Examining Perceptions of Academic staff on the Factors Affecting the use of Smartphones as a Constructivist Learning Tool: A proposed model

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Abstract

The rapid growth of mobile technology has brought enormous benefits in terms of communication and how some tasks may be accomplished using this technology. However, although many benefits have been identified, many disadvantages have also been identified. The focus of this study was to determine the perceptions of academic staff members on the factors that affect the use of smartphones as a constructivist learning tool by students rather than as a mere communication and distraction gadget.

The factors that could affect the use of smartphones as a constructivist learning tool were identified through a comprehensive literature review. Based on the factors found, a model depicting the relevant factors was constructed, and the model was validated. Six independent constructs for the model; Demographics, Attitudes towards smartphones, Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, and Performance Expectations, were identified by grouping variables to measure each construct together. A questionnaire, based on the constructs and variables, was administered. The resulting data were analysed to validate the model. The conceptual model, tested by the survey, showing the significance of each factor, indicated that all the independent constructs impact the use of smartphones as a constructivist learning tool, either for communication and/or sharing academic-related activities.

The results of this study found that Demographics, such as academic departments, Attitudes towards smartphones, Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, and Performance Expectations all impact the use of smartphones as a constructivist learning tool.

Keywords—Constructivist learning tools, Smartphones in education, Technology in education

Declaration

Mna, Sithembiso Dyubele ndivakalisa ukuba umsebenzi wophando owethulwe kule ngcaciso ngumsebenzi wam wangaphambili, kwaye awuzange ungeniswe ngaphambili okanye inxalenye yawo kwenye iyunivesithi. Ndikwazisa ukuba lo msebenzi wokuphanda awuphuli malungelo abanye, njengoko yonke imithombo ecatshulweyo okanye esetyenzisiweyo ibonisiwe kwaye iyavunyelwa ngoluhlu olubanzi lweenkcazelo ngokubhekiselele ekupheleni kwezi zihloko.

I, Sithembiso Dyubele, hereby declare that the research work presented in this dissertation is my original work and has not been previously submitted in its entirety or in part for a degree in any other university. I also declare that this research work does not violate the right of others, as all the sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references towards the end of this document.

Sithembiso Dyubele **29/06/2021**
Date

Ukuvunyelwa kokuhanjiswa kokugqibela:

Approved for final submission:

Dr. Delene Heukelman **6/07/2021**
Date

Dedications

I would like to dedicate this work to my dad (Makemfe Dyubele) and my two mothers (Notshatile Nomakhala and Nosapho Nomakhala) because of the unwavering love they always give us at home, and with the fact that, even though we have been through a lot of suffering at home during our childhood, they never gave up on us. They have been there for us from day one, and they have been clear from the early ages that they want their kids to succeed in school. Sometimes waking up early in the morning to find something to eat in the neighbourhood so that we, as their kids, can have something in our stomach before we go to school. I will always be grateful for that, and it is because of those reasons that I dedicate this work to them.

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CHAPTER 1: INTRODUCTION

The aim of this chapter is to present the context of this study, identify the problem, introduce the purpose and objectives, give a brief overview of the possible contribution of this study, as well as the structure of the dissertation. The first section of this chapter discusses the background and context of this research. Section two looks at the research problem of this study, followed by section three, which presents the research question, aim, and objectives. Section four provides a brief overview of the possible contribution of this study. A summary of the structure of this dissertation has also been outlined at the end of this chapter.

1.1 Background of the study

The background of this study resides in the context of technological usage for learning. This study attempts to determine whether technological devices, specifically, smartphones could be used by students to construct their knowledge.

1.2 Preliminary review of related literature on smartphones in learning

This section briefly discusses the adoption of smartphones and their usage for educational purposes in school or class environments.

1.2.1 Adoption of smartphones

According to Sarfoah (2017), in many evolving economies, including Africa, the increasing utilisation of mobile phones and other technological appliances has become a significant subject that has not escaped the attention of those in education. This is supported by Esmaeili, Eydgahi, and Amanov (2015) for whom these modern technological devices have become standard equipment in various institutions of learning. Esmaeili *et al.* (2015) indicated that statistics provided by the International Telecommunication Union (2008) proclaims that almost 60% of the world population is using mobile phones. Sarfoah (2017) continued by stating that the generation of the 21st century has grown up surrounded by computing environments, where even in schools, many students come to classes armed with smartphones, laptops, and iPods. The embodiment of students by these technological devices has been supported by Fryer and Bovee (2016) for whom these tools are essential, as they bring various ways of facilitating fruitful engagements amongst students. According to Esmaeili *et al.* (2015), one of the most popular and dominating technological tools in schools is smartphones. It allows students to connect to the internet, check emails, connect to social media, and interact in a digital space unparalleled by previous generations.

According to Souza, Giusti, and Batista (2018), the term smartphone was introduced in the market to refer to a new class of mobile phones that provides wireless communication capabilities for integrated services such as voice communication, messaging, and personal information management applications. This is supported by Miakotko (2017) for whom smartphones have become a vital part of modern telecommunication facilities. It allows people to maintain continuous communication without interruption by their movements and distances. McCormack (2015) also claims that one of the essential features of smartphones is their ability to facilitate text, phone calls, or short communication among individuals. Miakotko (2017) further states that smartphones provide fast and precise access to electronically mailed digital images without restrictions by a desktop personal computer's constraint. According to Jacob and Issac (2014), smartphones combine different features that can be found in other devices such as cameras, PDAs, and MP3 players. It is a well-known fact that smartphones are used in education, and they allow students to enhance, support and improve access to learning in almost any setting (Mulvaney, Cavaliere, and Baldo, 2017); (Tossell, Kortum, Shepard, Rahmati, and Zhong, 2015).

1.2.2 Harnessing impact of smartphones in the classroom environment

Rosyidi (2020) indicated that smartphones are crucial in education, as many students have been found using them to access their learning applications online. He further stated that students could learn to make their classes and make their own quizzes through game applications such as Kahoot via smartphones. According to Rosli (2018, p. 10), "learning-on-the-go, especially learning via smartphones, has become a way of life, augmented by the new communication technologies". Students' learning on the go has been great and fun, as they can pursue their learning anytime and anywhere on their own smartphone devices. The positive contribution of smartphones in learning has also been supported by Klimova (2019), according to whom the students from the Faculty of Informatics and Management in Hradec Králové, Czech Republic, have been using smartphones to learn a foreign language. The usage of smartphones has shown the enhancement of university students' performance in foreign language learning (Klimova, 2019).

1.2.3 Non- academic activities propelled by smartphones in learning

The introduction of these technological tools has brought some questions about using smartphones in schools and their impact on students' learning. This is supported by Anshari, Almunawar, Shahrill, Wicaksono, and Huda (2017), according to whom the existence of smartphones amongst students has been found to be problematic, as students become obsessed with their devices to the point where they send or receive entertainment messages during classes.

As a result, students become unable to focus on their learning activities. On the other hand, Gaved and Peasgood (2017) indicated that smartphones are a useful tool that can be used to pursue learning. According to Gaved and Peasgood (2017, p.1), “affordances of smartphones (highly portable, powerful and domesticated) make them ideal platforms to move learning beyond the classroom and into everyday life”.

According to Anshari *et al.* (2017), smartphones have introduced learning-related problems. This includes students’ obsessions with devices during classes where they send and receive entertainment messages, isolation from teachers, and lack of attention. This is supported by Mathew and Alenazi (2016, p. 265), for whom “mobile phones have the potential to attract students towards non-academic information which can have serious consequences in students’ academic careers.” Similarly, according to Mahesh, Jayahari, and Bijlani (2016), smartphones have been banned in many educational institutions as students misuse them during classes by chatting with friends and playing games. This is supported by Green (2019) for whom students use their smartphones to share inappropriate content or cause distractions during classes. According to Jenks (2015), some students want to share their lives with friends, and they do not care about doing these non-academic related activities in their classes. Jesse (2015) further states that smartphones are both a distraction and an annoyance to both the students and the teacher. Statistics provided by Elder (2013) as cited by Jesse (2015) indicate that 85% of university faculties and students are of the opinion that smartphones are distractive. Smartphones have been found to have a negative impact on the school life of students. This includes dropping of learners’ grades caused by the increased distractions that lead to their time's misappropriation (Al-Harrasi and Al-Badi, 2014). The big question at hand is, therefore, to wonder whether smartphones can be used in a positive way, such as for constructing learning.

1.3 Research Problem

The main problem at the core of this study is whether the distractions that mobile devices, specifically smartphones, bring to learning, despite the well-documented benefits that mobile devices can provide, could be changed to positive outcomes by using smartphones for constructivist learning. It is interesting to look at the described benefits of smartphones within the constructivist learning philosophy. Constructivism posits that learners construct their knowledge with the help of their learning environment and their instructors, who serve as learning facilitators in a community of learning (Cetin-Dindar, 2015); (Noel, 2015). The ultimate purpose of

constructivism is to promote reasoning, critical thinking, understanding, use of knowledge, self-regulation, and mindful reflection (Nugroho, 2017).

Therefore, the research problem is to determine whether the advantages of smartphones may be used to benefit rather than disrupting learning.

1.4 Research aims, objectives, and questions

The sections mentioned above offer some advantages and disadvantages that mobile devices can bring to the learning environment.

The aim of this study is to examine the perceptions of academic staff on the factors affecting the use of smartphones as a constructivist learning tool by students.

1.4.1 Research Objectives

The aim mentioned above was achieved through the following three research objectives:

- Identify, from the literature, the factors that could affect the use of smartphones as a constructivist learning tool.
- Construct a conceptual model depicting the factors that affect the use of smartphones for constructivist learning by students.
- Validate the model by surveying academic members of staff

1.4.2 Research sub-questions

The research objectives were obtained by answering the following research questions:

- Which factors could affect the use of smartphones as a constructivist learning tool?
- Which factors affecting the use of smartphones as a constructivist learning tool by students are related, and how?
- How accurate is the conceptual model?

1.5 A brief overview of research methodology

This study has utilised a quantitative method, as the numerical data was gathered and analysed to test the relationships amongst constructs. In the process, a stratified sampling approach was adopted to ensure a more realistic and accurate estimation of the population as it was gathered across five different Departments under the Faculty of Accounting and Informatics, and the author was aware of their specific figures. After applying the above approach, a simple random sampling method was used in this population according to the number of academic staff members in the departments mentioned above, and it was also used to extract a sample size in the population of this study. A printed version of the questionnaires was hand distributed to 92 participants to collect data and then later analysed using Statistical Package for Social Sciences (SPSS) version 25. The SPSS software was used to firstly test the reliability and validity of all the Likert scale variables, using the Cronbach Alpha coefficient, where all the constructs were greater than 0.8 (see Table 3.3), which confirms their reliability in this study.

