures, ways, or approaches for collecting and analyzing data, according to Polit and Beck (2017:735). With a group of third and fourth-year students, a descriptive non-experimental method was applied in this study. The approach was chosen to explain and investigate how they felt about the new teaching techniques used in the BNS program. If there is minimal information on the subject being examined, the descriptive method can be employed (Gray et al 2017:202). The descriptive method, according to Polit and Beck (2017:205), discusses the characteristics of the population and/or the phenomenon being examined rather than the reasons behind it. The phenomenon being studied was the perceptions of students regarding the innovative strategies, hence the research questions for this study were:

- What are the nursing students' knowledge, understanding and attitude toward innovative teaching and learning strategies used in the BNS module?

- What are the teaching strategies that motivate nursing students to participate in the innovative teaching and learning environment?

A survey was used as the sort of descriptive method to learn more about respondents' attitudes and knowledge about creative teaching techniques. Short replies from the students were gathered using questionnaires that contained closed-ended questions. The

questions centered on the creative teaching and learning methods used at the school under investigation. Jigsaw puzzles, group debates, multiple intelligence, and online and e-learning tools like WhatsApp were among the techniques used.

According to Polit and Beck (2017:205), the goal of the descriptive design is to identify and specify the traits of a situation in a typical circumstance. To guarantee accurate and high-quality data is gathered, the study's data were gathered in a typical classroom setting with unhurried students.

Characteristics of the descriptive methods are:

- It can be qualitative or quantitative. In this study, to gather quantifiable data for statistical analysis of the population sample, the researcher utilized a descriptive quantitative design. Therefore, the researcher used questionnaires to collect numerical data for statistical analysis.

- Uncontrolled variables, where the characteristics are not manipulated, and the researcher is not involved. In this study, the researcher was not involved and there was no intervention during data collection.

- Diverse data collection methods. Data can be collected using surveys, observations, and case studies. A survey was used in this study to collect a large amount of data (N=288).

- Characteristics of the respondents can be defined. Third- and fourth-year nursing students who participated in the implementation of interactive conversations, jigsaw puzzles, multiple intelligence, online and e-learning, such as the WhatsApp platform during the BNS class, were the respondents in the study.

3.3.1 Population

De Vos et al. (2017:223) describe a population as the entirety of individuals, events, organizational units, case records, or whatever can supply the knowledge or data needed for research, while Gray et al. (2017:329) define a population as a specific group of people in which a researcher is interested. In this study, the researcher's population was nursing students who were registered at a Nursing College in Gauteng, for General Nurse

(General, Psychiatry and Community) and Midwifery nursing programmes. The target group included the BNS students. The accessible group consisted of fourth-year students who studied BNS in 2019 and third years of the 2020 BNS class and who were involved in the different teaching strategies during BNS facilitation.

3.3.2 **Sample and sampling**

A sample, according to Polit and Beck (2017:743), is the segment of the population that consists of study participants who have been chosen.

Gray et al. (2017:329) define sampling as the process of selecting portions of the population or a group of people, events, behaviors, or other factors to use in research. (Ott et al 2018:109).

According to the literature, there are two primary types of sampling: probability sampling and non-probability sampling. In contrast to non-probability sampling, which excludes some population parts, probability sampling involves the random selection of individuals from a population in which each member has an equal and independent chance of being chosen (Gray et al 2017:342). The non-probability convenient sampling strategy was employed by the researcher.

The sample included the third- and fourth-year students who were accessible and knowledgeable about the phenomenon the researcher is investigating. The sample met the inclusion criteria. A sample size of 288 students was accessible from the student population. The sample size was large to ensure that the knowledge gained is representative of the population.

Inclusion criteria

All students at the selected campus who studied and passed BNS as a module in their second year of study and who were involved in the different teaching and learning strategies in 2019 and 2020.

Exclusion criteria

- All students at the selected campus who did not experience different teaching and learning strategies.
- Students from the three campuses where different teaching and learning strategies were not used.
- Students where a lecturer method was the only method used for teaching and learning.

3.3.3 Data collection

Data collection, according to Bhandari (2020), is the process of compiling information on relevant variables in a way that enables one to respond to the stated research topic.

3.3.3.1 Data collection approach and method

t has been noted by Polit and Beck (2017:725) and De Vos et al. (2017:226) that data can be gathered utilizing both structured and unstructured methods. In this study, the researcher created a questionnaire with 49 items that served as a structured self-report instrument (Annexure H). A questionnaire, as defined by Gray et al (2017:407), is a written self-report form intended to elicit information from the respondents' written responses. The instrument was given to the respondents, who were reading and writing-capable nursing students, and they self-administered it.

3.3.3.2 Characteristics of the data collection instrument

Gray et al (2017:407) explained a questionnaire as a document with questions to gather data suitable for research analysis. The content of the questionnaire was at the educational level of the respondents i.e. the students who did and passed BNS in the second year of study. According to Gray et al. (2017:407), the questionnaire's qualities are explicit, and its wording is straightforward. Avoiding leading questions will help to eliminate researcher bias (Polit & Beck 2017:270). In comparison to interviews, Polit and Beck (2017:275) believe that questionnaires are more cost-effective, time-efficient, and private.

The questionnaire consisted of 49 closed-ended questions divided into Sections A and B (Annexure H). Section A comprised nine dichotomous items about the demographic data. Section B (Questions 10 to 47) addressed the students' experiences about perceptions and attitudes toward innovative teaching methods, working in groups (jigsaw puzzles), multiple intelligence, and online teaching and e-learning in the BNS module. The last two variables (Questions 48 and 49) required respondents to answer, 'Yes' or 'No' to the question to motivate the choices they made. A four-point Likert scale was used where respondents were to indicate the extent to which they agree or disagree to express their viewpoints regarding the four constructs/factors in Section B. The rating was as follows: 'Strongly disagree; Disagree; Agree and Strongly agree'.

3.3.3.3 Data collection process

According to Disaster Management Act: Regulations: Alert level 3 during the COVID-19 lockdown, a 50% occupancy rate was to be maintained in the venues. The two auditoria with a capacity value of 360 seats were used for 153 fourth-year students, and 146 third-year students were accommodated in the separate 350-capacity classroom to ensure that a two-meter distance from each other was maintained. Clearly marked signs of: "No mask no entry was displayed on each entrance to ensure that all participants had their masks on. All venues were supplied with sanitizers for the lecturers assisting with the distribution of consent forms and questionnaires.

Two lecturers, one in each venue assisted the researcher with the issuing and collection of questionnaires and consent forms. The consent forms and questionnaires were placed on the marked desks before the students could come into the venue. The researcher read and explained the contents of the information letter and the consent form to the respondents before the completion of the questionnaire (Annexure F, Annexure G, Annexure H). The respondents were made aware that participation was voluntary and that the choice not to participate will not affect their relationship with the researcher nor the nursing college. They were also informed that they can withdraw at any stage if they decide not to participate and there won't be any penalties. After information sharing, the researcher left the venue with the lecturers to continue with the collection of data.

The questionnaire took an average of 30 minutes to complete. Two marked boxes were placed in each venue. Completed questionnaires and consent forms were dropped

directly into the designated boxes by respondents and were not handled by the lecturers. Two hundred and ninety-nine (299) questionnaires were issued and two hundred and eighty-eight (N=288) were received back from the respondents. The boxes were sealed and kept for 24-hours before they could be handled for sorting and coding.

3.3.3.4 Data analysis

- *Data preparation*

Data editing was done whereby the questionnaires were checked for errors, completeness, and that they can be read. Thereafter data was prepared in the form of numerical codes which were already in the questionnaire. De Vos et al (2017:252) define coding as the systematic reorganisation of raw data into a format that is computer readable. A coding spreadsheet with variables and number values was created using Microsoft Excel for computerised analysis. The questionnaires consisted of closed-ended questions which made it easier for numerical coding. Therefore, the responses in both Sections A and B were coded numbers from 1 to 5, except for questions 48 and 49 (Annexure H). The nominal data from the demographic information was coded using a coding scheme 1 for males and 2 for females. Ratio scale data such as age, the year the students passed grade 12 and the symbol obtained in life sciences were coded 1 to 5, or as entered by the respondent. The interval-ratio scaling in Table 4.4 to Table 4.7 was used to measure student participation, working in groups (jigsaw puzzle), multiple intelligence approach, and online teaching and e-learning. A four-point Likert scale where respondents were requested to agree or disagree with the statements was used where (1)=Strongly Disagree, (2)=Disagree, (3)=Agree and (4)=Strongly Agree.

Data cleaning was done, and the researcher and statistician went through the spreadsheet to identify and eliminate errors in the codes.

- *Analysis*

The researcher engaged a statistician to help assist with the editing and analysing of data using the Statistical Package of Social Sciences (SPSS) version 28 statistical software programme (Annexure J). Descriptive statistics were used to organise and summarise data from the sample. The types of descriptive statistics include the measure of

frequency, central tendency, and dispersion (Holcomb 2016:2). A measure of frequency that deals with the number of occurrences and percentage (Mishra, Pandey, Singh, Gupta, Sahu, Keshri & 2019:67) were applied for nominal data in Figure 4.1 which depicted the percentage of males against females in the sample. The mean as a measure of central tendency was used to obtain the value by adding all the scores in the distribution and dividing by the number of scores (Polit & Beck 2017:361). This is shown in Tables 4.4 to 4.7.

- *Statistical significance*

Pearson's chi-square test was conducted to assess the relationship between respondents' viewpoints towards biological natural sciences and symbols obtained in grade 12 as indicated in Table 4.3.

3.3.3.5   Ethical considerations related to data collection

Polit and Beck (2017:727) define ethics as a set of moral principles that are concerned with how closely research practices abide by their commitments to study participants on a professional, legal, and societal level. The Belmont Report identified three major ethical principles as respect for persons, beneficence, and justice (Polit & Beck 2017:139), to ensure that the research that is conducted will not be harmful to the participants. The researcher considered the ethical principles of respect for persons, beneficence and non-maleficence regarding the institution, respondents, the researcher, and the scientific integrity of the research (Polit & Beck 2012:139).

3.3.3.5.1   Institution

The researcher collected data after obtaining Ethical clearance from UNISA College Human Sciences Research Ethics Review Committee (HSREC), (Annexure A) and permission from the Gauteng Provincial Protocol Review Committee (PPRC) (Annexure C). The Campus Head signed and granted the researcher permission to collect data from the institution (Annexure E).

3.3.3.5.2   *Respondents*

- **Respect for persons**

Autonomy and freedom to participate

Respect for people upholds their freedom of choice to participate in the study and their right to self-determination (Gray et al 2017:163). It includes autonomy, which is the ability to choose one's course of action. The prospective participants had no diminished autonomy as they were all above the age of 18 and mentally competent. Therefore, the researcher explained the purpose, nature, and significance of the study to the students before collecting data. They were informed about the permission sought from the UNISA College Human Sciences Research Ethics Review Committee (HSREC) (Annexure A), the Provincial Protocol Review Committee (PPRC) (Annexure B) as well as the educational institution where data were collected (Annexure D).

The respondents were treated with respect and were allowed to ask questions after the information related to the study was shared with them so that they can make informed decisions, before consenting to participate in the study. The researcher informed the respondents that participation is voluntary and that they have the right to decline from the study at any time they wish to do so without any penalty. Prospective participants were not pressured to take part in the study and were informed that there won't be any penalty for non-participation.

Informed consent

In this study, no information was withheld necessary for the potential participants to have free choices and make informed decisions. They were issued consent forms to sign. Those who volunteered to participate in the research completed the consent forms and submitted them to the lecturers.

- **Beneficence and non-maleficence**

Beneficence requires the researchers to maximise benefits and prevent harm to the respondents. In the study the questionnaire was used to collect data thus no harm was

anticipated, furthermore, participation was voluntary. Respondents were taken through the purpose of the study to avoid conflicts and misunderstandings which might arise.

- **Justice**

Justice includes the right to fair treatment and the right to privacy (Polit & Beck 2017:141).

Right to privacy and anonymity

Participants have the right to expect their information to be kept in confidence. Therefore, the consent form was not attached to the questionnaire so that no particular response could be traced to a particular respondent, thus ensuring privacy. The researcher assured participants of privacy, confidentiality, anonymity, and that information collected will be shared with the researcher's supervisor, and the statistician and no other person will get access to it. At the end of data collection, the boxes were sealed and kept safe to avoid unlawful access to the questionnaires for 24-hours before they could be sorted and coded to observe COVID-19 protocol.

3.3.3.3 Researcher

To maintain integrity and fidelity the researcher was guided by the supervisor and statistician. Different sources in the form of books and publications were consulted and acknowledged according to the prescribed referencing method.