1.6 The possible contribution of this study

According to Al-Zoubi (2016), education is confronted with many problems. This includes the suffering facing students with disabilities whenever they have to go to school and those who stay far from school and come from underprivileged backgrounds. Moriña (2017) indicated that the number of students with challenges in higher institutions of learning rises every year. This has forced these institutions to improve their learning environments to accommodate disabled students. These issues include their inability to go to school sometimes because of various problems they are facing. As a result, advanced technological resources such as the internet to help them gain access to educational facilities were introduced to help them pursue their learning. As for people with underprivileged backgrounds, Dey and Bandyopadhyay (2019) indicated that a face-to-face learning paradigm had cost many students, especially those coming from impoverished backgrounds. These students sometimes become unable to attend school class because of environmental factors and personal problems that they face at home, which stops them from attending school. However, Dey and Bandyopadhyay (2019) also stated that these kinds of students could be able to further their studies if they can be introduced to the usage of technological resources in the pursuit of their learning. Recently, at the end of 2019 and at the beginning of 2020, the world has been facing a pandemic known as “Coronavirus.” Some of the precautions that were put in place to avoid its spread have forced students and their lecturers to stay at home, not to attend classes. This pandemic has been one of the most significant tests that

academics has ever faced, and some institutions have been utilising various kinds of technological platforms to keep academics going while students and their lecturers are far apart or staying at home. Within the context mentioned above, this study attempted to contribute towards using technology to advance education. More specifically, the expected contribution is to bring new insights into the utilisation of smartphones as a tool to help various students from diverse backgrounds to be able to construct their own learning.

1.7 Structure of the dissertation

This current dissertation on the perceptions of academic staff on factors affecting the use of smartphones as a constructivist learning tool by students consists of five chapters. The following is a brief explanation of what each of these chapters entails.

Chapter One: Introduction

This chapter presented the background and context of this research. The research problem was also outlined, as well as the aim, objectives, and research questions. This chapter provided some highlights in the form of a summary of the possible contribution of this study. It then concluded by outlining the structure of this thesis.

Chapter Two: Literature Review

This chapter describes constructivist learning and gives an overview of smartphones as a constructivist learning tool. It continues by explaining several factors affecting the use of smartphones by students. After discussing these factors, a theoretical model has been created to support the first objective of this study, and it was supported by the existing theories and models that agree with the factors that affect the use of smartphones as a constructivist learning tool.

Chapter Three: Research Design and Methodology

This chapter entails the research design and methodology of this study, population, sampling, reliability and validity, and analysis methods.

Chapter Four: Data Presentation, Analysis, and Interpretation

This chapter present and discuss results of this study on the factors affecting use of smartphones as a constructivist learning tool. These results are presented with a set of statistics computed from the survey data analysis in terms of means, frequencies, and correlations.

Chapter Five: Findings, Conclusions and Recommendations

This chapter concludes this study by providing an in-depth discussion of the analysis and recommendations on the factors affecting use of smartphones as a constructivist learning tool. This chapter also suggests new ideas for future research on improving the use of smartphones as a constructivist learning tool.

1.8 Summary

This chapter briefly introduced the background of this study, which resides in technological usage for learning and smartphone adoption. It also presented the impact of smartphones in education, including how smartphones offer flexibility to students in terms of learning. However, the related problems of smartphones despite their advantages in academics were also indicated in this chapter. The research problem, aim, objectives, and questions were also discussed. Lastly, a brief overview of the research methodology, the possible contribution of this study, and the structure of this thesis have also been discussed in the last sections of this chapter. The next chapter will discuss the literature review of this research.

CHAPTER 2: LITERATURE REVIEW

The previous chapter presented the structure of this thesis, which included the background and context of this research. The research problem was also outlined, as well as research questions, aim, and objectives. This chapter presents a brief description of constructivist learning and an overview of smartphones as a constructivist learning tool, as well as several factors that affect the use of smartphones for constructivist learning are presented.

2.1 Introduction

This chapter provides deep deliberation on the current state of mobile learning in higher education in South Africa (section 2.4) to understand what the reviewed literature says about mobile learning in the Republic of South Africa. The reviewed literature has found several factors that affect the use of smartphones by students to construct their knowledge and to learn with the help of their learning environment. Having found a vast number of factors, these factors are grouped into six categories. These categories include Demographics, Attitude towards smartphones, Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, and Performance Expectations. These categories are referred to as constructs going forward. This chapter also presents various hypotheses that have been developed and a conceptual model composed of the constructs mentioned above, as it is the second objective of this study. It then concludes by illustrating a conceptual model and providing a discussion on the theories and models that corroborate the constructed conceptual model or constructs of this study.

2.2 Brief description of constructivist learning

Xu and Shi (2018) describe constructivist learning as a theory that proclaims that learning is an active, communal process and that learners construct their knowledge more effectively through their own experiences or interaction with others than through traditional methods, such as lectures. This is supported by Selçuk and Yilmaz (2020) for whom constructivist learning is based on several principles, including the idea of a student building new knowledge rather than acquiring information, and instruction is regarded as a process of supporting that construction rather than communicating. Nugroho (2017) stated that when it comes to constructive learning processes, the student is structuring an inside representation of knowledge and an individual interpretation of experience. Similarly, Aina (2017) also indicated that the examples of lively learning processes encouraged by constructivist learning include practical experiments and field studies. Students also learn by working together and exchanging information or ideas with others online, in public, or in school.

The new evolution of technology has provided a space for students to utilise these online platforms to pursue their learning, as they are becoming more and more digitally literate and have grown immensely in terms of using technological tools. This is supported by Ozgul, Kangalgil, Diker, and Yamen (2018) who claim that a constructivist learning environment is an open space with abundant technology where students can utilise different tools and information resources to pursue their learning. Ozgul *et al.* (2018) also indicated that the fundamental promise of technology in learning is placed in its ability to improve the learning experience for those involved in it. Better learning will not come from finding better ways for teachers to instruct students but from giving learners better environments to construct their knowledge Ozgul *et al.* (2018). Miller-First and Ballard (2017) claim that constructivism is an appropriate theory for the initiation of technology in the learning process, and adequately managing the technology can help implement these principles in constructivist learning. Miller-First and Ballard (2017) also stated that integrating technology in education could effectively support constructivist learning.

According to Hu, Cleland, and Burt (2019), constructivist learning tools have been linked with the collaborating and communicative tools of learning technologies such as social networking platforms because they allow or have essential features for students to develop and maintain their content while engaging and communicating with one another for information or collaborative learning. This is supported by Nugroho (2017) for whom constructive learning tools must at least provide the following platforms: learner-centeredness, collaborative learning, interactivity, allow sharing, and many more. Hu *et al*. (2019) also reiterated that to improve the benefits of these technological tools in terms of becoming the constructivist learning tools for students means that students should be monitored and encouraged to communicate and work together within the learning context.

2.3 An overview of smartphones as a constructivist learning tool

The improvement of technology has become very interesting, especially when it comes to smartphones. According to Mark and Nguyen (2017), smartphones provide fast and precise access to electronically mailed digital images without restrictions by a desktop personal computer's constraint. This is supported by Miakotko (2017) for whom smartphones have become a vital part of modern telecommunications facilities. It allows people to maintain continuous communication without interruption of their movements and distances. Janzen, Chang, and Chen (2019) indicated that smartphones could perform many tasks as they can combine different

features that can be found from other devices such as cameras, PDAs, and MP3 players. It is a well-known fact that smartphones are used in education to enhance, support, and improve students' access to learning in almost any setting (Mulvaney *et al.* 2017); (Tossell *et al.,* 2015). This sentiment corresponds to the statement made by Imwa (2020) for whom the fact that smartphones are relatively cheaper when compared to mobile technology devices such as laptop computers allows students and teachers to have excellent cooperation in their pursuit of learning. Imwa (2020) also highlighted that the current mobile phones have either email or Short Messages Services (SMS) functionalities that allow information to be accelerated from or to learners and their mentors.

According to Berns and Sánchez (2021), learning methods could be enriched by combining innovations such as VR headsets with mobile devices such as smartphones, which provide learners with innovative opportunities to encounter and practice learning contents in settings that are typically difficult to incorporate in traditional learning environments. Even though laptops, Personal Digital Assistants (PDA), and smartphones may share some fundamental functionalities such as Microsoft office use, smartphones have slight advantages than the rest, as it differentiates itself through two essential capabilities. These two most significant smartphone capabilities include portability and always-available (Schrock 2015). Portability can be defined as the "perception of physical characteristics such as size and weight, as well as those evaluated through use, such as battery life"(Schrock 2015, p. 236). This is supported by Smith, Zhou, and Watzlaf (2017) for whom smartphone portability allows students to always have information in hand. Since smartphones have got weight and size that is insignificant, it fits an individual's hand. Since carrying it needs almost no energy, learners constantly carry them around wherever they go (Kushlev and Leitao, 2020). Tamimi, AlMazrooei, Hoshang, and Abu-Amara (2018) has seconded the features mentioned above and advantages of smartphones in learning by stating that smartphones can be used as a constructivist learning tool that can inspire students in the pursuit and the construction of their learning, as well as helping them to contribute to the making of meaningful knowledge through the content creation activities and critical reflection on their learning.

2.4 The current state of mobile learning in higher education in South Africa

According to Murire and Cilliers (2017), traditional universities in South Africa have tried various solutions to address the critical skills shortage that has become a problem in the South African

economy. This includes utilising information and communication technologies (ICTs) tools such as smartphones to enable effective communications among students and lecturers and, consequently, increase throughput rate and student pass rates (Murire and Cilliers, 2017). Students have used these ICT tools, such as smartphones to access learning management systems, smartboards, and e-learning (Murire and Cilliers, 2017). Similarly, Chuchu and Ndoro (2019) indicated that the South African higher education landscape is confronted by plenty of challenges that include transformation, student unrest, and poor student graduation rates. However, “Mobile applications have the potential to support teaching positively and learning in higher education institutions by providing universal communication, study aids and flexible location-based services for learners” (Chuchu and Ndoro, 2019; p. 54). Higher education landscape is appropriate for integrating student-centred mobile educational applications because mobile devices have brought enormous benefits, such as ubiquity on university campuses between students and staff members (Chuchu and Ndoro, 2019). According to Madlala *et al.* (2020), who conducted a study amongst 364 undergraduate students in different colleges, including Law and Management, Agriculture, Engineering and Science, and Humanities, in KwaZulu Natal, South Africa, undergraduate students were found to be using smartphone apps to participate in learning activities. Madlala *et al*. (2020) further indicated that perceived usefulness was found to have a higher positive impact on the usage of smartphone apps for learning purposes, while attitude and perceived ease of use was also found to affect the use of smartphones.

2.5 Factors affecting the use of smartphones by students based on previous studies.

The current study identified several factors that affect smartphone usage by students from previous studies. These factors include demographics, which composed of gender, age, study level or year of study, attitude towards smartphones, facilitating conditions, perceived usefulness, ease of use, and performance expectations. These factors are explained deeply below in terms of their impact on the use of smartphones for learning.

2.5.1 Demographics

According to Tolk, Janssen, Haanstra, van der Steen, Zeinstra, and Reijman (2020), *Demographics* can be defined as the study of a population based on factors such as age, race, sex, state, or nation, and many more. This corresponds to the claim made by DeVylder, Oh, Nam, Sharpe, Lehmann, and Link (2017) for whom *Demographics* are inclusive of a breakdown of a population such as gender, age, ethnicity, income, and employment status. In this literature

review, *Demographics* are composed of the following factors: gender, age, and level or year of study.

2.5.1.1 Gender

Gavali *et al.* (2017) conducted an observational cross-sectional study, which was inclusive of 446 medical students in Smt. Kashibai Navale Medical College, India. Their findings discovered a relationship between gender and the use of smartphones as a constructivist learning tool. Similarly, Alzougool and Almansour (2017) pursued a study of 376 students at the Arab Open University in Kuwait through a survey, studying the effect of gender among students on using smartphones for learning. They discovered that gender positively correlates with the students' smartphone utilisation as a learning tool, where female students were using smartphones to register their courses more than males. The findings disclosed by Alzougool and Almansour (2017) correlate with the outcomes discovered by Gavali *et al.* (2017), who claims, as a result of a study conducted at Smt. Kashibai Navale Medical College, India, using the observational cross-sectional study with 446 medical students, that gender impacts the use of smartphones for educational purposes. Almahfud (2014) conducted a survey that included 249 undergraduate teachers and 320 undergraduate students at King Kahlid University in Saudi Arabia. The findings from the study conducted by Almahfud (2014) agrees with the previous studies (Alzougool and Almansour, 2017); (Gavali *et al.* 2017) on the significant impact of gender on the use of smartphones for learning, as he found a positive correlation between students and teacher's gender, where the use of a smartphone to support learning were found to be higher among females.

2.5.1.2 Age

Twum (2014) conducted a descriptive survey to determine how the use of smartphones influences students' academic performance amongst three public universities in Ghana. The study was inclusive of 643 students, lecturers, and ICT coordinators. Twum (2014) discovered a correlation between students' age and the use of smartphones for learning, where the use of smartphones for educational purposes was higher for students with age groups under 21 than those between 22 to 31 years old. However, Anshari *et al.* (2017) found opposing results to those discovered by Twum (2014), as he indicated, as a result of a study in Brunei using a questionnaire-based survey with 355 students, that there is no significant difference between students' age for the use of smartphones to access educational material. Anshari *et al.* (2017) supported by Gilavand and

Shooriabi (2016) for whom there is a negative correlation between age and the use of smartphones for learning purposes due to a study conducted in southwestern Iran using a questionnaire-based survey with 60 students.

2.5.1.3 Study level or Year of study

Bikumalla *et al.* (2017) have conducted a cross-sectional questionnaire-based study at a teaching healthcare institution in Telangana, India. Their study was aimed at assessing the usage of smartphones for learning purposes among dental students. Bikumalla *et al.* (2017) found a statistically significant relationship between the level of study and the use of smartphones for learning purposes. Students that are doing 3rd and 4th year were utilising smartphones to browse study material on the internet more than others. Likewise, according to the findings discovered by Arpaci (2016) as a result of a study conducted at Lagos State University College of Medicine, using a cross-sectional survey with 125 medical school students, there is a positive correlation between the level of study and use of smartphones. The students in 6th year were found to be using their smartphones more frequently in taking notes and accessing journal articles. Nevertheless, Anshari *et al.* (2017) indicated that there is no correlation between the level of study and the use of the smartphone as a learning tool.

2.5.2 Attitude towards smartphones

Rashid (2018, p. 14) defined *Attitude* as a **"**settled manner of thinking or feeling about a person or a thing." Rashid (2018) continued to explore the attitude by stating that it is a tendency or orientation of a person's mind and can define how an individual behaves. In this study, *Attitude* refers to the students' mental positions towards using smartphones as a constructivist learning tool. An individual's attitude, which might be positive or negative, has been found to have an impact on the use of smartphones for learning by students.

2.5.2.1 Positive or Negative Attitude

Esmaeili *et al.* (2015) conducted a survey study at Eastern Michigan University in the United States of America (USA), which included 700 students to get their views about using smartphones as a learning tool. Their study showed that there is a positive correlation between students' attitudes and the use of smartphones for learning. In other words, if students have a more positive attitude towards using a smartphone, they are more willing to use their smartphones for learning. These findings are consistent with the results discovered in the study conducted by Yi *et al.* (2016) in the South Korean university, using an online survey with 1,923 college students, for whom

students' attitude towards smartphones has a strong positive effect on its utilisation for learning. This significant relationship indicates that students' positive attitude towards smartphone utilisation for learning can increase their performance in academic activities. However, even though this might be the case for the positive impact that attitude can provide towards the use of smartphones for learning, (Cheng and Iglesias, 2016); (Gavali *et al.* 2017) found to be on the contrary. According to Cheng and Iglesias (2016), as a result of a study conducted in the Spanish Castilla-Leon Region using a self-report questionnaire with 39 students, there is a negative correlation between students 'attitudes and the use of smartphones as a constructivist learning tool, as there were a smaller number of students who support the use of smartphones in the class environment. Similarly, Gavali *et al*. (2017) results, as a result of a study conducted in Smt. Kashibai Navale Medical College, India, using an observational cross-sectional study with 446 medical students, proclaim that use of smartphones for learning in class is the provision of destructiveness.

2.5.3 Facilitating Conditions

According to Sarfoah (2017, p. 14), *Facilitating Conditions* (FC) is the "perceived extent to which the organisations' technical infrastructure required for the support of the technologies that exists". In this study, *Facilitating Conditions* defined as the degree to which students and instructors believe that infrastructure and other supportive resources are available and can help them use smartphones to pursue their learning. *Facilitating Conditions* have been identified in the literature as one of the constructs with the most factors that have an impact on the use of smartphones as a constructivist learning tool by students. According to Sarfoah (2017); *Yi et al*. (2016); Esmaeili *et al.* (2015), and Alwraikat (2017), the following factors have been identified as having an impact on the use of smartphones for learning: This includes social norms (peer pressure and lecturers 'influence), and self-efficacy.

2.5.3.1 Social norms

According to Huang and Chuang (2016, p. 18), social norms refer to an "individual's beliefs about whether most other people, who are perceived as crucial, want the individual to perform a particular behaviour." Similarly, according to Ahmed (2016), the social norm is a social factor in which an individual sees that social relations like family, friends, or close peers influence his beliefs on using smartphones for learning. In this research, social norms refer to the vital influence of other people's beliefs regarding smartphone usage for learning. Yi *et al.* (2016) conducted an

online survey at the South Korean University, which included college students. They obtained 1,923 valid responses on the impact that social norms have on smartphone usage for learning. They discovered a correlation between social norms and the use of smartphones for learning, with the use of smartphones for learning being higher for students who are influenced by their peers. This indicates that as more students use smartphones for learning, they invite others to also use smartphones for their learning activities.

This is consistent with the study conducted by Sarfoah (2017) at the University of Ghana using a survey with 250 students, according to whom there is a significant statistical association between social influence and the use of the smartphone for learning. This positive correlation implies that peer pressure is one of the most critical factors contributing to students utilising smartphones as a learning tool. Sarfoah (2017) also proclaims that there is a positive impact between the lecturer's influence and smartphone usage as a learning tool, where the number of students who use smartphones in their learning activities was higher for students who were influenced by their lecturers. The findings from the previous studies (Huang and Chuang, 2016); (Yi *et al*. 2016) and (Sarfoah, 2017) correspond with the results from a study pursued in the Eastern Michigan University, using online surveys with 700 participants by Esmaeili *et al.* (2015) who claims that there is a significant positive relationship between social influence and smartphones, where the influence of external factors such as peers, families, and others are essential to the students' interest to utilise smartphones for educational purposes. Similarly, Ahmed (2016) found, as a result of a study conducted at the University of Canterbury, New Zealand, using a survey instrument with 310 participants that peer pressure has a significant impact on the implementation of learning through the smartphone in universities. Ahmed (2016) also stated that the more students are surrounded by students who get involved in using smartphones to conduct their learning, there is a higher possibility that others may practice this kind of technology to enhance their learning.

2.5.3.2 Self-efficacy

Gjengedal, Lagerveld, Reme, Osnes, Sandin, and Hjemdal (2021) defined self-efficacy as the decision made by someone to achieve a specific goal through organisation and execution. This is supported by Walling, Smith, Grayson-Sneed, and Smith (2021) for whom self-efficacy involves predicting the result, whether the action will lead to a result, or whether an individual can successfully execute procedures to achieve the results. In this literature review, only one study

(Esmaeili *et al.* 2015) found self-efficacy as the factor in using smartphones for learning. Esmaeili *et al.* (2015) discovered that self-efficacy has a positive relationship with smartphone usage to pursue better learning. This suggests that the more students make strong and bold decisions about the result they want to accomplish in school, the more they can be interested in using smartphones to support them in pursuing their learning goals.

2.5.4 Perceived Usefulness

Veríssimo (2018) indicated that *Perceived usefulness* is based on the belief that using technology enhances performance and is, therefore, associated with efficiency and effectiveness. In this research, *Perceived Usefulness* means the extent to which a student believes that using smartphones would be useful to their studies. Esmaeili *et al.* (2015) conducted a survey at Eastern Michigan University in South-East of Michigan with 24,000 students to examine the impact of the smartphone's usage in the class environments. Their study discovered a strong positive relationship between usefulness and the use of smartphones for learning. Therefore, students are more willing to use smartphones in the classroom if they feel that smartphones are useful in their learning. This is supported by Rung *et al*. (2014), as a result of a study in Australian Dental Students, using a descriptive questionnaire-based survey with 232 dental students, according to whom there is a positive correlation between usefulness and use of smartphones for learning, with the usage of smartphone devices higher to students who believe that it helps them gain access to learning material. Sumathi *et al.* (2018) also found in a study in Kalasalingam University, India, using a questionnaire-based survey with 40% of the students, that there is a significant relationship between usefulness and smartphones, in which mobile phone usage was higher for students who use them to share materials or notes.

2.5.5 Perceived Ease of Use

Pitafi, Kanwal, and Khan (2020) stated that *Perceived Ease of Use* is one of the critical aspects to be considered because when a tool or an application is perceived to be easier to use than another, it is more likely to be accepted by the user. This is supported by Ozturk *et al.* (2016) for whom ease of use is an extent to which an individual believes that the use of a particular thing will be free of effort. Rojas-Osorio and Alvarez-Risco (2019, p. 42) also indicated that Perceived Ease of Use refers to the "degree to which a person believes that using a particular system will make less effort to perform their usual tasks". In this study, *Perceived Ease of Use* refers to a degree to which students believe that smartphones would be easy to use when pursuing their learning. Rojas-Osorio and Alvarez-Risco (2019) conducted a study in one of the business

schools of one private university in Lima, Peru, using both open-ended and closed-ended with 366 students who participated in a study that aimed at investigating human motivations affecting an adoption decision for the smartphone among Peruvian university students. The findings indicated that the behavioural intention to keep using a smartphone (BIU) was significantly influenced by perceived ease of use (PEOU). The findings revealed by Rojas-Osorio and Alvarez-Risco (2019) correspond to the findings discovered by Darko-Adjei (2019), as a result of a study pursued in the University of Ghana, using a questionnaire-based survey with 294 participants, for whom ease of use has a significant impact on the use of smartphones, with the usage of smartphone devices higher to those who feel that it is not difficult to use them. Madlala, Civilcharran, and Singh (2020) also claims that ease of use has continued to have a substantial impact on the use of smartphones by learners to conduct their learning, as a result of a study conducted in the different colleges in KwaZulu Natal, including Law and Management, Agriculture, Engineering and Science, and Humanities using a questionnaire-based survey. The results revealed a strong correlation between Perceived Ease of Use and the use of smartphones for learning activities.

2.5.6 Performance Expectations

Sarfoah (2017) describes *Performance Expectations* as the extent to which an individual believes that technology can improve their performance. Likewise, according to Al-Sultan (2015), *Performance Expectation* is the degree to which the students trust that the system will enhance their school performance and help them accomplish various academic tasks in an educational context. This is also what *Performance Expectation* means in this study. Esmaeili *et al.* (2015) conducted a survey to evaluate the impact of smartphone usage in classrooms. Their findings include a strong positive relationship between performance expectancy and smartphone usage in the classroom, where the number of students who believe that smartphones' utilisation will enhance their performance in learning was high.