3.4   INTERNAL AND EXTERNAL VALIDITY OF THE STUDY

The validity, according to Sürücü and Maslakçl (2020:2696), refers to how well a measuring tool fulfils its intended purpose and identifies the quality or behaviour that it is anticipated to assess. The validity of the study is determined by its authenticity (Gray et al. 2017, 407), and any circumstance that reduces the validity of the research findings constitute a danger to validity.

3.4.1 Internal validity

The degree to which the observed results accurately reflect the population under study is known as internal validity (Andrade 2018:498). Threats to internal validity, such as instrumentation, selection bias, statistical regression to the mean, and attrition, were emphasized by Polit and Beck (2017:747) and should be eliminated for the study to be reliable.

3.4.1.1 *Instrumentation*

The questionnaire was developed by the researcher, after identifying the information desired and was reviewed by the supervisor and the statistician to ensure that it is relevant and appropriate can answer the research questions and the objectives of the study (Annexure H, Annexure J). A pilot study before the main study was conducted to test the understanding of the questionnaire. Questionnaires were distributed to five (5) third-year students who met the inclusion criteria. The students were to analyse the questions in the questionnaire with regards to spelling mistakes, clarity and repetition of the question as well as the time to be taken to complete the questionnaire (Gray et al 2017:55) The responses of the pilot study were included in the major study as there were no modifications to be made to the tool. The researcher implemented the same questionnaire for both third- and fourth-year students at the same time to collect data. In this study, internal validity was not compromised since, according to Andrade (2018:499), the use of a questionnaire in a single group study serves to conceal the study's goal and prevent challenges to internal validity.

3.4.1.2 *Selection bias*

Selection biases result from pre-existing disparities between the sample groups that are compared on a pre-test measure, (Gray et al. 2017:226). In this study, the researcher collected data from the sample at one point time, and participants were not compared. Therefore, there was no pre-existing knowledge between the groups which might have a negative impact on the validity of the study. The sample group was selected objectively as it consisted of students who experienced the different teaching and learning strategies only.

3.4.2 External validity

Examining the study's external validity determines whether the findings can be applied to a larger group (Gray et al 2017:227). According to the literature, the sample's representation of the population and the consistency of the results of earlier studies in the same field are what constitute external validity (Andrade 2018:498; Gray et al 2017:227; Polit & Beck 2017:747).

3.4.2.1 Sample size

In this study, 299 potentially eligible students who experienced different teaching strategies were invited to participate in the classroom setting. The accessible group was representative of the target population of 380 who studied BNS as a module thus preventing sample bias. Therefore, the sample size was adequate as 288 participated and eleven 11 declined to participate this was determined by the number of questionnaires returned to the researcher. Those who did not participate constituted only 4%, therefore the outcome can be generalised. Generalisation is regarded by literature as the essential goal of research (Andrade 2018:501; Gray et al 2017:228).

3.4.3 Content validity

Almanasreh, Moles and Chen (2019 214) defined content validity as the process of evaluating an instrument to see if all its components are relevant to and representational of the targeted construct,

- *Consultation with experts*

The draft questionnaire was submitted to the supervisor of the study at the University of South Africa (UNISA), a statistician who examined the questionnaire to determine whether all the component elements of were relevant and appropriate for the constructs.

- *Literature review*

The questionnaire was developed following an extensive literature review to determine the limits of the study

- *Representatives of the population*

A sample of five (5) third-year student nurses were issued with the questionnaires to check the wording, clarity or confusing responses and time required to complete the questions. (Polit & Beck 2017:337).

3.5 Reliability

The consistency with which measurements of a phenomenon provide the same results under the same circumstances is known as reliability (Taherdoost 2016:30). The internal consistency of the questionnaire items was assessed using Cronbach alpha. The reliability test was used to examine the statistical significance of how well the collection of items accurately measured a specific construct or component. The Cronbach alpha values of all the constructs indicated a high reliability (0.70-0.90) value above 0.70 (Taherdoost 2016:33).

3.6   CONCLUSION

The chapter discussed the method used in the study, the research design, sampling, data collection, data analysis, ethical considerations, validity, and reliability.

CHAPTER 4

ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH FINDINGS

4.1   INTRODUCTION

This chapter presents quantitative results analysed through the Statistical Package of Social Sciences (SPSS) computer program version 28. Data is presented using graphs and tables.

4.2   DATA MANAGEMENT AND ANALYSIS

One hundred and fifty-three (153) questionnaires were distributed to the fourth-year students and 146 questionnaires to the third years. One hundred and forty-eight (148) and 140 were returned respectively from both groups. Two hundred and ninety-nine (299) questionnaires were distributed, and 288 completed questionnaires were received back from the respondents. The questionnaires that were analysed were two hundred and eighty-eight (N=288). Eleven of the respondents did not return the questionnaires. Before data analysis, the questionnaires were given unique identity numbers from 1 to 288. A Microsoft Excel spreadsheet was used to compute statistics.

Researchers often use quantitative data analysis to transform data into numerical form and apply it to statistical analysis (De Vos et al 2017:249). To study, test, and draw conclusions from the relationship between the research problem and the data, data analysis reduces the data to a form that can be read. The researcher engaged the services of statisticians to analyse data (Annexure J). Statistical Package of Social Sciences (SPSS) version 28 software program was used to analyse data. The descriptive statistics that were applied included the frequency distribution, percentages, and the mean.

4.3   RESEARCH RESULTS

4.3.1   Demographic characteristic

4.3.1.1   Respondents' gender
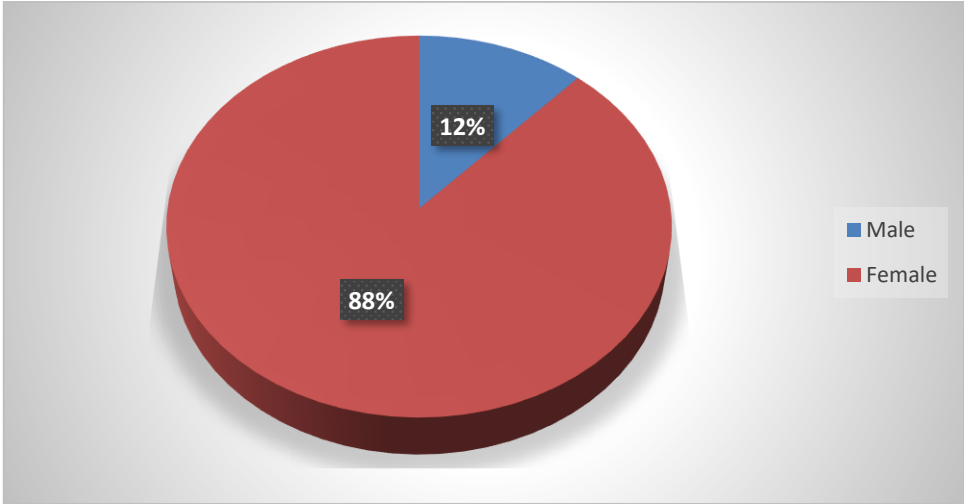
Figure 4.1 Gender distribution (N=288)

Figure 4.1 provides a summary of the gender distribution of the respondents. The result shows that 12% were male respondents while 88% were female, suggesting that more females were represented in the survey than males.

4.3.1.2   Age of respondents
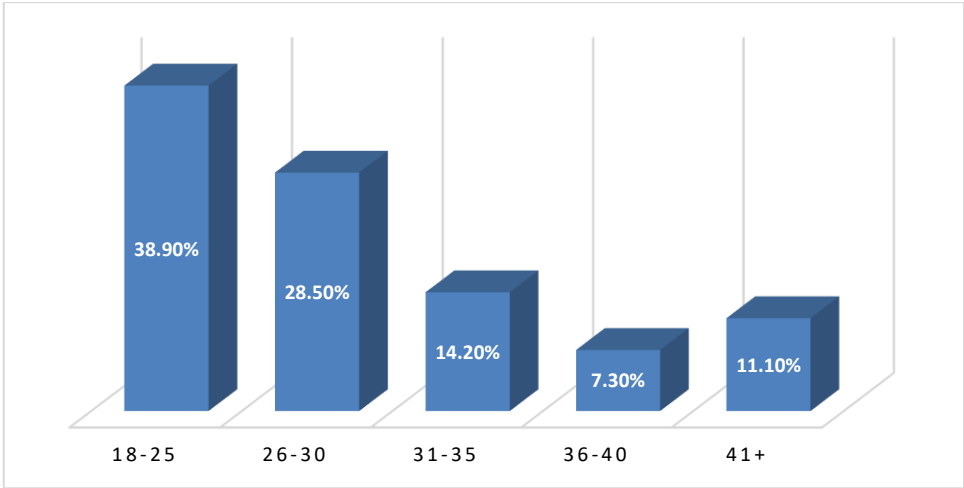
Figure 4.2 Age distribution (N=288)

Figure 4.2 provides a report on the age distribution of respondents ranging from 18 years to 41+. According to the report in Figure 4.2, most of the respondents, thus 38.9%, were within the age bracket of 18-25. This is followed by the ages between 26 and 30 represented by 28.5% of the respondents. About 14.2% of the respondents were within the age bracket of 31-35, while 11.1% were beyond forty (40) years. The age bracket with the least number of respondents was 36-40, representing 7.3%. The survey results indicate that most of the sampled respondents were in their youthful age and may still have fresh memories regarding the life sciences done at school.

4.3.1.3 Highest level of education attained by respondents
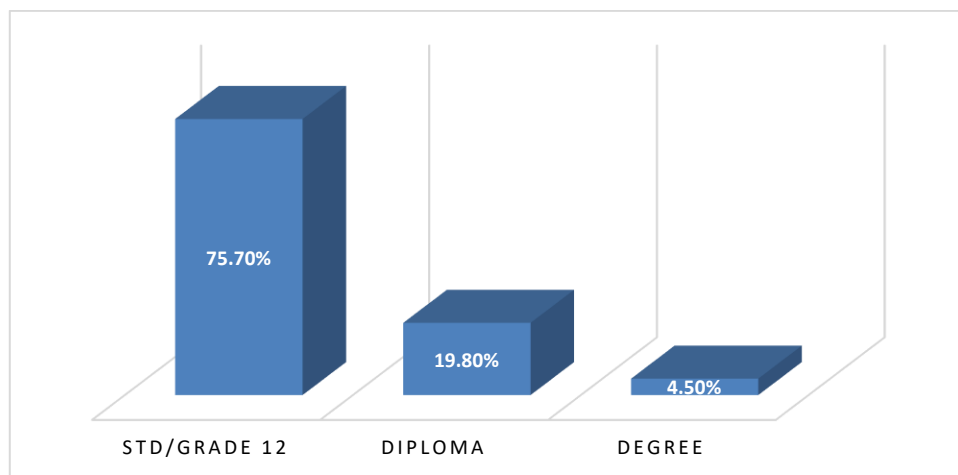
Figure 4.3 Level of education (N=288)

The respondent's level of education was also considered in the study. the degree holders constituted 4.5% of the respondents. The level of education with the highest representation as standard (STD)/Grade 12, is represented by 75.7% of the total respondents, which is more than 50% of the sample size. About 19.8% have a diploma as their highest level of education. The results show that the respondents have attained standard/ grade 12, the minimum educational level which is required for this study. It also suggests that respondents can comprehend and provide relevant answers to questions regarding their experiences in the BNS module.

4.3.1.4   Recognition of prior learning (RPL) students
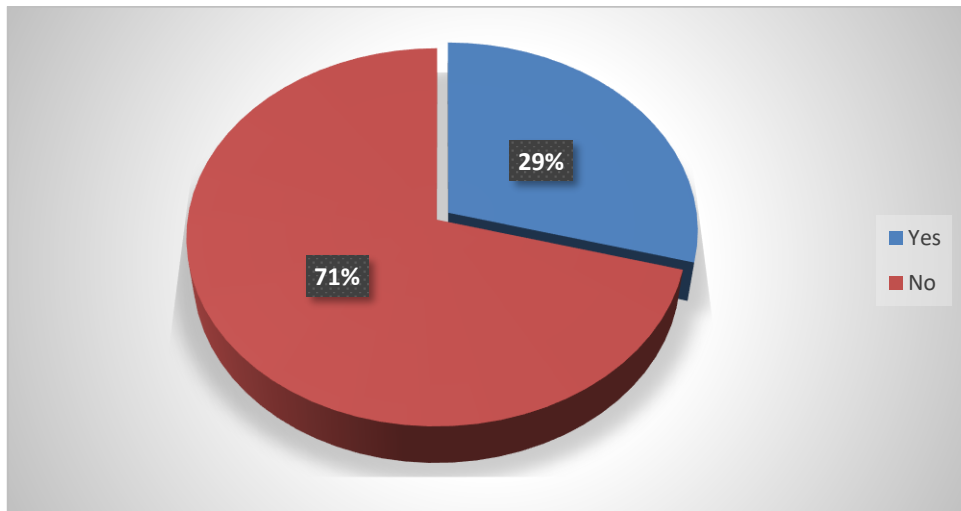
Figure 4.4 Recognition of prior learning (RPL) students (N=288)

Respondents were asked whether they were RPL students (recognition of prior learning). Interestingly, more than half of the sample (71%) did not go through the RPL programme, whereas 29% went through the programme. It will be interesting to know how the RPL students will relate to the innovative teaching strategies.