According to Ahmed (2016), as a result of a study in the University of Canterbury, New Zealand, using a survey instrument with 310 participants, also discovered findings that correspond with Esmaeili *et al.* (2015), in which there is a significant positive correlation between *Performance Expectations* and the use of smartphones for learning purposes. Twum (2014) also conducted a study at the public universities of science in Ghana with six hundred and forty-three students, lecturers, and ICT coordinators formed the sample size. He found a significant impact between

academic performance and utilisation of smartphones in science by university students. Twum (2014) emphasised the correlation by stating that the use of smartphones for learning is higher for students who see improvement in their academics after applying mobile phone technologies in their learning. However, two studies in the reviewed literature (Gavali *et al.* 2017) found no relationship between *Performance Expectations* and the use of smartphones as a learning tool.

2.6 Researcher's own conceptualisation

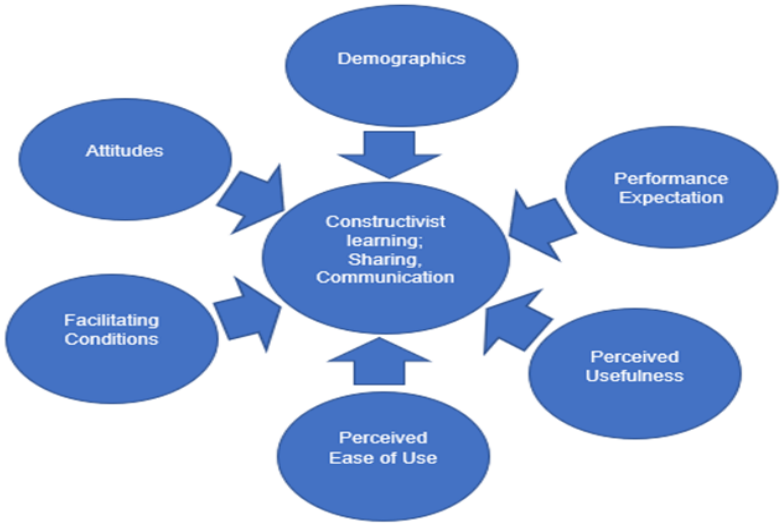

Figure 2. 1: Theoretical conceptual model based on the literature review

The conceptual model in Fig 2.1 uses the constructs identified in the reviewed literature to demonstrate the influence of each of them on the usage of smartphones as a constructivist learning tool.

2.7 Theories and Models that support the above proposed conceptual model

After the conceptual model was created, the current study identified theories and models that support the theoretical conceptual model illustrated in figure 2.1. These theories and models are discussed from 2.7.1 to 2.7.5 according to the research construct they support and how they are aligned to those respective constructs.

2.7.1 Attitude

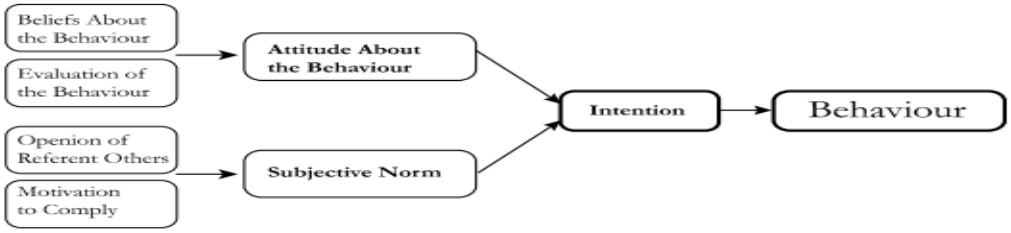

Figure 2. 2: Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975).

Figure 2.2 presents the Theory of Reasoned Action (TRA). The influence of students' attitudes and their strength with the use of smartphones for learning is supported by the Theory of Reasoned Action (TRA). According to Ahmed (2016), TRA was developed by Fishbein (1979) who declared that the most crucial factor in an individual's behaviour is his behavioural intention. Ahmed (2016) also indicated that behavioural intent is perceived as the main factor of behaviour. TRA emphasises an individual's behaviour, which includes the subjective norms of influential people that could affect those attitudes. Al-Emran and Salloum (2017) described the attitude as an individual's positive or negative assessment of the performance impact of a particular behaviour. In this study, a positive or negative attitude has been identified as one of the factors that directly influence the use of smartphones for learning by students, as discussed in 2.5.2 and represented on the conceptual model figure 2.1 as *Attitudes*.

2.7.2 Performance Expectancy

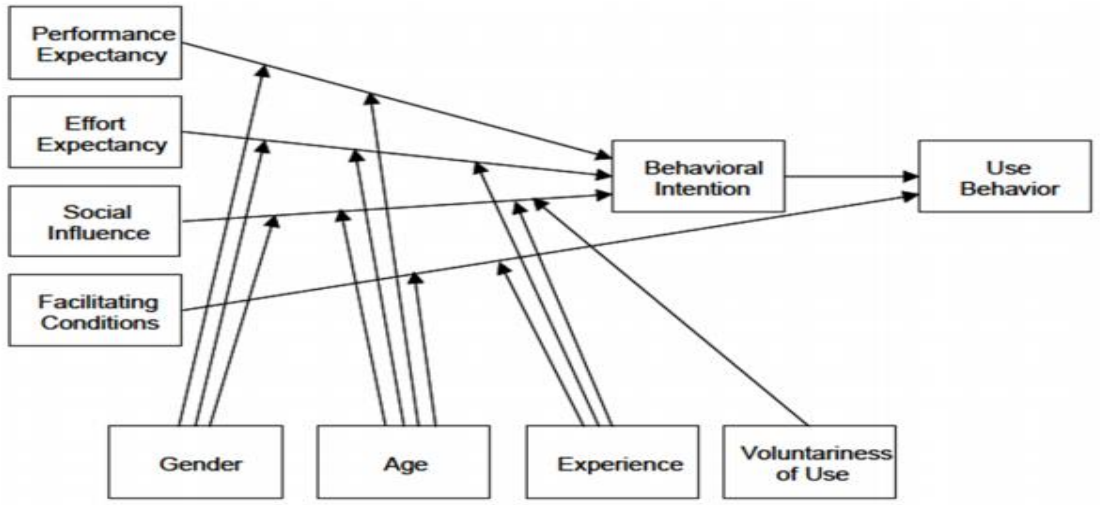

Figure 2. 3: UTAUT model, (Venkatesh et al. 2003)

Figure 2.3 illustrates the Unified Theory of Acceptance and Use of Technology (UTAUT). The effect of *Performance Expectations* on the use of smartphones for learning has been supported by the Unified Theory of Acceptance and Use of Technology (UTAUT). According to Ahmed (2016), UTAUT was established after reviewing previous studies that enabled a theoretical foundation for hypothesis formulation. This is supported by Venkatesh *et al*. (2016, p. 1) for whom UTAUT is "little over a decade old and has been used extensively in information systems (IS) and other fields, as a large number of citations to the original paper that introduced the evidence in this theory." According to Ahmed (2016), UTAUT posits that performance expectancy and other factors such as effort expectancy, social influence, and many others are direct factors of behaviour intention and user behaviour. Ahmed (2016) also indicated that UTAUT has an inclusive model of all eight Information System (IS) crucial constructs, strengths, and limitations. *Performance expectation* has been outlined deeply in 2.5.6 and represented on the conceptual model in figure 2.1 as a construct.

2.7.3 Demographics

The effect of *Demographics* on behavioural intention and use behaviour has been illustrated in figure 2.3 (UTAUT model). According to Skjeie, Holst, and Teigen (2017), gender and age were introduced as the moderating construct in the UTAUT model. They confirmed that demographics such as age and gender contribute to the influence between affecting factors, independent constructs, dependent constructs, and user acceptance. Chopdar, Korfiatis, Sivakumar, and Lytras (2018) also indicated that different kinds of demographics such as gender, age, profession, income, and marital status have an impact on the acceptance of the technology. Gender and age have been identified as one of the factors that influence the use of smartphones for learning in this study, as discussed under *Demographics* in 2.5.1 and represented on the conceptual model in figure 2.1.

2.7.4 Facilitating Conditions

According to Ahmed (2016), Facilitating Conditions can be described as the availability of facilities to support the use of technology. This includes a broad range of technical support, educational systems, learning environments, and many more. *Facilitating Conditions* have been associated with one of the key constructs that have an impact on user behaviour in the UTAUT model. Venkatesh and Zhang (2010) highlighted that when an individual attempt to use new technology, he is expected to have a prior understanding of the kind of technology he is going to utilise. This initial understanding includes resources, technical support, and peer support which can be

described or accommodated by this construct (*Facilitating Conditions*). This study also identified *Facilitating Conditions* as having an impact on the use of smartphones for learning, as outlined in 2.5.3 and represented on the conceptual model in figure 2.1.

2.7.5 Perceived Ease of Use, and Usefulness

Figure 2.4 illustrates the Technology Acceptance Model (TAM) proposed by Davis (1989). According to Joo, Park, and Lim (2018), *Perceived Ease of Use* can be defined as the extent to which an individual believes that the system will be free of effort. While *Perceived Usefulness* can be defined as the extent to which an individual believes that technology would benefit their activities. Ma, Gam, and Banning (2017) indicated that the *Perceived Ease of Use* and *Usefulness* is directly associated with a model proposed by Davis *et al.* (1989) called the Technology Acceptance Model (TAM). TAM suggests that IT development is affected by previous use-related beliefs (Ma *et al.,* 2017). This is supported by Ahmed (2016) for whom TAM suggests that two beliefs can describe user acceptance. This includes *Perceived Usefulness and Perceived Ease of Use.* The TAM has been chosen in this study as the theory that supports *Perceived Usefulness and Perceived Ease of Use* on the use of smartphones for learning. *Perceived Ease of Use and Usefulness* has been discussed in 2.5.4 and 2.5.5 and represented on the conceptual model figure 2.1.

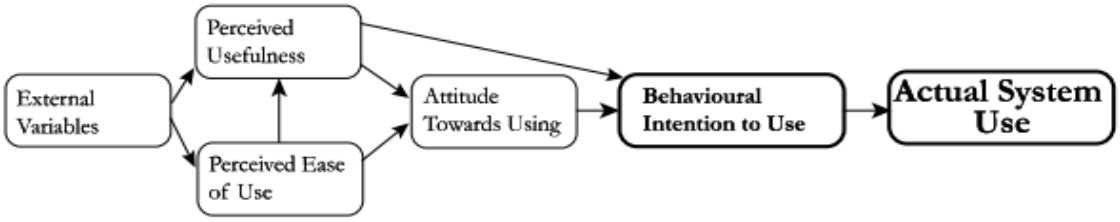

Figure 2. 4: Technology Acceptance Model (TAM), (Davis et al., 1989)

2.8 Itemisation and weighting of factors as identified in the literature

Table 2.1 presents several factors found from the reviewed literature to have an impact on the use of smartphones as a constructivist learning tool by students. This table (2.1) also introduces six independent constructs that were constructed after the factors mentioned above were classified (refer to the introduction of chapter 2 for more information about this categorisation of factors). The second column of each row contains two numbers separated by a comma: The first number represents how many factors for the corresponding row were found from the reviewed

studies not to have any impact on the usage of smartphones as a constructivist learning tool, and the second number represents how many factors for the corresponding row were found from the reviewed studies to be affecting students' use of smartphones as a constructivist learning tool. All the independent constructs in Table 2.1 have been statistically analysed (values inside brackets) to determine which one has the strongest influence on the dependent construct (use of smartphones as a constructivist learning tool) based on the identified factors from the reviewed studies. For example, in this case, *Perceived Usefulness* and *Perceived Ease of Use* are the constructs that were found to have the highest number of factors that are influencing the dependent construct with 0.9.

Table 2. 1: Measurement of the factors found from the reviewed studies

Independent Construct	Number of factors affecting or not the Dependent construct
Attitude towards smartphones	1,8 (1/9,8/9) (0.111,0.888)
Facilitating Conditions	4,14 (4/18,14/18) (0.222, 0.777)
Demographics	5,9 (5/14,9/14) (0.357, 0.642)
Perceived Usefulness, Perceived Ease of Use	1,9 (1/10, 9/10) (0.1, 0.9)
Performance Expectations	3,5 (3/8, 5/8) (0.375, 0.625)
Total	14, 45

According to this literature overview, *Perceived Usefulness and Perceived Ease of Use* have been found to have more factors that affect the use of smartphones as a constructivist learning tool. Examples of reviewed studies that have found *Perceived Usefulness and Perceived Ease of Use* to positively impact the use of smartphones for constructivist learning include (Esmaeili *et al.* 2015); (Gavali *et al.* 2017). *Attitude* towards smartphones is the second construct with the most critical factors that were found to influence the use of smartphones for constructivist learning, as confirmed by the studies conducted by Sarfoah (2017) and (Yi *et al.* 2016). This literature also found *Facilitating Conditions* to have several factors that significantly impact the use of smartphones for constructivist learning. Some of the reviewed studies that confirmed the relationship between Facilitating Conditions and the use of smartphones for constructivist learning include (Alzougool and AlMansour, 2017); (Almahfud, 2014). As for *Demographics* and *Performance Expectation,* the reviewed literature found the least number of studies that showed an impact on the dependent construct (use of smartphones for constructivist learning), as well as,

few studies from this literature that were found with no relationship with the use of smartphones for constructivist learning (Pullen *et al.* 2015); (Sarfoah, 2017).

2.9 Conclusion

This chapter presented a brief description of constructivist learning and an overview of smartphones as a constructivist learning tool. It continued by discussing the factors that were identified by the literature review as the main factors affecting the use of smartphones as a constructivist learning tool by students. In the process of discussing these factors, it has grouped them into six categories that were used as constructs of the conceptual model. The first category is *Demographics*. This category includes three factors (gender, age, and level or year of study) that were acknowledged as influencing smartphone usage for learning. The second category, which is an *Attitude* towards smartphones, brought together all the studies or authors that justify the effect of attitude (whether it is positive or negative) towards using smartphones as a learning tool by the students. The third category, *Facilitating Conditions,* had three factors, namely mobile phone features (storage and weight, and internet), social norms (peer pressure, anxiety, and lecturers' influence), and self-efficacy were identified. *Perceived Ease of Use* and *Usefulness* has a significant role in influencing students to use smartphones in their learning. The last category is *Performance Expectations*. This chapter concluded by presenting a proposed conceptual model as required by the second objective of this study and provides the theories and models that support the presented model. The literature in this study was sufficient to identify the constructs with their respective factors. However, we still need to measure each factor's influence and detect relationships between factors that the literature has not provided. That will be covered in chapter 3,4, and 5.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

The previous chapter identified and discussed the relevant studies from the literature that were used to formulate a conceptual model to support the second objective of this study: construct a conceptual model depicting the factors that impact the use of smartphones for constructivist learning by students. This chapter provides an in-depth explanation of the methodology that had been employed in this study

3.1 Introduction

This chapter discusses the research design and methodology used to accomplish the third objective of this study: empirical testing of the model of the factors affecting the use of smartphones as a constructivist learning tool. In the process, a research population that gives the exact number of the participants and the location of this study have been outlined. A research approach has also been reflected, and justification was provided as to why the study was conducted in that particular environment (Durban University of Technology). Sampling approaches such as stratified and random sampling methods are also discussed with proper justification as they were used in this study for sampling purposes or to help the researcher select the participants that were to be used in the current study. The data collection and data analysis are also indicated, and the reliability results for the test were conducted amongst constructs and variables of this study.

3.2 Research Population

Fredrick, (2015) described the population as a comprehensive group of individuals, institutions, and other objects with a shared characteristic in where a researcher have an interest in pursuing. The population of this study was inclusive of 92 participants from the Faculty of Accounting and Informatics at Durban University of Technology (DUT). Only 80 participants completed the questionnaires, while some members did not return the questionnaire. DUT is one of the four universities in the province of Kwazulu-Natal (KZN) in the Republic of South Africa. The main campus of the university is situated in Durban. The choice of this research population is linked to the current location of the researcher.

3.3 The research paradigm

The research paradigm employed by this study is positivism. According to Makalima (2019; pg. 21), positivism is “based on the idea that science is the only way to learn about the truth”. Makalima (2019) further indicated that positivism relies on measurable reflections that lead to

statistical analyses. This is corroborated by Collis and Hussey (2013) for whom positivism is driven by an attempt to justify beliefs and add the available and acceptable knowledge as a part of the developed strategy. This method was used in this study as the researcher was trying to prove the established hypotheses using scientific methods of analysis. Alharahsheh and Pius (2020) also claim that in positivism studies, the researchers' responsibility is constrained to data collection and interpretation objectively. This is what this study has done, where the data was gathered, analysed, and reported in chapter four.

3.4 Research Approach

This study is quantitative in nature. According to Apuke (2017), quantitative research is where the research results can be measured. Rutberg and Bouikidis (2018) indicated that quantitative data is mathematical and statistical. The quantitative method was adopted as the data used in this study was numerical, as well as helping in quantifying and analysing variables of this study in order to get results. In the process, two methods were used, namely, content analysis and survey. According to Roller (2019), content analysis, as a research method, is a systematic and objective means of describing and quantifying phenomena. Content analysis was used to review existing literature in pursuit of the first objective, which seeks to identify from the literature the factors that could affect the use of smartphones as a constructivist learning tool and the second objective of this study. Hulland, Baumgartner, and Smith (2018) indicated that surveys are used to get data about contemporary attitudes, opinions, or beliefs, and that is what this study has done, where a survey was carried out for the achievement of the third objective of this study. Readers are reminded that the third objective of this study sought to validate the proposed model on the perceptions of academic staff on the factors affecting the use of smartphones as a constructivist learning tool. According to Ukaegbu (2020), surveys are suitable to analyse the perceptions of the participants in a particular study. In order to collect survey data from participants, the researcher sought ethical approval from the Durban University of Technology Faculty Research Committee (FRC) under the Faculty of Accounting and Informatics. The researcher received Level 2 ethical approval (Appendix O) and permission (Appendix N) to go ahead with the current study. The researcher has successfully completed online ethical training courses and achieved Ethics Certification in Introduction to Research Ethics (Appendix K), Research Ethics Evaluation (Appendix L) and Informed Consent (Appendix M).

3.5 Hypotheses Development

After identifying this study's constructs, based on literature, hypotheses are introduced to predict the relationship between independent constructs and their dependent constructs. According to Kay (2020, p. 15), “hypothesis testing in statistics is formulated to gain answers to questions of interest”. These hypotheses are structured according to the constructs of this study. These hypotheses are tested in 4.3 (chapter 4) under data analysis.

They are outlined in the following:

I. Attitude towards smartphones

For students’ attitude, it is hypothesised that:

H1: There is likely to be a significant statistical association between students’ Attitude and usage of smartphones as a constructivist learning tool.

II. Facilitating Conditions

The second hypothesis is as follows:

H2: There is likely to be a significant statistical association between Facilitating Conditions and usage of smartphones as a constructivist learning tool.

III. Performance Expectations

The third hypothesis:

H3: There is likely to be a significant statistical association between Performance Expectations and usage of smartphones as a constructivist learning tool.

IV. Perceived Usefulness

As for Perceived Usefulness, it is hypothesised that:

H4: There is likely to be a significant statistical association between Perceived Usefulness and usage of smartphones as a constructivist learning tool.

V. Perceived Ease of Use

On Perceived Ease of Use, it is suggested that:

H5: There is likely to be a significant statistical association between Perceived Ease of Use and usage of smartphones as a constructivist learning tool.

3.6 Sampling

A stratified sampling approach was adopted in this study. According to Fern, Rahim, Saba, Almazyad, and Rehman (2017), in a stratified sampling approach a population is categorised into subgroups that will share the same attributes. This supported by Yu, Wang, Ciren, and Sun (2018) for whom the stratified sampling method is used when an individual might reasonably anticipate the measurement of interest to differ among different subcategories and where there is assurance of representation from all the subcategories. In this study, a stratified sampling approach was

applied to ensure a more realistic and accurate estimation of the population that has been used. This method was applied across the five Departments under the Faculty of Accounting and Informatics, as the author knows their specific figures. After applying the above approach, a simple random sampling method was used for this population according to the number of academic staff members in the departments mentioned above. Sharma (2017) proclaims that, in a simple random sampling method, the selection of the participants depends on a chance or by probability. Hence, this technique is also known as the method of chances. This method is used to extract a sample in a larger population, and this is the same reason why it was used in the study.

The Faculty of Accounting and Informatics was selected to conduct the survey based on convenience and because technology is being used extensively in this faculty. The specific departments included Information Technology, Auditing and Taxation, Management Accounting, Information, and Corporate Management, and Financial Accounting. This faculty had a total of 128 academic staff. The academic staff members were chosen as the participants of this study because the researcher felt that they would be more realistic when giving answers or perceptions on the distributed questionnaire, unlike students who might be biased. After all, they are directly involved in the usage of these smartphones in the class environment. Since the population of the study is finite or countable, the sample size of this survey was calculated in line with the sample size formula suggested by Happ, Bathke, and Brunner (2019) (see equation 3. 1) for whom n' = Sample size, N = Population size, Z = Confidence level, P = Estimated proportion, and d = Accuracy. Using equation 3.1, a sample size of 92 was obtained, where the following values were applied: N = 128 academic staff that ended up giving a sample size of 92, p = 0.7, d = 0.05, and Z = 1.96.

$$\boldsymbol{n' = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \boldsymbol{Equation} \qquad \mathbf{3.1}$$

3.7 Data Collection

A survey was conducted during July and August 2019 before and after the school mid-year holiday. A printed version of the questionnaires was hand distributed to 92 participants. They were required to complete the questionnaires within two weeks. Only 80 participants completed the questionnaires, so all further calculations for analyses are based on 80 participants. This

questionnaire-based survey was inclusive of nine constructs, six of which represent the independent constructs, and the other three are the dependent constructs (use of smartphones as a constructivist learning tool) in an attempt to cover some of the factors that students might use smartphones for. With each of the nine constructs, factors contributing towards that construct were associated. The constructs included the following: *Demographics, Attitude towards smartphones, Facilitating Conditions, Performance Expectations, Perceived Usefulness, Perceived Ease of Use, Sharing, Communication*, and *Constructivist learning*. A 5-point Likert-scale, using strongly disagree, disagree, weakly agree, agree, and strongly agree, was implemented in the questionnaire. The nine constructs are described briefly below. The complete questionnaire can be found in Appendix A.