3.4.1.5   Type of school attended
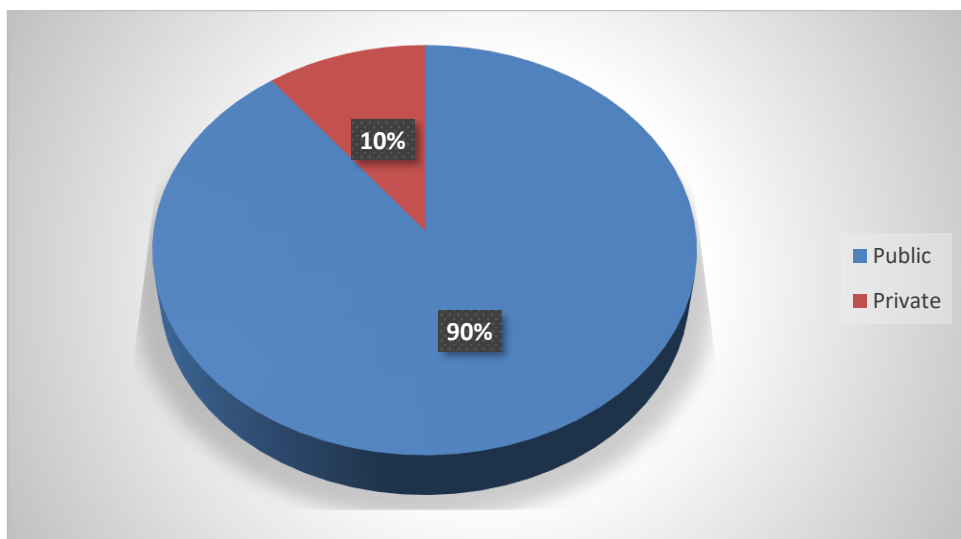
Figure 4.5 Types of schools attended (N=288)

Figure 4.5 reveal that more than half (90%) attended a public school, while only 10% of the respondents attended private schools.

3.4.1.6 Did you study Life Sciences/Biology at school?
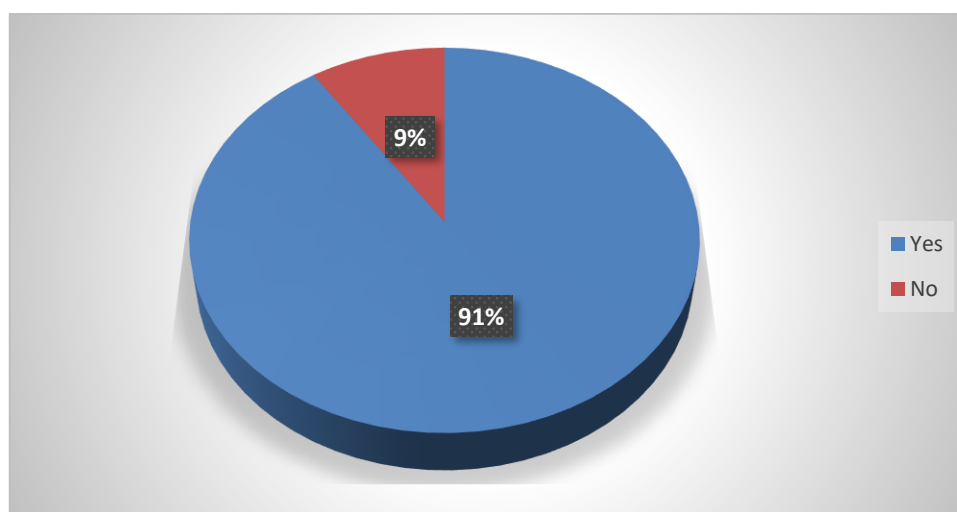
Figure 4.6 Studied Life Sciences/Biology at school (N=288)

The results in Figure 4.6 show that most of the respondents, representing 91%, studied Life Sciences at school while 9% were not taught Life Science at school. This implies that most of the respondents have some knowledge about the Life Sciences/Biology module at school. Hence, represent the right respondents to express their views about the BNS survey questions.

4.3.1.7 Assessment of Life Sciences/Biology at School

Table 4.1   Assessment of Life Sciences/Biology at school (N=288)

Variables	Categories	Frequency	Percentage
Year of completion in Life Sciences	One year ago	0	0.0
	Two years ago	0	0.0
	Three years ago	2	0.70
	Four years ago	15	5.20
	Five+ years ago	244	84.70
	Did not do Life Sciences at school	27	9.40
Symbol obtained in Life Sciences	A	27	9.40
	B	104	36.10
	C	73	25.30
	D	38	13.20
	E	19	6.60
	None	27	9.40

(Source: Field Data 2021))

This section assesses the experience of respondents regarding the Life Sciences/Biology module at school. Two hundred and sixty-one (261) did Life Sciences at school whereas 27 did not. The findings from Table 4.1 reveal that 84.7% of the respondents passed Life Science/Biology five-plus years ago. About 5.2% stated they passed their Life Science/Biology course four years ago, while only 0.70% passed their Life Science course three years ago. No respondent passed their Life Science/Biology course in recent years; thus, in the past two years. About 9.4% of the respondents did not do Life Science/Biology as a course in school.

The survey results further revealed that about 9.4% scored A in their Life Science/Biology course. About 36.10% scored B, while 25.30% scored C. About 13.2% and 6.6% of the students scored D and E, respectively, in their Life Science/Biology course. The results in Table 4.1 shows that most of the respondents performed above average, which gives a good impression about their understanding and performance in Life Science or Biology courses at school.

4.3.1.8 Recognition of Prior Learning (RPL) student and symbol obtained

Table 4.2   Symbols (N=288)

RPL student	Symbol						Total
	None	**A**	**B**	**C**	**D**	**E**	
No	7 (3.41%)	27 (13.17%)	98 (47.80%)	58 (28.29%)	15 (7.32%)	0 (0.0%)	205
Yes	20 (2.10%)	0 (0.0%)	6 (7.23%)	15 (18.07%)	23 (27.71%)	19 (22.89%)	83
Total	**27**	**27**	**104**	**73**	**38**	**19**	**288**
Pearson Chi-Square: 139.623 (0.000)							

Table 4.2 examines whether there is a statistically significant difference between RPL students and the symbols they recorded. Surprisingly, the results show that no RPL students scored A, while 19 of the RPL students scored E, showing poor performance The results indicate that understanding BNS might be a challenge for the RPL students.

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4.3.1.9   *Viewpoint towards Biological and Natural Sciences*

Table 4.3   Viewpoint towards Biological and Natural Sciences (BNS) and symbol (N=288)

Viewpoint towards Biological Natural Sciences	Symbol						Total
	None	A	B	C	D	E	
Interesting	18 (7.11%)	25 (9.88%)	100 (39.53%)	63 (24.90%)	33 (13.04%)	14 (5.53%)	253 (87.85%)
Boring	0 (0.00%)	1 (10.00%)	2 (40.00%)	2 (40.00%)	0 (0.00%)	0 (0.00%)	5 (1.74%)
Difficult	9 (30.00%)	1 (3.33%)	2 (6.67%)	8 (26.67%)	5 (16.67%)	5 (16.67%)	30 (10.42%)
Total	**27**	**27**	**104**	**73**	**38**	**19**	**288**
Pearson Chi-Square: 36.112 (0.000)							

The results in Table 4.3 show the relationship between respondents' viewpoints towards biological natural sciences and symbols obtained. Out of the total respondents, 88% found the Life Science/Biology course interesting. This supports the reason why most of the students performed beyond the average mark in school. Figure 4.3 further reveals that only 2% stated that Life Science/Biology courses were boring, while about 10% indicated that it was very difficult to understand.

The chi-square value was statistically significant (0.000). In summary, the viewpoints of respondents towards BNS are associated with their performance.

4.3.1.10 Level of Biological and Natural Sciences (BNS) knowledge
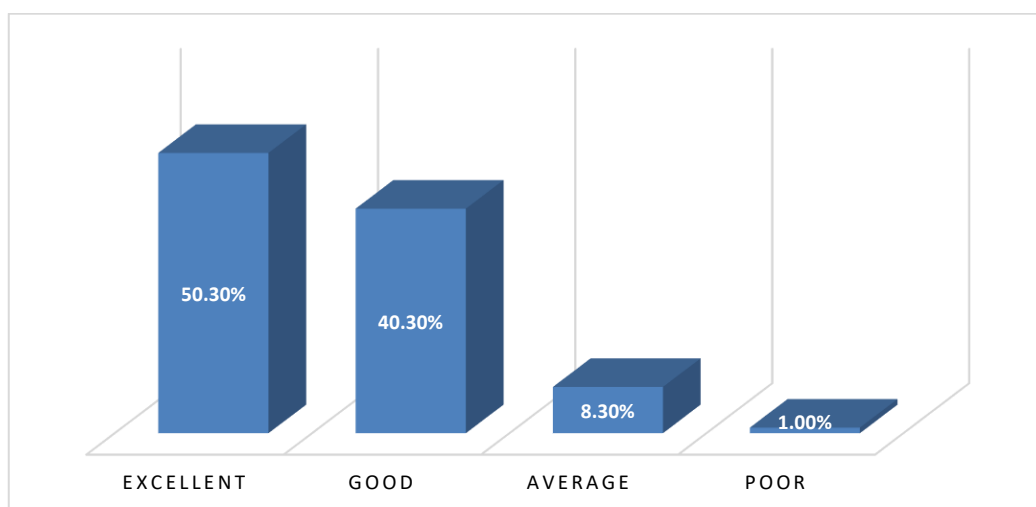
Figure 4.7 Level of BNS knowledge (N=288)

According to the survey as shown in Figure 4.7, about half (50.30%) recorded that lecturers' level of BNS knowledge was excellent. About 40.3% indicated that the lecturer's level of BNS knowledge was good, and 8.30% recorded their lecturers had an average level of knowledge. Only 1% of the respondents rated their lecturers as having a poor level of knowledge in BNS courses. In summary, the survey response showed that most lecturers possessed adequate knowledge of facilitating the BNS module.

4.3.1.11 Teaching methods of Biological and Natural Sciences (BNS) lectures
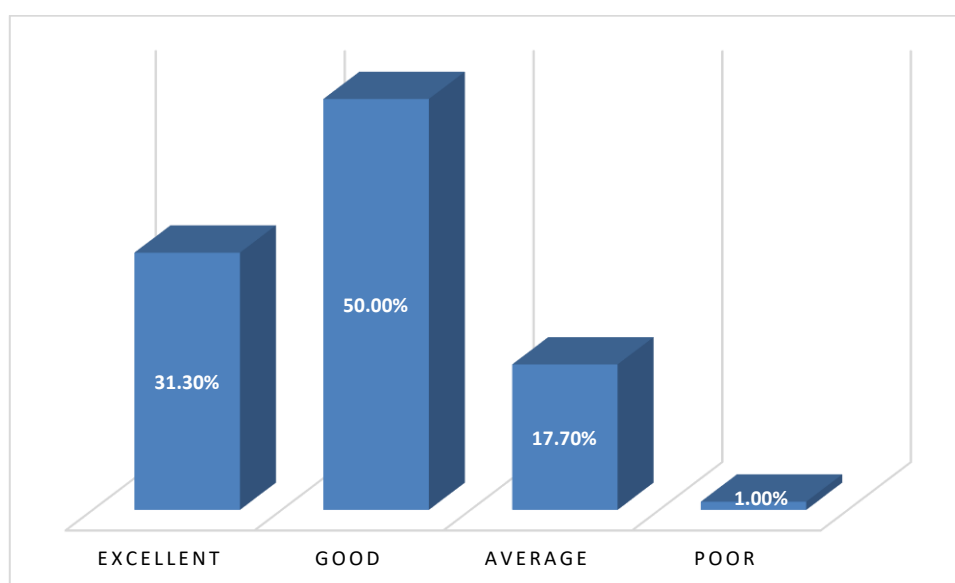
Figure 4.8 Rating the teaching methods of BNS lectures (N=288)

Regarding the jigsaw puzzle, the Multiple intelligence approach and online and e-learning teaching and learning methods adopted by BNS lecturers, 31.3% stated that they were excellent, while 50.00% stated that they were good. Figure 4.8 states that only 17.70% revealed that the lecture teaching method was average, while 1% said the lecturers' teaching method was poor.

4.3.2 Perceptions and attitudes toward different/innovative teaching methods during the Biological and Natural Science (BNS) module

4.3.2.1 Students' participation

Table 4.4   Students' participation (N=288)

Item	Responses as frequency (%)				N	Mean	P-values
	Strongly Disagree	Disagree	Agree	Strongly Agree			
	1	2	3	4			
I believe that students should take part in learning through discussion	7 (2.4%)	13 (4.2%)	160 (55.6%)	109 (37.8%)	288	3.29	0.000*
Participation in class activities helps me to think about what I am learning	3 (1.0)	38 (13.2%)	152 (52.8%)	95 (33.0%)	288	3.17	0.000*
I learn better when I am to interact with the teacher and other students	8 (2.8%)	40 (13.9%)	147 (51.0%)	93 (32.3%)	288	3.12	0.000*
I like learning situations where I can take an active part in discussions and ask questions	12 (4.2%)	47 (16.3%)	159 (55.2%)	70 (24.3%)	288	2.99	0.000*
I like classes where I can participate by putting my views and points forward	7 (2.4%)	67 (23.3%)	146 (50.7%)	68 (23.6)	288	2.95	0.000*
I wish more classes were taught with an emphasis on students' participation	17 (5.9%)	71 (24.7%)	137 (47.6%)	63 (21.9%)	288	2.85	0.000*
I don't like classes where students do the teaching instead of the lecturer	17 (5.9%)	70 (24.3%)	97 (33.7%)	104 (36.1%)	288	3.00	0.000*

(Source: Field Data 2021)

Table 4.4 presents respondent opinions on student participation during the BNS module. The results indicated that 37.8% of the respondents strongly agreed that students should take part in learning through discussions. This is supported by 55.6% who agreed with this assertion. Also, about 85.8% of the respondents agreed (both agree and strongly agree) with the notion that participation in class activities help them to think about what they are learning. On the contrary, a total of 14.2% disagree with this notion. The results from Table 4.4 further show that more than 50% of the respondents supported the following regarding students' participation. These include:

- "I learn better when I am to interact with the teacher and other students" (32.3%=Strongly Agree; 51%=Agree).
- "I like learning situations where I can take an active part in discussions and ask questions" (24.3%=Strongly Agree; 55.2%=Agree).
- "I like classes where I can participate by putting my views and points forward" (23.6%=Strongly Agree; 50.7%=Agree).
- "I wish more classes were taught with an emphasis on students' participation" (21.9%%=Strongly Agree; 47.6%=Agree).
- "I don't like classes where students do the teaching instead of the lecturer" (36.1%=Strongly Agree; 33.7%=Agree).

Regarding the mean values, the question that states "I wish more classes were taught with an emphasis on students' participation" had the lowest mean of 2.85, while "I believe that students should take part in learning by discussion" had the highest mean of 3.29. This implies that the students are prepared to participate in class during group discussions.

4.3.2.2 Working in groups (jigsaw puzzles)

Table 4.5   Jigsaw puzzles (N=288)

Item	Responses as frequency (%)				N	Mean	P-values
	Strongly Disagree	Disagree	Agree	Strongly Agree			
	1	2	3	4			
I attend class to learn from the teacher, not from other students	40 (13.9%)	111 (38.5%)	63 (21.9%)	74 (25.7%)	288	2.59	0.000*
I learn more in classes where I work together with other students rather than listening to lecturers	32 (11.1%)	128 (44.4%)	106 (36.8%)	22 (7.6%)	288	2.41	0.005*
Working in groups in class help me to understand the material better	29 (10.1%)	85 (29.5%)	135 (46.9%)	39 (13.5%)	288	2.64	0.000*
The jigsaw puzzle makes students rely on each other for information	17 (5.9%)	72 (25.0%)	167 (58.0%)	32 (11.1%)	288	2.74	0.000*
I like the jigsaw puzzle because I learn from fellow students rather than from a teacher	29 (10.1%)	132 (45.8%)	103 (35.8%)	24 (8.3%)	288	2.71	0.000*
I can express myself when using jigsaw a puzzle	25 (8.7%)	105 (36.5%)	126 (43.8%)	32 (11.1%)	288	2.57	0.000*
I was able to improve social and emotional learning through a jigsaw puzzle	27 (9.4%)	89 (30.9%)	131 (45.5%)	41 (14.2%)	288	2.65	0.003*
Jigsaw puzzle helps to improve listening, communication, and problem-solving skills	8 (2.8%)	66 (22.9%)	154 (53.5%)	60 (20.8%)	288	2.64	0.000*
A jigsaw puzzle is a waste of time, I want to be taught by the lecturer	23 (8.0%)	98 (34.0%)	112 (38.9%)	55 (19.1%)	288	2.69	0.000*
A jigsaw puzzle is a waste of time, I want to be taught by the lecturer	71 (24.7%)	120 (41.7%)	71 (24.7%)	26 (9.0%)	288	2.18	0.000*
The method should be used frequently	36 (12.5%)	89 (30.9%)	129 (44.8%)	34 (11.8%)	288	2.56	0.000*

(Source: Field Data 2021)

Respondents' opinions regarding students working in groups were assessed. The essence of this construct was to identify how working in groups facilitates understanding. To achieve this, eleven statements were considered, as shown in Table 4.5. Respondents were asked to rate their level of agreement concerning the questions outlined in Table 4.5. More than 50% of the respondents agreed to each of the questions that working in groups and jigsaw strategies help them to understand the content better. Only two of the questions recorded more than 50% disagreement by the respondents.

That is:

- "I learn more in classes where I work together with other students rather than listening to lecturers" (11.1%=Strongly disagree; 44.4%=Disagree).
- "Jigsaw puzzle is a waste of time; I want to be taught by the lecturer" (24.7%=Strongly disagree; 41.7%=Disagree).

The mean score for the questions in Table 4.5 recorded above-average values except for the two questions recording a higher level of disagreement by the respondents. The results indicate a strong agreement to the various questions indicating that working in groups is important in helping students understand BNS subjects. This was confirmed by the p-values of 0.000*, which was statistically significant.

4.3.2.3   Multiple intelligence approach

Table 4.6   Multiple intelligence approach (N=288)

Item	Responses as frequency (%)				N	Mean	P-values
	Strongly Disagree	Disagree	Agree	Strongly Agree			
	1	2	3	4			
I do not forget information when it is presented in a form of music, as a role play or in drama	38 (13.2%)	54 (18.8%)	107 (37.2%)	89 (30.9%)	288	2.86	0.000*
I do not like performing in front of other students	31 (10.8%)	66 (22.9%)	89 (30.9%)	102 (35.4%)	288	2.91	0.000*
Multiple intelligence promotes student involvement	12 (4.2%)	27 (9.4%)	155 (53.8%)	94 (32.6%)	288	3.15	0.000*
Multiple intelligence promotes group cohesion	3 (1.0%)	27 (9.4%)	149 (51.7%)	109 (37.8%)	288	3.26	0.000*

I like learning and working alone	32 (11.1%)	77 (26.7%)	80 (27.8%)	99 (34.4%)	288	2.85	0.000*
The method should be used frequently	31 (10.8%)	75 (26.0%)	137 (47.6%)	45 (15.6%)	288	2.68	0.000*

(Source: Field Data 2021)

The Multiple Intelligence approach describes how the use of different techniques promotes student involvement and creativity. Different techniques such as music, role play, and drama were considered. According to the results in Table 4.6, 30.9% of the respondents strongly agreed that they do not forget information when it is presented in the form of music, as a role play or drama, 37.3% agreed with the statement, while about 18.8% and 13.2% disagreed or strongly disagreed. About 35.4% of the respondents indicated that they do not like performing in front of other students, while 30.9% agreed. Conversely, 22.9% disagreed with this statement, whiles 10.8% strongly disagreed, hence like performing in front of other students.

The study further revealed that the Multiple Intelligence Approach promotes student involvement and creativity. This was supported by (53.8%=Agree; 32.6%=Strongly Disagree). Only 9.4% disagreed with this statement, and 4.2% strongly disagreed. More so, more than half (51.7%) agreed that multiple intelligence promotes group cohesion. This is supported by 37.8% who strongly agreed with this fact. About 10% showed some level of disagreement with this statement.

Interestingly, 27.8% of the respondents revealed that they like learning and working alone, and 34.4% strongly agreed. On the contrary, 26.7% disagreed with this statement, while 11.1% strongly disagreed that learning and working alone was something they did not enjoy. The last question for this category shows how the Multiple Intelligence Approach should be used frequently. About 47.6% agreed to its continual usage, while 15.6% strongly agreed. On the other hand, 10.8% strongly disagreed, and 26% disagreed that this approach should be used frequently.

The mean, which collectively measures the average response for each question, records an average score above 2.5, indicates above-average acceptance of the multiple intelligence approach, and vice-versa. The one-sample t-test was used to determine whether the level of agreement for these questions differs significantly from the average score of 2.5. Table 4.6 shows that the p-values were statistically significant, supporting

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the argument that the Multiple Intelligence Approach is a vital part of the teaching and learning strategy.

4.3.2.4 Online teaching and e-learning

Table 4.7   Online teaching and e-learning (N=288)

Item	Responses as frequency (%)				N	Mean	P-value
	Strongly Disagree	Disagree	Agree	Strongly Agree			
	1	2	3	4			
I benefit more through WhatsApp group discussions because of feedback from classmates and the teacher	47 (16.3%)	80 (27.8%)	84 (29.2%)	77 (26.7%)	288	2.66	<.000*
The reference material (e.g. online videos, and voice recording posted by my lecturers are useful in understanding the learning outcomes of the course	20 (6.9%)	41 (14.2%)	111 (38.5%)	116 (40.3%)	288	3.12	<.000*
The use of online teaching is a good tool to supplement face-to-face discussion in class	37 (12.8%)	94 (32.6%)	83 (28.8%)	72 (25.8%)	288	2.65	0.000*
I like seeing and listening to my lecturer face-to-face	8 (2.8%)	35 (12.2%)	125 (43.4%)	120 (41.7%)	288	3.24	0.000*
I like when the student looks for information online and presents in it class	26 (9.0%)	84 (29.2%)	136 (47.2%)	42 (14.6%)	288	2.67	0.000*
I benefit more from the Zoom conferencing classes	96 (33.3%)	141 (49.0%)	40 (13.9%)	11 (3.8%)	288	1.88	0.000*
I benefit more from the WhatsApp discussion classes	51 (17.7%)	90 (31.3%)	91 (31.6%)	56 (19.4%)	288	2.53	0.000*
I benefited more when using Primal pictures	32 (11.1%)	71 (24.7%)	126 (43.8%)	59 (20.5%)	288	2.74	0.000*
Zoom conferencing classes make me like BNS	95 (33.0%)	137 (47.6%)	45 (15.6%)	11 (3.8%)	288	1.9	0.000*
The procedure of Zoom is difficult to understand and follow	68 (23.6%)	80 (27.8%)	82 (28.5%)	58 (20.1%)	288	2.45	0.000*
I like using online learning resources e.g. the internet	22 (7.6%)	49 (17.0%)	128 (44.4%)	89 (30.9%)	288	2.99	0.000*
The online and e-learning method should be used frequently	50 (18.5%)	103 (35.8%)	90 (31.3%)	45 (15.6%)	288	2.45	0.000*
I benefit when a teacher uses mixed methods of teaching	7 (2.4%)	25 (8.7%)	94 (32.6%)	162 (56.3%)	288	3.43	0.000*

(Source: Field Data 2021)

The opinions of respondents regarding the importance of online teaching and e-learning were described in this sub-section. Thirteen (13) questions were asked under this category. While each of the questions recorded an above-average value, two questions recorded mean values below the average. Respondents were asked to rate their level of agreement concerning the questions outlined in Table 4.7. More than 50% of the respondents agreed to each of the questions that online teaching and e-learning promote understanding of BNS subjects. This is against two of the questions, with more than 50% of the respondents in disagreement. Thus,

- "I benefit more from the Zoom conferencing classes" (33.3%=Strongly disagree; 49.0%=Disagree).
- "The online and e-learning method should be used frequently" (31.3%=Strongly disagree; 35.8%=Disagree).