3.7.1 Demographics

According to Sarfoah (2017), the primary purpose of demographics in a study is to understand whether the participants are suitable to respond to a specific topic. The essential moderators in this construct, such as gender and age, are part of the Unified Theory of Acceptance and Use of Technology (UTAUT) establish by Venkatesh *et al.* (2003). UTAUT is one of the key models at the centre of this study and is explained in chapter two (section 2.8.2). Therefore, demographic characteristics were included in this survey. The seven factors (variables) used to measure Demographics were: department, age, gender, ethnic group, employment, citizenship, and rank. These biographical variables were analysed to determine the profile of the sample participants.

3.7.2 Attitude towards smartphones

Fredrick (2015, p. 14) defines attitude as “the way of thinking or acting towards a particular event.” This is supported by Gilavand, Moezzi, and Moradi (2019) for whom the differences of individuals in terms of attitude, belief, and skills can influence a particular person in accepting a specific kind of technology. The majority of studies concerning smartphone adoption have employed attitude as well as other theories and models such as Technology Acceptance Model (TAM) by Davis (1989), Innovation Diffusion Theory (IDT) by Rogers (2003), Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh *et al.* (2003). This study involved *Attitude* towards smartphones as one of its constructs, and to check whether attitudes might have an impact on influencing students to use smartphones as a constructivist learning tool. Nine variables (listed in Table 3.1) were used to measure this construct.

3.7.3 Facilitation conditions

According to Ahmed (2016), facilitating conditions can be defined as the extent to which specific organisations' technical resources are available to assist in using the system. This assertion is corroborated by Sarfoah (2017) for whom facilitating conditions refer to an extent to which an organization's infrastructure might support technology usage. This study is consistent with previous research (Sarfoah, 2017; Yi e*t al*.,2016; Esmaeili *et al*., 2015; Alwraikat, 2017) on the significant impact of facilitating conditions to the use of smartphones for learning. The construct of *Facilitating Conditions* was brought in this study to check whether the institution's infrastructure impacts the usage of smartphones as a constructivist learning by students. Eight variables (listed in Table 3.1) were used to measure this construct.

3.7.4 Performance expectations

Ahmed (2016) also shared his sentiments on performance expectations. Performance expectations is an instance in which individuals believe that using the system will boost their performance (Ahmed, 2016). This is supported by Lwaga *et al.* (2015) cited by Sarfoah (2017) for whom performance expectations are a degree to which students see smartphones assisting them in performing better in their studies. This construct (Performance expectations) is one of the four primary determinants indicated in Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh *et al*. (2003), and it has a significant impact on the usage and intention of involving a specific technology by users to accomplish a particular mission. The construct of *Performance Expectations* was included as one of the model constructs to check whether there is any impact that smartphones can bring to students' performance. Nine variables (listed in Table 3.1) were used to test this construct.

3.7.5 Perceived usefulness

According to Cho, Lee, and Quinlan (2017), perceived usefulness can be defined as the extent to which an individual believes that technology would benefit their activities. This construct has been corroborated with a model (TAM) in section 2.8.5 to vindicate its importance in the introduction of technology in various institutions. According to Ahmed (2016), Technology Acceptance Model (TAM) proclaims that the following two beliefs describe user acceptance of a particular technology. This includes Perceived ease of use and Perceived usefulness. The belief that technology is useful can significantly influence its practice (Ahmed, 2016). In this study, perceived usefulness was used as the construct with seven variables (listed in Table 3.1) to measure *Perceived Usefulness.*

3.7.6 Perceived ease of use

Perceived ease of ese can be defined as an extent to which an individual believes the system will be free of effort (Cho *et al*., 2017). Alomary and Woollard (2015) also posit that Perceived ease of use is one of the TAM determinants, and it proclaims a belief that users will accept technology if they believe it is easy to use. Ahmed (2016) indicated that Perceived usefulness and Perceived ease of use are also significant factors in the Theory of Planned Behaviour (TPB). This study included *Perceived Ease of Use* as one of its constructs to check whether smartphones would be easy to use by students to construct their learning. Eight variables (listed in Table 3.1) were brought to the respondents' attention under this construct to check whether they are strongly disagreeing', 'fairly disagree,' 'weakly agree,' "fairly agree," or 'strongly agree' to the questions raised. Similarly, to Perceived usefulness, Perceived ease of use has been supported by various theories in this study (section 2.8.5).

3.7.7 Sharing

According to Shooriabi and Gilavand (2017), students can take advantage of smartphone mobility to support their learning. Smartphones allow students and lecturers to share their school activities (Shooriabi and Gilavand, 2017). This study involved *Sharing* as a construct to understand whether academic staff members believe that students could use their smartphones to share any of their school activities, either among themselves or with their lecturers. Eight variables (listed in Table 3.2) were used to measure this construct (*Sharing*).

3.7.8 Communication

Kibona and Rugina (2015) believe that one of the major functionalities of smartphones is to consolidate communication among human beings. The significant features of smartphones, such as facilitating communication, have been an essential factor that propels students or institutions of learning to exercise smartphones as a constructivist learning tool. This assertion is corroborated by Ahmed (2016, p. 3) for whom" a large spectrum of communication possibilities (phone calls, video conferencing, text messaging, social networking and accessing email)" that smartphone provide various learning stakeholders to utilise smartphones in the pursuit of learning. Therefore, this study investigated whether students could use smartphones to facilitate communication between themselves or their lecturers. Four variables (depicted in Table 3.2) were used to measure this construct (*Communication*).

3.7.9 Constructivist learning

According to Twum (2014), constructivist learning is the concept of learning that assumes that students are energetic in their learning and that they utilise their available knowledge to "process and personalise the incoming information." This is supported by Bensalem (2018) for which constructivism is when students construct their learning based on the experiences and reflection on those experiences. Ahmed (2016) posits that there are several mobile learning theories that involve students in mobile learning environments. This includes Constructivism, Behaviourism, Cognitivism, and many more (Ahmed, 2016). This study recognises constructivism as one of the key aspects that play a significant role in fostering smartphones' adoption as a constructivist learning tool. *Constructivist learning* is used as one of the constructs of this study. Eight variables (to be found in Table 3.2) were used to measure this construct (*Constructivist learning*).

All the variables from the questionnaire used in this survey to measure each construct are briefly presented as follows: Table 3.1 contains independent variables with their corresponding constructs, and Table 3.2 has dependent variables with their measured construct.

Table 3. 1: Independent variables to measure a construct

Construct	Independent variables (Statement in the questionnaire)
Demographics	Department
	Age
	Gender
	Ethnic group
	Employment
	Citizenship
	Rank
***Attitudes towards the use of smartphones as a learning* tool**	Students have a positive attitude towards smartphones.
	Students prefer learning from smartphones to learning from books.
	Smartphones are fun for students.
	Students would like to work with a smartphone in class.
	Smartphones would help students organize their work accurately.
	Students would feel comfortable working with a smartphone.
	The use of smartphones would help to provide a better learning experience.
	Students would feel confident when asked to perform a new task on their smartphones.
	Lessons using smartphones as a tool would be enjoyable.
Facilitating Conditions	There is a specific person or group that is available to assist them with smartphone difficulties.
	Smartphones are compatible with other school devices they use.
	Smartphones have functions that they need to use in their learning.
	Students have adequate knowledge and skills to use smartphones.

	The institution provides students with the necessary resources to enhance smartphone learning.
	Students' friends are using smartphones.
	Students' lecturers recommend them using smartphones for learning.
	The operating costs of smartphones allow them to use it.
Performance Expectations	Improve their academic performance.
	Increase productivity in the class.
	Make their learning more effective.
	Help them easily retrieve information for their studies.
	Improve their learning outcome.
	Enable them to accomplish tasks more quickly.
	Will increase their chances of improving their marks.
	Improve their communication
	Improve their competency skills.
Perceived Usefulness	Smartphones encourage collaborative learning among students.
	Smartphones help students to be more active in class.
	Smartphones promote autonomous learning among students.
	Smartphones help students to do their learning activities quicker.
	Smartphones allow students to gain access to up-to-date information through the web.
	Smartphones are an effective tool for giving students immediate support and feedback.
	Smartphones provide students with more flexible access to learning, as it can be done anytime, anywhere.
Perceived Ease of Use	Download class materials.
	Work with different school apps.
	Read materials.
	Navigate the application on the screen.
	Engage in schoolwork.
	Remember how to perform tasks.
	Record a class lecture.
	Search course materials.

Table 3. 2: Dependent variables to measure a construct

Construct	Dependent variables (Statement in the questionnaire)
Sharing	Handwritten notes.
	Educational videos.
	Screenshots.
	In discussion forums, educational blogs, or newsfeeds.
	Downloaded books, lecture notes, and/or articles.
	Audio recordings.
	Learning apps and games.
	Class information messages.
Communication	Students and other students.
	Students and lecturers.
	Students and administrative staff.
	Students and parents.
Constructivist learning	By doing something when they learn instead of simply absorbing what is being transmitted to them.
	By allowing them to discover many new ways of learning when using their smartphones to learn.
	By allowing them to get involved in many activities that strongly engage the thinking process in their minds.

	By enabling them to interact with the learning material in the language that they are most comfortable with.
	By enabling them to connect what they are learning with things that are happening in their life.
	By enabling them to connect the new knowledge to their existing knowledge.
	By giving them enough time to reach their learning goals.
	By adding excitement and motivation for them to learn more.

3.8 Conceptual model

The constructs influencing the use of smartphones as a constructivist learning tool by students that have been identified in the literature are listed in Table 3.1. This includes *Demographics, Attitude towards smartphones, Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, and Performance Expectation*. Figure 3.1 depicts these constructs and how they relate to the constructs measured by the identified dependent variables, as listed in Table 3.2. These constructs were used as the basis for the questionnaire used to gather data from academic staff members on their perceptions of which factors would influence the use of smartphones as constructivist tools by students.

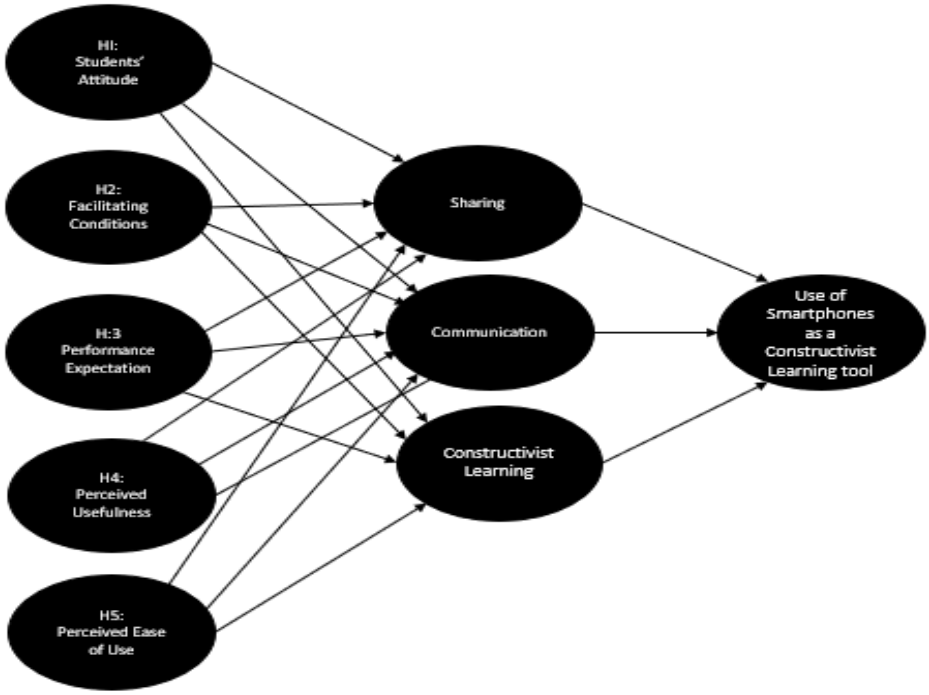

Figure 3. 1: Empirical Tested model

3.9 Data Analysis

This section provides an in-depth explanation of the methods used to analyses the data collected in this study. The data were analysed using the Statistical Package for Social Sciences (SPSS) version 25. According to Aljandali (2017), SPSS is an effective and user-friendly program that offers several ways of quickly analyzing data and test scientific hunches. Holmes *et al.* (2014) cited by Sofowora (2015) indicated that SPSS has many functionalities, which include Factor Analysis, Cluster analysis, Chi-Square, Nonlinear Regression, Data Examination, Reliability tests, Correlation, T-tests, ANOVA, MANOVA, Data transformations, Discriminant Analysis, Loglinear Regression, Logistic Regression, Descriptive Statistics and many more.