In addition, the mean score for the questions in Table 4.7 recorded an above-average value (2.5) except for the questions that had high disagreements by the respondents, hence recording a mean value below the threshold value (2.5).

In summary, the results indicate a strong agreement with the assertion that online teaching and e-learning is a good tool for helping students understand the BNS module. This was confirmed by the p-values, which were statistically significant across all the questions. The study, therefore, concludes that online teaching should be used to supplement face-to-face discussions in class. However, 82.3% of respondents did not benefit from Zoom classes, therefore, the method is not preferred, and it might not be used in future.

4.3.3 Reliability statistics

Table 4.8   Cronbach Alpha result (N=288)

Factors	Number of items	Valid cases(N)	Cronbach Alpha
Students' participation in the BNS module	7	288	0.755
Working in groups (jigsaw puzzle)	11	288	0.729

Multiple intelligence approach	6	288	0.698
Online teaching and e-learning	13	288	0.738

Table 4.8 reports the reliability statistics of the four factors assessed in the survey instrument. The internal consistency of the questionnaire items was assessed using Cronbach's alpha. The reliability test was used to examine the statistical significance of how well the collection of items measured a particular construct or factor. If the questions were repeatedly posed to the group under comparable circumstances, the Cronbach's alpha also aids in determining the similarity of responses (Gray et al 2017:373). The perception and attitudes towards innovative teaching methods in the BNS module had the highest Cronbach's alpha value of 0.755. The alpha value for the jigsaw puzzle was 0.729, while online teaching and e-learning were 0.738.

The Multiple Intelligence Approach recorded the lowest alpha value of 0.698, however, approximately the same as the normal threshold of 0.70 (Gray et al 2017:374). The scale reliability of these factors is in the accepted range as most of the alpha values were above the threshold of 0.70. The Cronbach's alpha results indicate that the items and responses from the survey are statistically reliable (Gray et al 2017:574). The significance of the Cronbach's alpha results indicates that the type of instrument used is consistent and trustworthy and can yield the same results if used under the same circumstances.

4.3.4 Qualitative responses to the closed-ended question (item 48)

Item 48 required respondents to answer, 'Yes' or 'No' to the question "Does different teaching methods motivate you to study and seek more information?".

A total of 240 respondents (84.5%) responded "Yes", indicating that different teaching methods motivated them to study and seek more information. Thirty (n=31) representing 10.9% responded "No", indicating that different teaching methods did not motivate them to study and seek more information. Thirteen (4.6%) of the respondents did not attempt the question.

4.3.4.1 *Qualitative responses "Yes" to the closed-ended quested (item 48)*

The comments given by these respondents were analysed using the content analysis approach. Responses indicating that different teaching methods motivated students to study and seek more information were grouped under one category, "students" views on the benefits of using different teaching methods". This suggests that different teaching and learning strategies motivate them to search for information on their own

Table 4.9   Motivating teaching strategies generated from "Yes" responses (n=240)

Category	Sub-category	Comments from respondents
The benefits of using different teaching methods/different teaching methods are beneficial	Active involvement and participation	"The learning method helps me to want more information and to participate." "They promote participation." "Being actively involved through role-play and the internet."
	Seek and explore more information	"Different teaching methods motivate me to study and seek more because if I did not understand one method the other method may explain things better." "Because teaching methods like the internet have lots of information that will encourage you to seek more information." "Different teaching methods motivate me to study and seek more information because I am not limited to one method."
	Understand presented content easily	"Different teaching methods help me to understand the presented content in a variety of ways, different approaches help one to understand the content better." "It helps with better understanding from different angles and resources as well as techniques." "Some of the methods motivate me to study as I understand the content better when certain teaching methods are used." "It helps clarify subjects that were not fully understood in class."
	Grasp, retain, and remember information easily	"Seeking more information on your own promotes an increase in knowledge and turns to retain information and retrieves it easily." "I'm able to discover a new way of remembering information I learned." "Multiple Intelligences approach help me to grasp and understand systems that are long and confusing." "It gives me more energy and enhances my knowledge." "Helps not to forget what you have been taught other than using other methods."

Category	Sub-category	Comments from respondents
	Have varieties of methods to choose	"Because I got different experiences and good to decide which method works well for me."
	Stimulates thinking, curiosity, and creativity	"It makes me interested in a topic and the results in me wanting to know more." "I become more curious, always keen to learn more depending on the teaching style." "They make one think out of the box." "It makes one more interested to know more about the topics taught for the day and to get more clarity." "We learn and grasp information differently, if we try different methods of learning, we get interested and keen to want to know more rather than being in class and only listening to a lecturer."
	Gain knowledge and enhance learning	"I was able to gain more knowledge and understand the content." "Because you can learn one thing in more ways than one."
	Individual independence and hard work	"It allows me to work independently and to seek more information from different sources." "It encourages one to work harder, and try doing own research for more insight into the topic taught."
	An interesting study session and class	"The classroom is filled with students with personalities." and different ways of studying, so teaching methods are necessary – the more interesting the class the more motivated we become to study." "It makes it interesting, and it intrigues me."
	Own responsibility for learning and know-self	"Allow me to take more responsibility for my learning."

Table 4.9 provides a summary of the responses from the 240 respondents that indicated 'Yes' to item 48. Most students indicated that different teaching methods enabled them to understand taught content easily. Some of the respondents' comments included:

> "different teaching methods help me to understand the presented content in a variety of ways, different approaches help one to understand the content better."

Others commented that:

> "it helps clarity on subjects that were not fully understood in class."

Some of the responses also indicated that using different teaching methods enabled them to seek and explore more information. The selected comment was:

> "because teaching methods like the internet have lots of information that will encourage you to seek more information."

Again, the ability to grasp and remember information easily also appeared as an advantage of using different teaching methods. Other reasons cited by respondents were active involvement and participation; having varieties of methods to choose and work with; gaining independence; having an interesting class; and stimulating thinking, curiosity, and creativity.

Few also added different teaching methods and made their responsibility and know themselves. One respondent commented, "allow me to take more responsibility for my learning". Gaining knowledge and enhancing learning were also indicated by some respondents for using different teaching methods. For example, one respondent stated:

> "I was able to gain more knowledge and understand the content."

This implies that using different strategies during teaching and learning allowed them to gain knowledge and understand the content.

4.3.4.2 Qualitative responses "No" to the closed-ended quested (item 48)

Thirty-one (10.9%) of the total respondents responded "No" to item 48. This indicates that using different teaching methods did not motivate them to study and seek more information. Their responses were analysed, and their reasons analysed using the content analysis approach. The comments given by respondents that answered "No" to item 48 were grouped under one category and six sub-categories as displayed on the table. Selected samples of their direct quotes were added to explain the category. The category "Reasons for different teaching methods not motivating students to study and seek more information/different teaching methods do no motivate students/the bad side of using different teaching methods for students" was grouped under six sub-categories. The sub-categories that emerged from respondent's comments included: "prefer one type of teaching method"; "confusing, overwhelming and difficult to relate"; "easily distracted and loss of concentration"; "demotivating"; "scary and stage fright" and "ineffective and a waste of time" (refer to Table 4.9).

Table 4.10   Motivating teaching strategies generated from "No" responses (n=31)

Category	Sub-category	n (%)	Example of selected comments
The disadvantages of using different teaching methods/Different teaching methods are not useful	Prefer one type of teaching method	13 (41.9%)	"I'm a visual learner so I like being taught in a specific way." "Listening to the lecturer and studying alone is effective for me, consulting where I don't understand." "I work and learn much better when I go through the content after the lecturer has presented (R61)." "I enjoy studying alone, and I will seek clarity when I need it."
Multiple intelligences approach	Confusing, overwhelming and difficult to relate	8 (25.8%)	"It is confusing and results in poor academic performance, unlike focusing on one teaching method that benefits and saves time." "Sometimes I become more confused, especially during role play when I am the one who is supposed to be part of the role play." "They get confusing at times."
	Easily distracted and loss of concentration	3 (9.7%)	"Different tea Ching methods make lose concentration and be unable to follow what is being taught." "I become distracted and lose focus during drama singing or acting because other students do not put effort during the presentation."
	Demotivating	2 (6.5%)	"They do not motivate me nor seek more information." "They do not motivate me to learn more."
	Scary and stage fright	2 (6.5%)	"Some of us have stage fright therefore presenting in front of the students at the podium is scary and frustrating (R62)." "Not all the students can present at the front."
	Ineffective and a waste of time	3 (9.7%)	"Certain teaching methods aren't as effective as the lecturers think they are (R2)." "They take a lot of time than can be used for the study (R48)." "I feel like it's a waste of time because the focus will be on the people doing drama or singing rather than on the actual content being taught (R44)."

Key: N=total number of respondents; %=corresponding percentage; R=respondent

Findings from Table 4.10 show the categories and sub-categories that emerged from the "No" responses to item 48. The majority (41.9%) of the respondents (n=31) indicated that they preferred one type of teaching method as a motivation for seeking more information rather than the use of different teaching methods. Responses such as:

> "listening to the lecturer and studying alone is effective for me, consulting where I don't understand.", and

> "I enjoy studying alone, I will seek clarity when I need it.", were made.

Some respondents (25.8%) also revealed that different teaching methods used were confusing, overwhelming, and difficult to relate to. One respondent commented,

> "it is confusing and results in poor academic performance, unlike focusing on one teaching method that benefits and saves time".

Of the respondents, 9.7% stated that using different teaching methods rather made them distracted and lose concentration. For example, one respondent indicated that:

> "different teaching methods make me lose concentration and be unable to follow what is being taught."

Similarly, 9.7% of the respondents also state that the use of different teaching methods was ineffective and a waste of time. For instance, one respondent stated that:

> "Certain teaching methods aren't as effective as the lecturers think they are."

Another respondent also indicated that:

> "I feel like it's a waste of time because the focus will be on the people doing drama or singing rather than on the actual content being taught."

Only 6.5% stated that different teaching methods are demotivating and make teaching scary and associated with stage fright. Expressions such as:

> "Some of us have stage fright, therefore, presenting in front of the students at the podium is scary and frustrating."

This indicates the stage fright respondents go through. Another respondent reasoned that admitting that it was demotivating stated that:

> "They do not motivate me nor seek more information."

This indicates that the Multiple intelligence approach did not motivate students to seek more information.

Based on the respondents' comments above the Multiple intelligence approach is not a preferred teaching approach, they rather be taught by the lecturer.

4.3.4.3   Qualitative response: Closed-ended response on the item (49)

Item 49 also required respondents to provide their suggestions about the use of different teaching methods. A total of 98 students provided comments on item 49. Individual comments and suggestions were analysed using the content analysis approach. Similar suggestions were grouped under one category and different ones were classified under separate categories. Suggestions provided were grouped under six categories, namely: "frequent use of videos, pictures and dolls"; "group presentation and discussion"; "use of multiple intelligences and different teaching methods"; "online teaching and learning"; "the use of WhatsApp as an alternative" and "time and language medium for teaching and presentation"; as in Table 4.10.

Table 4.10 provides a summary of the suggestions provided by the respondents. Most of the respondents suggested the frequent use of pictures, videos, diagrams, and dolls teaching both online and face-to-face. YouTube videos were, for instance, highlighted by some respondents as helpful. Others also suggested that videos used for presentation purposes should be made available to students. Some of the selected comments on the frequent use of videos, pictures, and diagrams included:

> "more videos on PowerPoint Presentations would make content more interesting"; and

"Use of videos and visuals in presentations."

Group discussions and presentation was also suggested by some respondents. Some responded stating that group discussions and presentations were helpful, however, they should be limited and made optional. Again, it was suggested that students should always be guided and corrected after group presentation as indicated by one respondent:

"Students should not be primary teachers. They should be corrected after presenting to prevent the passing of wrong information."

Another key suggestion was the continuous use of different teaching methods. It was suggested that lecturers should use all the available teacher methods as they were very beneficial. However, the lecturer should consider and understand the student differences when using different teaching methods. For example, two of the respondents stated:

"When incorporating the different teaching methods don't give the students the full responsibility of teaching the content."

"Lecturers should use all available methods to teach."

Table 4.11   Suggestions for using different teaching methods

Categories	Selected comments
Frequent use of videos, pictures, diagrams, and dolls	"Use and watch movies and documentaries frequently." "Make use of YouTube and information on the internet." "More videos are needed e.g. YouTube." "Lecture videos should be available for the students." "More videos on PowerPoint Presentations would make content more interesting." "More pictures and diagrams should be used in the slides." "Use of videos and visuals in presentations." "Use more of the dolls that are available in the skills lab for a more visual representation."
Group presentation and discussions	"Limit group work." "Group discussions should be optional and not compulsory." "Group work and presentations help." "Peer tutoring, group work, and presentations help." "During last week lecturers avoided giving group activities or presentations as they are exhausting, and we need time to prepare for tests." "Jigsaw method is useful provided the lecturer also emphasises the topic presented." "Students should not be primary teachers. They should be corrected after presenting to prevent the passing of wrong information."
Use of multiple intelligence and different teaching methods	"The method of learning through drama has to be kept." "Do not give role play or music as a task."

Categories	Selected comments
	"Can lecturers not expect us to dance in front of other students? They should use other methods."
	"Have a question-and-answer question in the form of a quiz."
	"Use teaching aids like activities of filling the missing words."
	"Lecturers should use all available methods to teach."
	"The lecturer can present first then group work can be done."
	"Continue using the Multiple Intelligences approach."
	"The lecturers should not use methods that work for themselves and not for the students."
	"Lecturers should introduce more methods of studying to the students."
	"Mix method where students and lecturers are involved."
	"Stick to one method at a time."
	"I suggest that lecturers should understand the differences in personnel among students."
	"When incorporating the different teaching methods doesn't give the students the full responsibility of teaching the content."
Online teaching and learning	"Improve the use of the internet."
	"Should have more online classes as the way of submitting our assignments online."
	"Early introduction of online learning at level 1."
	"Online learning and teaching should be done more frequently."
	"Make Wi-Fi and internet data available for online teaching."
	"Add online teaching to lecture presentations to reinforce information."

Categories	Selected comments
	"Online classes should not be considered unless data is provided."
	"Train lecturers for online teaching."
The use of WhatsApp as an alternative	"Use the WhatsApp platform for online teaching, it is not costly, and information can be retrieved at any time."
	"WhatsApp voice notes should be used frequently as it is simple to use, and you can go back and refer to or reinforce the information at a later stage."
	"Zoom is very slow and gives us difficulties to study."
	"I highly recommend the WhatsApp teaching method, using voice notes as I can go back when studying and get clarity."
Time and language medium for teaching and presentation	"Emphasis on the use of English as the medium of communication in all presentations."
	"Students should be given enough time before the presentation."
	"Suggest that subjects must not be taught by almost four lecturers; at least two."
	"Students should be given more time to go home and study and internalise content taught for the day."
	"Use Multiple languages because adults find it difficult to understand English."
	"Lecturer should demand at least five learners to consult each week."
	"Reduce the amount of content being studied per day because it is a serious sensory overload."

One other suggestion was the use of online teaching and learning. Some respondents indicated it should be introduced early for students to familiarise themselves before beginning the year or level. Again, due to internet connectivity issues, some respondents suggested that the supply of internet data could be needed. Also, lecturers need to be well trained before using the online teaching and learning approach. Comments such as:

"early introduction of online learning at level 1"

"add online teaching to lecture presentation to reinforce information" and "train lecturers for online teaching"

were stated by some respondents.

Some respondents also suggested an alternative means such as the 'use of WhatsApp, for online teaching'.

For instance, one respondent said:

"I highly recommend the WhatsApp teaching method, using voice notes as I can go back when studying and get clarity".

One other added that:

"use the WhatsApp platform for online teaching, it is not costly, and information can be retrieved at any time".

Lastly, the time and language medium for teaching and presenting was also key suggestion made. Some respondents emphasised that the medium for presentation and communication should be the English language. Others also stated that having multiple languages for adults especially was also good. Comments such as:

"emphasis on the use of English as the medium of communication in all presentations", and

"use multiple languages because adults find it difficult to understand English",
explain their suggestions.

Some respondents also suggested the need to have enough time to prepare for
presentations.

4.4   DISCUSSIONS OF RESEARCH FINDINGS

4.4.1 Demographic profile

4.4.1.1   Gender

The pie chart in Figure 4.1 indicated that 12% (n=34) were male respondents while 88%
(n=254) were female respondents, suggesting that more females were represented in the
survey than males. The researcher did take cognisance of the fact that demographic
profiles in this study indicated that students who participated in the nursing programme
are still dominated by females at 90% as compared to their male counterparts. These
results corroborate with existing literature that females are still dominating the nursing
profession (Monisi 2018:50; Sathees, Sanchayan, Sivapalan & Thabotharan 2018:63;
Haji 2018:31).

4.4.1.2   Recognition of prior learning (RPL)

More than half of the sample revealed that they are not RPL students, representing 71%,
while 29% indicated they are RPL students. Surprisingly, the results show that 19 of the
RPL students scored E, showing poor performance while non-RPL students scored A.
The results indicated that non-RPL students performed better in life sciences courses
than RPL students. The above-mentioned findings are in line with the research by
Mothokoa and Maritz (2018:6), which found that RPL students struggle academically
because of age-related and family-related problems. The chi-square p-value (0.000) is
statistically significant at 5%, indicating that the variables RPL student and symbol are
not independent of each other. This result may be because of the difference in the sample
size as most of the respondents were non-RPL students.

4.4.2 Perceptions and attitudes toward innovative teaching methods used for teaching and learning of Biological and Natural Science (BNS) module

4.4.2.1 Students' participation

The results indicated that students were able to be involved and interact with each other in the learning process as this facilitated their understanding. A total of 85.8% of respondents agreed with the notion that participation in class activities help them to think about what they are learning, and that group work and presentations help to learn and understand the content better. The findings are consistent with a study by Entezari and Javdan (2016:228), on Active Learning and Flipped Classroom, Hand in Hand Approach to Improve Students Learning in Human Anatomy and Physiology, whose findings revealed that students supported that active-learning strategies helped them to learn better and be familiar with the content. Similarly, Megaw and Zimanyi (2019:33) on redesigning first-year Anatomy and Physiology subjects for Allied Health students indicated that increased interaction between students and educators improved student satisfaction and performance. On the contrary, a total of 14.2% disagree with this notion as shown in Figure 4.4.

Regarding the mean values, the question that states "I wish more classes were taught with an emphasis on students' participation" had the lowest mean of 2.85, while "I believe that students should take part in learning by discussion" had the highest mean of 3.29, suggestive of positive attitude towards students' discussion during teaching and learning.

4.4.2.2 Jigsaw puzzle

The results indicate a strong agreement to the various questions indicating that working in groups is important in helping students understand BNS. This was confirmed by the p-values of 75.1%, which was statistically significant. This finding indicated that the jigsaw puzzle improves communication, thinking, and problem-solving skills as students are working in groups. The present findings are consistent with the results of Abd El Aliem et al (2019:368) on the utilisation of a jigsaw cooperative learning strategy on maternity nursing students' attitudes and achievement. Similarly, Renganathan (2020:18) found student satisfaction with the jigsaw puzzle, improving unity and togetherness. Students can learn different skills from each other. In addition, Karacop (2017.421), found that the

Jigsaw method promotes increased students' performance in academic activities as compared to the lecture method.

The mean score for the questions in Table 4.5 recorded above-average values except for the two questions recording a higher level of disagreement by the respondents. The results indicate a strong agreement to the various questions indicating that working in groups is important in helping students understand BNS subjects. This was confirmed by the p-values at $0.000*$, which was statistically significant.

4.4.2.3 Multiple intelligences approach

It is interesting to find that the results indicated that BNS students also supported the argument that the multiple intelligences approach is a vital part of the teaching and learning strategy, whereas in question 48 (Table 4.10) where students were to indicate motivating teaching strategies, 58% of respondents suggested that other teaching methods are better as compared to the multiple intelligences approach. Similarly, Singh et al. (2019:8) observed that teaching anatomy utilizing an active and engaging learning technique revealed that students felt at ease when participating in numerous modalities, such as music, auditory, kinaesthetic, and kinaesthetic modes of learning. On the other hand, a study by Bakon et al. (2016:13) on the relationship between nursing students' preferred learning methods and their academic achievement in the bioscience field, discovered that different student abilities did not seem to affect either learning methods or academic achievement in the field. However, studies show that little attention has been paid by researchers to the use of multiple intelligences in higher education, especially in South Africa.

4.4.2.4 Online teaching and e-learning

The results of this study also demonstrated that online teaching and e-learning including YouTube videos are useful and motivating. Students reported that they can view videos repeatedly at any time and can share the information with each other to support their learning needs. The findings support the use of videos to support the teaching and learning of clinical skills in nursing education recommended by Forbes, Oprescu, Downer, Phillips, McTier, Lord, Barr, Alla, Bright, Dayton, and Simbag (2016:55). Additionally, Forbes et al. (2016:56), indicated that students preferred downloading videos, which is

vital for later use. The results showed that the use of videos with pictures, diagrams, and structures as well as the WhatsApp mode can be used as an alternative tool to assist students in understanding the BNS module.

According to the results, 67.4%, were within the age bracket of 18-30 years. This age group falls under the millenniums. The results suggest that 56% of respondents prefer WhatsApp e-learning methods. The results agree with the findings of Mosca, Curtis and Savoth (2019:73) that the millenniums are influenced by technology such as Smart Phones and prefer online teaching through WhatsApp mode. The results also indicated that the WhatsApp platform should be used frequently because it is not costly, and information can be retrieved at any time. Similarly, Mbukusa (2018:118) observed that WhatsApp is a novel and pleasant application in the learning situation that should be incorporated into the curriculum in the study, "The Perceptions of Students on the Use of WhatsApp in Teaching Methods of English as a Second Language." On evaluating the online learning engagement of nursing students, Chan, Lin, Chau, Takemura, and Fung (2021:5) were also in agreement. Their findings showed that the high flexibility of online teaching and learning, allowed students to achieve their educational goals. There is a high level of positive attitude among students (80%) regarding the implementation of mobile learning methods through the WhatsApp application (Sharma et al 2021:12).

According to Busa et al (2020:743) and Guzacheva's (2020:458) research, Zoom technology is a fantastic tool for student and teacher cooperation. However, in this study Zoom conferencing classes had high disagreements of 82% by the respondents indicating that the Zoom platform is not an effective approach to teaching and learning, hence recording a mean value below the threshold value (1.9). The notion was supported by Nurieva and Garaeva (2020:447) in the study, Zoom-based distance learning of English as a foreign language, indicating that there are many challenges in zoom-based learning, including appropriate teaching strategies, a lack of technical skills, as well as organizational issues that may pose a challenge. In contrast, Bahtiar (2021:629) revealed that Zoom is seen by students as the most useful and effective tool when compared to other applications. This study looked at "the students' impressions of the utilization of google classroom and Zoom in writing skills during the COVID-19 Pandemic.
Interestingly, students suggested training for lecturers to improve the online teaching platform. This finding is suggestive of the support of other modalities of online teaching by the students.

4.4.3 The teaching strategies which motivate students to participate in the teaching and learning environment

The findings showed that most of the respondents (84.5%) agreed that the use of different teaching methods motivates students to study and seek more information. Beyond that, others' vital reasons included active involvement and participation and having varieties of teaching methods to work with. These factors motivated them to grasp and retain information easily and stimulated thinking. These results also support the findings of Granbom and Granbom (2019:199) on a wider variety of teaching methods, indicating that by employing different teaching strategies, such as group work and active student participation, students felt inspired to study.

In contrast, 31 (10.9%) of the total respondents responded "No" to item 48 (Table 4.10). This indicates that using different teaching methods did not motivate them to study and seek more information. Others also seek the use of different teaching methods as a waste of time, scary, confusing, and ineffective. Similarly, Cudney and Ezzell (2017:39) evaluated the impact of teaching methods on student motivation and found showed that the success of different teaching methods depended on the particular learning preferences of the students and that the strategies did not always enhance motivation.

Another important finding was that the students recommended the frequent use of visuals and YouTube videos which are stimulating and motivate them to study and improve academic performance. Saeedi, Ghafouri, Tehrani and Abedini (2021:5) indicated in a study regarding "the effects of teaching methods on academic motivation in nursing students", also found that the usage of mobile-based video clips in nursing has been found to promote learning and stimulate students to access diverse videos among other technological resources.

Alternative use of the WhatsApp social media platform was also suggested to be added to the already existing online teaching media as a strategy that motivates the students to share information for teaching and learning.

4.5   CONCLUSION

This chapter discussed the data analysis, presentation, and description of the research findings on the experiences of student nurses in innovative teaching and learning strategies used for the BNS module. A descriptive method of data analysis is used to describe the numerical data, and to report the distribution of a sample. Frequency distribution in the study was presented using pie charts, bar graphs, and frequency distribution tables. The findings show that students support and are motivated to take part in the implementation of different teaching strategies.