The SPSS software was used in this study to test the reliability and validity of all the Likert scale variables, using the Cronbach Alpha coefficient, where all the constructs were greater than 0.8 (see Table 3.3), which confirms their reliability in this study. Descriptive and inferential statistics were then calculated from the validated data. The inferential statistics were calculated with the assistance of the Pearson correlation coefficient analysis for all the Likert scale variables of this study. Factor analysis and principal component matrix were also analysed using SPSS for all the above-mentioned Likert scale variables, the same as regression. The effect of demographics on the Likert scale variables of this survey was analysed using ANOVA. According to Plonsky and Oswald (2017), Analysis of variance (ANOVA) is a statistical method used to identify differences between the experimental group means, and it is the same purpose why ANOVA was used in this study.

3.10 Reliability and validity

This section presents the results of Cronbach's alpha (α) coefficients after a questionnaire-based survey was tested for reliability and Pearson's coefficients for this study.

3.10.1 Instrument reliability

According to Mohajan (2017), reliability is used to measure consistency among the instruments. This questionnaire-based survey used Cronbach's alpha (α) coefficients to test the reliability of the study variables and their constructs. According to Hoekstra, Vugteveen, Warrens, and Kruyen (2019), Cronbach's alpha is a reliability test technique that needs only a single test administration to give a unique estimate of the reliability among a given test. Hoekstra *et al*. (2019) continue by stating that Cronbach's alpha is the average value of the reliability coefficients that one can get in all the possible combinations of variables and their constructs when they are divided into two half-tests. Rey, Carballo-Fazanes, Varela-Casal, and Abelairas-Gómez (2020) indicated that the

closer Cronbach's alpha coefficient is to 1.0, the better the internal consistency of the constructs in the scale. Rey *et al.* (2020, p. 26) further provided the following guidelines for Cronbach's alpha reliability coefficient values: above 0.9 – Excellent reliability, above 0.8 – Good reliability, above 0.7 – Acceptable reliability, above 0.6 – Questionable reliability, above 0.5 – Poor, and below 0.5 – Unacceptable".

Table 3.3 shows Cronbach's alpha (α) coefficients of the research constructs and the Likert-scale research variables of this study. The Cronbach's alpha coefficients for the variables measuring the constructs of this survey were all greater than 0.8, which confirms their reliability in this study.

Table 3. 3: The reliability of all the research constructs and their variables

Research Constructs	No of variables	Cronbach's alpha (α)
Attitude towards smartphones	9	0.873
Facilitating Conditions	8	0.829
Performance Expectations	9	0.946
Perceived Usefulness	7	0.885
Perceived Ease of Use	8	0.919
Sharing	8	0.938
Communication	4	0.809
Constructivist Learning	8	0.945

3.10.2 The validity of the research constructs and their variables

Mohajan (2017) indicated that validity is concerned with the level to which an instrument measures what it is supposed to measure. This is supported by Barak, Watted, and Haick (2020) for whom the internal consistency of constructs in the scale should be examined before a test can be conducted for research to ensure validity. This section used Pearson's correlation coefficients (r) to check each validity of the research constructs and their Likert-scale variables. The correlation between each set of variables and the constructs that have been measured indicates whether the variable measured what it was supposed to measure. According to Xu and Deng (2017), Pearson correlation measures the existence (given by a p-value) and strength (given by the coefficient r between -1 and +1) of a linear relationship between two constructs.

Pearson coefficients were therefore used to measure whether each variable correlate to the construct. According to Kelter (2020), the p-value can be defined as the probability under the

assumption of no effect (null hypothesis) of getting results that are equal to what was observed. This is supported by Solla, Bertoncelli, Musoff, and Bertoncelli (2018), according to whom p in p-value stands for probability and measures a chance that any observed difference between groups is likely to happen. Kelter (2020) also indicated that if $p < 0.05$, there is a statistically significant relationship between the two tested constructs.

Pearson's coefficient was calculated to determine the relationship between each of the research constructs and the Likert-scale variables of this study. The validity of these variables and their constructs are presented from Table 3.4 to 3.11. These tables show the Pearson correlation coefficient (r), its significant value (p), and the sample size (N) that was used in this study.

From Tables 3.4 to 3.11, all the Pearson Correlation Coefficients were above 0.5, with p-values of 0.000, making the correlations significant. This confirms that the variables used to measure the construct is valid.

Table 3. 4: Data validity for Attitude towards smartphone and its variables

Variables measuring *Attitude*	**Pearson Correlation(r)**	**p**	**N**
B1. Students have a positive attitude towards smartphones	.522	.000	79
B2. Students prefer to learn from smartphones than books	.538	.000	79
B3. Smartphones are fun for students	.635	.000	79
B4. Students work with smartphones in class	.719	.000	79
B5. Smartphones help students organize their work properly	.794	.000	79
B6. Students feel comfortable with smartphones	.752	.000	79
B7. Smartphones provide better-learning experience	.809	.000	79
B8. Students feel confident when using smartphones	.759	.000	79
B9. Smartphones lessons would be enjoyable	.788	.000	79
Correlation is significant at the 0.01 level (2-tailed).			

Table 3.4 shows the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between *Attitude towards smartphone* (construct) and its variables. The results in Table 3.4 (above Table) indicate that all variables obtained a significant value or p-value of 0.000 <0.05, and Pearson's correlation coefficients which is above 0.5. This propels a conclusion: there is a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables.

Table 3. 5: Data validity for Facilitating Conditions and its variables

Variables measuring *Facilitating Conditions*	Pearson Correlation(r)	p	N
C1. Specific group to assist students with smartphones difficulties	.692	.000	79
C2. Smartphones are compatible with other school devices	.806	.000	79
C3. Smartphones have functions students' needs for learning	.752	.000	79
C4. Students have adequate knowledge to use smartphones	.599	.000	79
C5. The institution provides the necessary resources	.651	.000	79
C6. Students' friends are using Smartphones	.624	.000	79
C7. Lecturers recommend-students on using smartphones	.618	.000	79
C8. Operation costs allow students to use smartphones	.672	.000	79

Table 3.5 illustrates the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between *Facilitating Conditions* (construct) and its variables. The results in Table 3.5 (above Table) reveal that all variables obtained a significant value or p-value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.5. A conclusion can be made that there is a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables.

Table 3. 6: Data validity for Performance Expectation and its variables

Variables measuring *Performance Expectation*	Pearson Correlation(r)	P	N
D1. Improve their academic performance	.825	.000	80
D2. Increase their productivity in the class	.885	.000	80
D3. Make their learning more effective	.876	.000	80
D4. Help students easily retrieve information for their studies	.776	.000	80
D5. Improve their learning outcomes	.881	.000	80
D6. Enable them to accomplish tasks more quickly	.822	.000	80
D7. Will increase their chances of improving their marks	.872	.000	80
D8. Improve students' communication	.760	.000	80
D9. Improve their competency skills	.838	.000	80

Table 3.6 demonstrates the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between Performance Expectations (construct) and its variables. The results in Table 3.6 (above Table) indicate that all variables obtained a p-value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.7. These results reveal a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables.

Table 3. 7: Data validity for Perceived Usefulness and its variables

Variables measuring *Perceived Usefulness*	**Pearson Correlation(r)**	**P**	**N**
E1. Smartphones encourage collaborative learning	.778	.000	80
E2. Smartphones help students to be more active in class	.705	.000	80
E3. Smartphones promote autonomous learning among students	.782	.000	80
E4. Smartphones help students to do their learning activities quicker	.788	.000	80
E5. Smartphones allow students to gain access to up-to-date information	.797	.000	80
E6. Smartphones are an effective tool for students	.791	.000	80
E7. Smartphones provide students with more flexible access to learning	.771	.000	80

Table 3.7 illustrates the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between *Perceived Usefulness* (construct) and its variables. The results in Table 3.7 (above Table) indicate that all variables obtained a p-value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.7. These results show a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables.

Table 3. 8: Data validity for Perceived Ease of Use and its variables

Variables measuring *Perceived Ease of Use*	**Pearson Correlation(r)**	**P**	**N**
F1. Download class materials	.815	.000	80
F2. Work with different learning apps	.851	.000	80
F3. Read materials	.849	.000	80
F4. Navigate applications like Evernote on the-screen	.820	.000	80
F5. Engage in learning activities work	.787	.000	80
F6. Remember how to perform tasks	.760	.000	80
F7. Record a class lecture	.731	.000	80
F8. Search course materials	.801	.000	80

Table 3.8 shows the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between *Perceived Ease of Use* (construct) and its variables. The results in Table 3.8 (above Table) reveal that all variables obtained a p-value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.7. It can be concluded that there is a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables

Table 3. 9: Data validity for Sharing and its variables

Variables measuring *Sharing*	**Pearson Correlation(r)**	**P**	**N**
G1. Handwritten notes	.780	.000	80
G2. Educational videos	.867	.000	80
G3. Screenshots	.882	.000	80
G4. In discussion forums, educational blogs, or news feeds	.863	.000	80
G5. Downloaded books, lecture notes, and articles	.829	.000	80
G6. Audio recordings	.832	.000	80
G7. Learning apps and games	.841	.000	80
G8. Class information messages	.836	.000	80

Table 3.9 illustrates the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between *Sharing* (construct) and its variables. The results in Table 3.9 (above Table) indicate that all variables obtained a p-value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.7. These results reveal a statistically significant relationship between variables and measured construct, according to a rule proclaimed

by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables.

Table 3. 10: Data validity for Communication and its variables

Variables measuring *Communication*	Pearson Correlation(r)	P	N
H1. Students and other students	.757	.000	80
H2. Students and lecturers	.854	.000	80
H3. Students and administrative staff	.793	.000	80
H4. Students and parents	.795	.000	80

Table 3.10 demonstrates the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between Communication (construct) and its variables. The results in Table 3.10 (above Table) indicate that all variables obtained a significant value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.7. It can be concluded that there is a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically significant relationship between tested constructs. This also confirms the validity of these variables.