CHAPTER 5

LIMITATIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1   INTRODUCTION

This chapter presents the overview of the methodological processes, summary and recommendations, contributions of the study, and limitations of the study as well as the concluding remarks.

5.2   OVERVIEW OF THE METHODOLOGICAL PROCESSES

The purpose of this study was to explore the nursing students' experiences with innovative teaching and learning strategies used for the Biological and Natural Sciences (BNS) module.

The research objectives were:

- To establish the nursing students' knowledge, understanding and attitude toward innovative teaching and learning used in the BNS module.
- To determine the teaching strategies that motivate the Nursing students to participate in innovative teaching and learning environment.

The research questions were:

- What are the nursing students' knowledge, understanding and attitudes toward innovative teaching strategies used for the BNS module?
- What are the teaching strategies that motivate Nursing students to participate in the teaching and learning environment?

The descriptive non-experimental quantitative design was used in the study to explore the third-and fourth-year nursing students' experiences of innovative teaching and learning strategies used for the BNS module. A questionnaire for the data collection was used to address the research objectives of this study.

5.3   SUMMARY OF RESEARCH FINDINGS

5.3.1 Perceptions and attitudes toward innovative teaching strategies used during the Biological and Natural Science (BNS) module

The four main factors/constructs; students' participation working in groups (jigsaw puzzle), multiple intelligence approach, and online teaching and e-learning, were assessed using a four-point Likert scale. The one-sample t-test was used to determine whether each item differs significantly from the average score of 2.5. The results indicated that all the questions under the four constructs recorded a mean value above the expected value of 2.5, indicating a high agreement of students' participation in innovative teaching methods in the BNS module. However, the responses on the use of Zoom for teaching and learning, had high disagreements, recording a mean value of 1.9 below the threshold value (2.5). This implies that Zoom was not a preferred method of teaching and learning for the students.

The p-values (probability) of 0.000 in students' participation, working in groups (jigsaw puzzle), multiple intelligence approach, and online teaching and e-learning were also statistically significant, affirming the relevance of student's participation in the teaching and learning process, suggesting that the results are unlikely to have been produced by chance. The implication is that if the same sampling technique can be used to sample the student population, the same results can be obtained. Therefore, the results are statistically significant. The findings show some correlation between lecturers' level of BNS knowledge and teaching methods, which contributes to positive students' performance outcomes.

The findings showed that students were enthusiastic and interested in group discussions, especially those involving jigsaw puzzles.
Although the Multiple intelligences approach (MI) was also favoured, some respondents did not seem to be interested in the approach, per the results. The respondents did not have a favourable opinion of many intelligences.

Online and e-learning were recognized by respondents as the greatest methods for stimulated and motivated interest in studying the BNS subject. Positive feelings were

expressed by students for the WhatsApp platform. They believed the approach ought to be applied regularly.

5.3.2 Teaching strategies that motivate students to participate in the teaching and learning environment

The findings showed that most of the respondents (84.5%), agreed that the use of different teaching methods motivates students to study and seek more information. Students highlighted online and e-learning as the best method that stimulates interest in studying the content given. Furthermore, they explained that the use of different teaching methods promoted their active participation where they had to look for information themselves and were able to grasp and retain information easily. However, the use of Zoom is indicated as a poor method of choice in teaching and learning.

Jigsaw puzzles were used by respondents because they encouraged involvement and interpersonal contact. They acknowledged that the jigsaw puzzle served as a motivator for them to conduct independent research.

The respondents said that the multiple intelligences approach left them feeling less driven and that they would learn better from a lecturer. This shows that for some of the pupils, MI is not an effective inventive method.

Respondents felt motivated to use WhatsApp as well as the online Videos because they were able to refer and share information among themselves any time anywhere.

5.4   RECOMMENDATIONS

5.4.1 Recommendation for nursing education institutions

According to the findings, the students showed a positive attitude and a willingness to take part in the different teaching strategies, therefore internet connections for the students are necessary so that they can access information from their smartphones. They also indicated that lecturers need to be empowered to use online and e-learning

strategies effectively. Therefore, the nursing education department needs to support nursing institutions with relevant technological resources such as smartboards or blackboards and sufficient internet connection to enhance the implementation of online and WhatsApp platforms during teaching and learning.

Based on the findings, there is a need to change rules and regulations regarding the use of cell phones in class situation so that lecturers move from a lecturer-based method.

The educators are to be capacitated through training workshops, on blended teaching that incorporate different teaching strategies to maximise teaching and learning in the BNS module for nursing students.

Teaching and learning platforms such as YouTube videos, including diagrams eBooks, as well as the WhatsApp platform, were strongly suggested by students as the alternative means that can be added to the already existing online teaching media. More studies need to be done about the use of social media in teaching and learning environments. More innovative teaching strategies need to be explored and implemented in nursing education institutions to improve students' participation, interests, and academic performance.

The study also revealed that 80% of the respondents were between the ages of 20 and 30 years, suggestive of the generation of students that are socialised and prefer the use of technology. Based on the findings, institutional support from the Information and communication technology (ICT) Department is required to capacitate educators on the use of ICT equipment and technology. The technology being used at the institution need to be upgraded to the level of the students who are technologically -savvy to facilitate teaching and learning using methods relevant to the present generation of students.

5.4.2 Recommendation for further research

The study was conducted at a single college, therefore further research on innovative teaching strategies is necessary for a larger population. A comprehensive study is necessary to determine if new findings can emerge or if new information revealed and be

generalised. More studies using the jigsaw method were conducted in medical schools, especially in physics, therefore more studies need to be conducted at the Nursing Colleges.

5.5   CONTRIBUTION OF THE STUDY

The study will assist the institution to identify effective teaching and learning strategies relevant and applicable to the present generation of students. Educators will be able to implement and facilitate content relevantly and according to student's learning styles, needs and capabilities thus improving students' performance in BNS.

Innovative teaching will boost students' interest in learning the content and be motivated in search can search for more information.

The findings of the study will also assist educators to identify barriers to the use of innovative teaching strategies. The use of innovative teaching strategies will also assist the institution to maintain teaching and learning, irrespective of challenges within the teaching and learning environment.

5.6   LIMITATIONS OF THE STUDY

The study was conducted at only one Campus in Gauteng Province thus compromising the generalisation to the whole student population in nursing education institutions in Gauteng province. The study was also limited to the BNS module only and not to other subjects.

The responses suggested support for the use of creative teaching and learning techniques, but as the effect of these techniques on students' academic achievement was not examined, it is difficult to say whether it helped students perform better in BNS.

5.7   CONCLUDING REMARKS

The objectives of the study were to establish the students' knowledge, attitudes, and understanding of innovative teaching and learning as well as to determine the teaching strategies which can motivate students in the learning environment. The teaching strategies under discussion included: the students' participation, jigsaw group discussion, multiple intelligence approach, and online teaching and e-learning. The results revealed that group discussions including jigsaw puzzles were the preferred method of teaching and learning. The multiple intelligences approach was also preferred however according to the results, some respondents do not have an interest in the method. Zoom as an e-learning teaching platform did not receive approval from respondents, therefore it is not a preferred strategy for teaching and learning.

The results also revealed that the use of innovative teaching strategies does motivate students to study and seek more information, therefore the use of different teaching strategies is imperative to stimulate students' interest and participation thus, improving the quality of nursing education.

Although extensive research has been carried out on different teaching strategies, and an increasing amount of literature about combining different teaching modalities, the literature suggests that much uncertainty still exists about the relationship between teaching methods and their effect on students' learning outcomes in bioscience as well as good academic performance.

Motivation is one of the most studied concepts in educational research. However, many questions remain, such as the generalisability of research findings relating to different motivating factors for students to put more effort into their studies, and time. Therefore, it is of great importance to pay due attention to different teaching and learning strategies to motivate students' active participation in teaching and learning.

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ANNEXURES

ANNEXURE A: Ethical clearance certificate from the Research Ethics Committee: Department of Health Studies, UNISA

UNISA | university of south africa

14 December 2020

Dear Mrs Constance Ntsamaeng Ringane

> **Decision:**
> **Ethics Approval from 14 December 2020 to 31 November 2023**

Researcher(s): Mrs C.N. Ringane (06474357@mylife.unisa.ac.za)

Supervisor: Prof JM Mathibe-Neke   (012 429 6443)

> *Title: The nursing students' experiences regarding the innovative teaching and learning strategies used in Biological and Natural Sciences course at a Nursing College*

Degree Purpose: MA - Nursing

Thank you for the application for research ethics clearance by the Unisa College of Human Science Ethics Committee. Ethics approval is granted for three years.

The *low risk application* was *reviewed* by College of Human Sciences Research Ethics Committee, on **14 December 2020** in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevantto the ethicality of the study should be communicated in writing to the College Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.

Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied bya progress report.

The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.

- Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
- No fieldwork activities may continue after the expiry date **(31 November 2023).** Submission of a completed research ethics progress report will constitute an application for renewal ofEthics Research Committee approval

Note:
*The reference number **2020-CHS-06474357** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee*

Yours sincerely

Signature: Signature: PP

Dr. K.J. Malesa   Prof K. Masemola
CHS Ethics Chairperson   Executive Dean: CHS
Email: maleskj@unisa.ac.za   E-mail: masemk@unisa.ac.za
Tel: (012) 429 4780
Tel: (012) 429 2298

ANNEXURE B: Letter to request permission from Gauteng Department of Health to conduct a study at Gauteng College

Enquiries: Ringane, CN

PO Box 505

Montana Park

0182

Cell no: 071 155 3315

Email: cn.ntsamaeng@gmail.com

To: Ms N Dlamini

Director: Compliance and Research

Provincial Government

Pretoria 0001

Dear Madam

PERMISSION TO CONDUCT RESEARCH STUDY TITLED: THE PERCEPTION OF NURSING STUDENTS REGARDING INNOVATIVE TEACHING AND LEARNING STRATEGIES USED FOR A BIOLOGICAL AND NATURAL SCIENCES COURSE AT A GAUTENG NURSING COLLEGE

I, Constance Ntsamaeng Ringane, studying Master of Arts in Nursing Science through UNISA, hereby request a permission to conduct a research and collect data at SG Lourens Campus.

This research project will involve the third-year nursing students registered for the diploma in nursing (General, Community and Psychiatry) and Midwifery (R.425) by completing a questionnaire online from the campus. The identity of the institution and the participants will not be revealed. The purpose of the study will be explained to the participants and will be obtained in writing and emailed back. The information letter will be given to participants and will be informed that their participation in the study is voluntary and they are under no obligation to participate. The participants will be informed that they have the right to withdraw from the study at any time during data collection without penalty or discrimination.

Participants have the right to anonymity and will be reassured that data collected as well as the results will be kept safe to ensure privacy and confidentiality. The questionnaire is

designed to achieve anonymity by the fact that their names will not appear on the questionnaire.

The findings of the completed study will not be linked to any of the individuals who took part in the study. The researcher will ensure that the aggregated data from the questionnaires is kept with an encrypted password.

Findings of the study will be presented to the campus on completion of the study. Your approval to conduct the study will be greatly appreciated. My contacts are as follows:

Constance Ringane
Cell no: 071155331
Email: cn.ntsamaeng@gmail.com

Chair email: HSREC@unisa.ac.za

CN Ringane   **Date: 26 August 2021**

ANNEXURE C: Letter of approval: Gauteng Department of Health – outcome of Provincial Protocol Review Committee (PPRC)

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

OUTCOME OF PROVINCIAL PROTOCOL REVIEW COMMITTEE (PPRC)

Researcher's Name	Constance Ntsamaeng Ringane
Organization / Institution	University of South Africa
Contact number	071155331
Research Title	The perceptions of nursing students regarding innovative teaching and learning strategies used for a Biological and Natural Sciences course at a Gauteng Nursing College
Protocol number	GP 202102057
Sites	S G Lourens Nursing Campus

Your application to conduct the abovementioned research has been reviewed by the Province and permission has been granted.

We request that you submit a report after completion of your study and present your findings to the Gauteng Health Department. We wish you well in your study.

X   Permission granted

☐   Permission denied

On behalf of Provincial Protocol Review Committee (PPRC).

Ms N Dlamini
Dir. Nursing Compliance and Research/Dir. Nursing Education and Training
Date: 01\04\2021

GAUTENG HEALTH DEPARTMENT
PRIVATE BAG X085, MARSHALLTOWN 2 07
NURSING EDUCATION & TRAINING
DATE: ....

ANNEXURE D: Request for permission to conduct a study as SG Lourens Campus

Enquiries: Ringane, CN
PO Box 505
Montana Park
0182
Cell no: 071 155 3315
Email: cn.ntsamaeng@gmail.com

The Campus Head
SG Lourens Campus
Private bag x755
Pretoria 0001

Dear Madam

PERMISSION TO CONDUCT RESEARCH STUDY TITLED: THE PERCEPTION OF NURSING STUDENTS REGARDING THE INNOVATIVE TEACHING AND LEARNING STRATEGIES USED FOR A BIOLOGICAL AND NATURAL SCIENCES COURSE AT A GAUTENG NURSING COLLEGE

I, Constance Ntsamaeng Ringane, studying Master of Arts in Nursing Science through UNISA, hereby request a permission to conduct a research project in your campus.

This research project will involve the third-year nursing students registered for the diploma in nursing (General, Community and Psychiatry) and Midwifery (R.425) by completing a questionnaire from your campus. The identity of the institution and the participants will not be revealed. The purpose of the study will be to explore second and third-year students" experiences of innovative teaching strategies during Biological and Natural sciences course and will be explained to the participants. The consent will be obtained in writing. The information letter will be given to participants and will be informed that their participation in the study is voluntary, and they are under no obligation to participate. The participants will be informed that they have the right to withdraw from the study at any time during data collection without penalty or discrimination.

Participants have the right to anonymity and will be reassured that data collected as well as the results will be kept safe to ensure privacy and confidentiality. The questionnaire is designed to achieve anonymity by the fact that their names will not appear on the questionnaire.

The findings of the completed study will not be linked to any of the individuals who took part in the study. The researcher will ensure that the aggregated data from the questionnaires is kept in a locked cabinet with the boxes sealed.

Findings of the study will be presented to the campus on completion of the study. Your approval to conduct the study will be greatly appreciated. My contacts are as follows:

Constance Ringane
Cell no: 071155331
Email: cn.ntsamaeng@gmail.com

Chair email: HSREC@unisa.ac.za

CN Ringane   **Date: 26 July 2021**

ANNEXURE E: Approval letter from the Gauteng College of Nursing: SG Lourens Campus

GAUTENG PROVINCE
REPUBLIC OF SOUTH AFRICA

Enquiries	: Ms. NB Mothokoa
Tel Number	: 012 319 5730
Fax Number	: 012 319 5742
Cell Phone	: 082 774 8100
Email	: Noma.Mothokoa@gauteng.gov.za

Ms. CN Ringane
Protocol number: GP 202102057

SUBJECT: APPROVAL FOR DATA COLLECTION AT GAUTENG COLLEGE OF NURSING (GCON): SG LOURENS CAMPUS

This serves as a response to your request in undertaking the study on "The perceptions of nursing students regarding innovative teaching and learning strategies used for a Biological and Natural Sciences course at a Gauteng Nursing College"

Permission is hereby granted for collection of data as indicated in your proposal.
Please take note of the following:
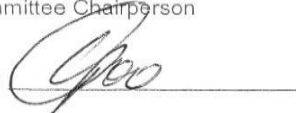
- All information and data collection should be treated as confidential and ethical considerations adhered to as stated in the proposal.
- At the end of the study kindly furnish the Campus with the study results.
- On completion of your research study, you are requested to donate a hard copy of your Dissertation to the Campus library.
- The research committee might invite you to present during their annual research day.

Kind regards

M Motswasele (Ms.): _____   Date: 10 9 2021
Research Committee Chairperson

MM Poo (Ms.): _____   Date: 10/09/2021
Campus Head

GAUTENG COLLEGE
OF NURSING

ANNEXURE F: Information letter for the participants

Enquiries: Ringane, CN

PO Box 505

Montana Park

0182

Cell no: 071 155 3315

Email: cn.ntsamaeng@gmail.com

16 May 2020

Dear Participant

You are invited to participate in my study titled: The experience of nursing students regarding the innovative teaching and learning strategies used for a Biological and Natural Sciences module at a Nursing College. Am studying master's degree with the University of South Africa (UNISA) in the Department of Health Studies.

The purpose of this quantitative study is to explore the students' experiences of innovative teaching and learning strategies used for the BNS module/course

You will be expected to complete a questionnaire. Your name will not appear on the questionnaire and all the information that you gave will be confidential but will be disclosed only in a scientific form without any identifiable names. You will not be remunerated for taking part, but the study will benefit teaching and learning in the institution.

Your participation is voluntarily. Your choice not to participate will not affect your rapport with the nursing college or the healthcare institution. If you decide not to participate, you may withdraw at any stage without any penalties whatsoever.

The signed consent forms will be locked away or encrypted with a password in order to ensure confidentiality and the researcher will not manipulate or falsify any data in any way. If you have any enquiries about the research, you may contact me.

Constance Ringane (researcher) at 071 155 3315 and Ethics Chair email: HSREC@unisa.ac.za

Regards

Constance Ringane

ANNEXURE G: Consent for participation in the study

TITLE: THE NURSING STUDENTS' EXPERIENCES REGARDING INNOVATIVE TEACHING AND LEARNING STRATEGIES IN BIOLOGICAL AND NATURAL SCIENCES COURSE AT A NURSING COLLEGE

I_____ (participant's name), agree to participate in the abovementioned study and confirms that the person requesting my consent to take part in this study has explained to me the nature, procedure potential benefits and that the researcher will not identify me by name in any reports.

I have read and understood the study as explained in the information letter and that participation involves completing a questionnaire.

I have an opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without prejudice.

I am aware that the findings of this study will be processed into the research report, journal, publication and/or conference proceedings, but that my participation and that of the College will be kept confidential.

Participant's name and surname: _____(print please)

Participant's signature: _____   Date: _____

Witness name and surname: _____ (print please)

Witness signature: _____   Date: _____

ANNEXURE H: Questionnaire

Instructions

- Please answer all the questions with honesty and without assistance.

- Indicate with an (X) next to your answer:

e.g.:

YES **X**	No

- Do not write your name or personal details on the questionnaire.

- Please do not write on the column marked "**official use only"**.

- Make an explanation on the space provided; where relevant.

- Return the completed questionnaire in the box provided.

SECTION A: Demographic profile

Question	**Office use only**
1. How old are you? <table><tr><td>1.1 18-25 years</td><td>1</td></tr><tr><td>1.2 26-30 years</td><td>2</td></tr><tr><td>1.3 31-35 years</td><td>3</td></tr><tr><td>1.4 36-40 years</td><td>4</td></tr><tr><td>1.5 41 and above</td><td>5</td></tr></table>	
2. Gender: Male ☐ Female ☐	
3. Highest level of education: Std 10/Grade 12 ☐ Diploma ☐ Degree ☐	
4. Are you an RPL student: <table><tr><td>No</td><td>1</td></tr><tr><td>Yes</td><td>2</td></tr></table>	

5. What type of school did you attend?

5.1.	public	1
5.2.	private	2

6. Did you do Life Sciences as school?

6.1.	No	1
6.2.	Yes	2

If your answer is NO, go to question 7.

If your answer is Yes:

6.2.1 When did you pass Life Sciences/ Biology at school?

6.2.1.1 One year ago	1
6.2.1.2 Two years ago	2
6.2.1.3 Three years ago	3
6.2.1.4 Four years ago	4
6.2.1.5 Five and above years	5

6.2.2 What symbol did you get?

6.2.2.1	A	1
6.2.2.2	B	2
6.2.2.3	C	3
6.2.2.4	D	4
6.2.2.5	E	5

7. Indicate your viewpoint towards Biological and Natural Science.

1.	Interesting	1
2.	Boring	2
3.	Difficult	3

8. Indicate your viewpoint to the way Biological and natural sciences is being taught

1.	Interesting	1
2.	Boring	2

9. How do you rate the level of BNS knowledge of your Lecturers		
1. Excellent	1	
2. Good	2	
3. Average	3	
4. Poor	4	
10. How do you rate the **teaching** methods of BNS Lecturers		
1. Excellent	1	
2. Good	2	
3. Average	3	
4. Poor	4	

SECTION B: Perceptions and attitudes toward different/innovative teaching methods during Biological and Natural Sciences module

Statements	Strongly disagree	Disagree	Agree	Strongly agree	Office use
	1	2	3	4	
Please indicate the extent of your agreement or disagreement with the following statements according to the ratings below:					
Perceptions and attitudes toward Innovative teaching methods in BNS module					
Students' participation					
11. I believe that students should take part in learning by discussion					
12. Participation in class activities help me to think about what I am learning					
13. I Learn better when I am to interact with the teacher and other students					
14. I like learning situations where I can take active part in discussions and ask questions					
15. I like classes where I can participate by putting my views and points forward					
16. I wish more classes were taught with emphasis on students' participation					
17. I don't like classes where student do the teaching instead of the lecturer					

Statements	Strongly disagree	Disagree	Agree	Strongly agree	Office use
	1	2	3	4	
Working in groups					
Jigsaw puzzle					
18. I attend class to learn from the teacher not from other students					
19. I learn more in classes where I work together with other students rather than listening to lecturers					
20. Working in groups in class help me to understand material better					
21. Jigsaw puzzle make students to rely on each other for information					
22. I like jigsaw method because I learn from fellow students rather than a teacher					
23. I am able to express myself when using jigsaw puzzle					
24. I was able to improve social and emotional learning though jigsaw puzzle					
25. Jigsaw puzzle helps to improve listening, communication, and problem-solving skills					
26. Jigsaw method helped me to understand BNS					
27. Jigsaw puzzle is a waste of time, I want to be taught by the lecturer					
28. The method should be used frequently					
Multiple intelligence approach					
29. I do not forget information when it is presented in a form of music, as a role play or drama					
30. I do not like performing in front of other students					
31. Multiple intelligence approach promotes student involvement and creativity					
32. The lecturer gives feedback after multiple intelligence presentations					
33. I like learning and working alone					
34. The method should be used frequently					

Statements	Strongly disagree	Disagree	Agree	Strongly agree	Office use
	1	2	3	4	
Online teaching and e-learning					
35. I benefit more through WhatsApp group discussion because of feedback from classmates and the teacher					
36. The reference material (e.g. online videos, voice recording posted by my lecturers are useful in understanding the learning outcomes of the course					
37. The use of online teaching is a good tool to supplement face-to-face discussion in class					
38. I like seeing and listening to my lecturer face-to face					
39. I like when the student looks for information online and present in class					
40. I benefit more on the Zoom conferencing classes					
41. I benefit more on the WhatsApp discussion classes					
42. I benefited more when using Primal pictures					
43. Zoom conferencing classes makes me to like BNS					
44. The procedure for using Zoom conferencing is difficult to understand and to follow					
45. I like using online learning resources e.g. internet					
46. The online and e-learning method should be used frequently					
47. I benefit when teacher use mixed methods of teaching					

48. Does different teaching methods motivate you to study and seek more information if "Yes", motivate your answer.

_____

_____

_____

_____

_____

If "No", motivate your answer

_____

_____

_____

_____

_____

49. If you have any suggestions or comments about different teaching methods write in this box.

ANNEXURE I: Letter from the editor

B-Square Synergy Consultants

Tax no: 93 087 48 228

Idea.Concept.Product

LETTER FOR EDITING OF THE DISSERATION OF CONSTANCE NTSAMAENG RINGANE

THE NURSING STUDENTS' EXPERIENCES REGARDING THE INNOVATIVE TEACHING AND LEARNING STRATEGIES USED IN BIOLOGICAL AND NATURAL SCIENCES COURSES AT A NURSING COLLEGE

Submitted in fulfilment of the requirements for the degree: Master of Arts in the discipline of in the subject Health Studies at the University of South Africa

10 May 2022

TO WHOM IT MAY CONCERN

I have edited the dissertation of Constance Ntsamaeng Ringane, for her degree Master of Arts, in the discipline of Health Studies at the University of South Africa and I have sent her and her Study Leader(s) my comments/suggestions.

Kind regards

Dr Liesl Brown (PhD)

ANNEXURE J: Letter from the statistician

HORVSEN RESEARCH CONSULT

E-mail: horvsenenterprise@gmail.com
Address: Winstead Gardens
Phone: 084 470 9160

HORVSEN

18th May 2022
Tax No.: 0241019306

To whom it may concern

LETTER FOR DATA ANALYSIS OF THE DISSERTATION OF CONSTANCE RINGANE

This is to confirm that I assisted Constance Ntsamaeng Ringane with her data analysis on the topic "The Nursing Students Experiences Regarding the Innovative Teaching and Learning Strategies Used in Biological and Natural Health Sciences Courses at a Nursing College."

Submitted in partial fulfilment for the degree in Master of Arts in the subject area of Health Studies at the University of South Africa.

Please do not hesitate to contact me for any further information.

Best Regards.

Sylvester Horvey
(Researcher)