Table 3. 11: Data validity for Constructivist Learning and its variables

Variables measuring *Constructivist learning*	Pearson Correlation(r)	P	N
I1. By doing something when they learn	.881	.000	80
I2. By allowing them to discover many new ways of learning	.887	.000	80
I3. By allowing them to get involved in many activities	.887	.000	80
I4. By enabling them to interact with the learning material	.826	.000	80
I5. By enabling them to connect with what they are learning	.814	.000	80
I6. By enabling them to connect the new knowledge	.856	.000	80
I7. By giving them enough time to reach their learning	.884	.000	80
I8. By adding excitement and motivation for them	.768	.000	80

Table 3.11 shows the results of Pearson's correlation coefficient (r), its significant value (p), and the sample size (N) for validity that was tested between *Constructivist Learning* (construct) and its variables. The results in Table 3.11 (above Table) indicate that all variables obtained a significant value of 0.000 <0.05 and Pearson's correlation coefficients which are above 0.7. These results signify a statistically significant relationship between variables and measured construct, according to a rule proclaimed by Kelter (2020) for whom if $p < 0.05$, there is a statistically

significant relationship between tested constructs. This also confirms the validity of these variables.

3.11 Analysing of Data for Hypotheses

The five hypotheses (*H1-H5*), in Section 3.4, were formulated for this study to determine significant associations between the adopted independent constructs and dependent construct. These tested independent constructs include *Attitude towards smartphones, Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, and Performance Expectations*, and a dependent construct which is the use of smartphones as a constructivist learning tool. Three dependent constructs (*Sharing, Communication, and Constructivist learning tool*) were introduced in this study to determine what kind of activities do academic staff think students use smartphones for. Chi-square was used to test the hypotheses mentioned above, and results are presented in section 4.4 of chapter 4. According to Shukla, Pathak, Singh, and Sharma (2019, p. 2), "Chi-Square statistic is commonly used for testing relationships between categorical variables", and this is the same reason why Chi-Square has been used to test hypotheses of this study. Shukla *et al.* (2019) also indicated that the Chi-Square statistic is mostly used to assess tests of independence when a crosstabulation is being used.

3.12 Summary

The population of the survey conducted by this study involved 80 academic staff from 5 departments of the Faculty of Accounting and Informatics at the Durban University of Technology (DUT) in the KwaZulu-Natal province of South Africa. This survey data was collected using a questionnaire that contained 68 variables for nine constructs that are illustrated in Table 3.1 and Table 3.2. These constructs include *Demographics, Attitude towards smartphones, Facilitating Conditions, Performance Expectations, Perceived Usefulness, Perceived Ease of Use*, and three dependent constructs (Sharing*, Communication*, and *Constructivist learning*) to get more views on the actual point of this study, which is to create a model depicting the relevant factors affecting the use of smartphones as a constructivist learning tool by students. The collected data was then analysed using the Statistical Package for the Social Sciences (SPSS version 25). The results of the data analysis of this survey will be presented in the following chapter.

CHAPTER 4: DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

This chapter presents the results of this study and the analysis, which were done using the Statistical Package for the Social Sciences (SPSS version 25). SPSS was used to analyse descriptive and inferential statistical results and factor analysis, including the principal component matrix, and regression. Chi-square was used to achieve the 3rd objective of this study by empirically testing the model based on the perceptions of the academic staff on the factors affecting the use of smartphones as a constructivist learning tool by students as proposed by this study.

4.1 Introduction

This chapter started by discussing descriptive statistics of the current study per construct. Inferential statistics which include hypotheses testing, are reported, and deliberated based on the obtained results. The empirical tested model is indicated in section 4.4 to illustrate the relationships between constructs after they were tested. The Pearson correlation test is also pursued to poses if there is any form of correlation or statistical significance between study constructs. This chapter concluded by reporting on factor analysis test which was conducted. This includes KMO and Bartlett's value, rotated component matrix, and lastly, regression.

4.2 Descriptive statistics

This section presents descriptive statistics on the *Demographics* of academic staff, their perceptions on each of the constructs, being the *Attitude* of students towards smartphone usage, their perceptions on the *Facilitating Conditions*, *Performance Expectations*, *Perceived Usefulness, Perceived Ease of Use, Sharing, Communication*, and *Constructivist learning.*

4.2.1 Demographics

The results of all variables under *Demographics* are shown in Table 4.1. These outcomes for *Demographics* represent all the academic staff who answered the questionnaire-based survey of this study.

Table 4. 1: Results for descriptive statistics for all variables under Demographics

Demographics		**Percentages (%)**
Department	Information Technology (IT)	43
	Auditing and Taxation	9,5
	Management Accounting	14
	Information and Corporate Management	23
	Financial Accounting	10,5
Age	Under 30 years	15
	30-40 years	36
	41-50 years	38
	51-60 years	10
	Above 60 years	1
Gender	Male	44
	Female	50
	Prefer not to say	6
Ethnic group	Black	58
	Coloured	0,5
	White	9
	Indian	25
	Other (specify	2,5
	Prefer not to say	5
Employment	Permanent	54
	Contract	46
Citizenship	South Africa	79
	Expatriate	15
	Prefer not to say	6
Rank	Junior Lecturer	11
	Lecturer	60
	Senior Lecturer	13
	Associate Professor	4
	Full Professor	1
	Other (specify)	11

The interesting part of this survey is that females were the ones who participated the most as they accumulated 50% in terms of gender for those who form part of this survey, 44% were male, and 6% preferred not to say. The ethnic majority in terms of participation in this study was shown to

be South Africans with 79%, as illustrated by Table 4.1, the highest number being Black, followed by Indians. The age of the participants in this study was also an exciting part, where we see the academic staff between 41-50 years dominating in terms of age, followed by 30-40 years old. In terms of departments, Information Technology has superior involvement compared to the other departments, followed by Information and Corporate Management, possibly because the Department of Information Technology is by far the largest department within the faculty.

4.2.2 Attitudes towards the use of smartphones

Table 4.2 illustrates the descriptive statistics on the perceptions of academic staff on the students' *Attitudes towards* using smartphones as a constructivist learning tool. This Table includes the minimum, maximum, mean, and standard deviation, which shows us a grouping of data. The highest mean in Table 4.2, which is 4.41 out of 5 for variable B1, with a standard deviation close to 1, indicating agreement of the participants on students' positive attitude towards smartphones. However, the belief that smartphones would help students organize their work properly (B5) was given the lowest rating by the participants of this study, with 3.62 out of 5 and a higher standard deviation of 1.267. This shows that not all participants agree with this. The mean also highlights that the perceptions that smartphones are fun for students (B3) were rated slightly above average, with a mean of 4.34 out of 5 and a standard deviation close to 1.

Table 4. 2: Attitude of students towards smartphones Usage

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
B1: Students-Postv-Attitude	80	1	5	4.41	1.076
B2: Studnts-prefer-learn-frm-books	80	1	5	3.69	1.086
B3: Smtphnes-are-fun-for-students	80	1	5	4.34	1.078
B4: Studnts-work-with-Smtphnes-in- class	80	1	5	3.98	1.113
B5: Smtphnes-help-students-organize-work-properly	80	1	5	3.62	1.267
B6: Studnts-feel-comfortable-with-Smtphnes	79	1	5	3.85	1.122
B7: Smtphnes-provide-better-learning-experience	80	1	5	3.80	1.118
B8: Studnts-feels-confident-when using-Smtphnes	80	1	5	3.87	1.151
B9: Smtphnes-lessons-would-be-enjoyable	80	1	5	4.09	1.058
Valid N (listwise)	79				

4.2.3 Facilitating Conditions

Table 4.3 presents the mean values of the perceptions of academic staff on the impact of *Facilitating Conditions* on the use of smartphones as a constructivist learning tool by students. This Table shows that the academic staff members believe that when friends of students are using smartphones for learning (C6), the students themselves will be willing to use them in their learning.

This belief of academic staff in terms of *Facilitating Conditions* is demonstrated by the highest mean of "C6: if students' friends are using smartphones" in Table 4.3 with a mean of 4.05 out of 5 and a standard deviation of 1.054. Nevertheless, the perceptions of academic staff on whether "C5: if an institution provides students with the necessary resources to enhance smartphone for learning" was given the lowest mean of 3.35 out of 5, and a standard deviation of 1.223, indicating a wider variety of responses, but still a lower score. However, the same participants have rated "C4: if students have adequate knowledge and skills to use smartphones," slightly higher with 3.86 out of 5 and a standard deviation of 1.177. This signifies that participants believe adequate knowledge is crucial for using smartphones for learning by students.

Table 4. 3: Facilitating Conditions descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
C1: Specific-group-to-assist-students-with-Smtphnes-difficulties	79	1	5	3.42	1.429
C2: Smtphnes-are-compatible-with-other-school-devices	80	1	5	3.63	1.216
C3: Smtphnes-have-functions-students-needs-for-learning	80	1	5	3.69	1.259
C4: Studnts-have-adequate-knowledge-to-use-Smtphnes	80	1	5	3.86	1.177
C5: Institution-provide-necessary-resources	80	1	5	3.35	1.223
C6: If students'-friends-are-using-Smtphnes	80	1	5	4.05	1.054
C7: Lectures-recommend-students-on using-Smtphnes	80	1	5	3.43	1.251
C8: Operation-costs-allow-students-to-use-Smtphnes	80	1	8	3.45	1.431
Valid N (listwise)	79				

4.2.4 Performance Expectations

Table 4.4 shows the mean values of the perceptions of academic staff on the usage of smartphones in terms of *Performance Expectations*. This Table includes the minimum, maximum, mean, and standard deviation, which gives us data classification. The highest mean in Table 4.4, which is 3.98 out of 5 for variable D4, with a standard deviation of 1.125, indicates that the participants believe that the use of smartphones for learning by students will "help them easily retrieve information for their studies" (D4). However, the belief of smartphones will improve students' academic performance (D1) was given the lowest rating by the participants of this study, with 3.47 out of 5 and an average standard deviation of 1.222, indicating a wider variety of responses.

Table 4. 4: Performance Expectations descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
D1: Improve-their-academic-performance	80	1	5	3.47	1.222
D2: Increase-their-productivity-in-the-class	80	1	5	3.55	1.200
D3: Make-their-learning-more-effective	80	1	5	3.73	1.125
D4: Help-students-easily-retrieve-information-for-their-studies	80	1	5	3.98	1.125
D5: Improve-their-learning-outcome	80	1	5	3.61	1.108
D6: Enable-them-to-accomplish-tasks-more-quickly	80	1	5	3.81	1.115
D7: Will-increase-their-chances-of-improving-their-marks	80	1	5	3.63	1.107
D8: Improve-their-communicative	80	1	5	3.67	1.251
D9: Improve-their-competence-skills	80	1	5	3.57	1.188
Valid N (listwise)	80				

4.2.5 Perceived Usefulness

Table 4.5 illustrates the academic staff's collaborative descriptive statistics on the *Perceived Usefulness* of smartphones as a constructivist learning tool by students. This Table also includes a minimum, maximum, mean, and standard deviation, which gives us a grouping of the data. The highest mean in Table 4.5, which is 4.15 out of 5 for variable E7, with a standard deviation of 1.045, clearly indicates that the participants believe that smartphones would provide students with more flexible access to learning, as it can be done anytime anywhere. However, Table 4.5 also shows that the perception that smartphones will help students to be more active in class (E2) was given the lowest rating by academic staff with a mean of 3.11 out of 5 and the highest standard deviation of 1.283. The mean also highlights that the perceptions that smartphones allow students to gain access to up-to-date information (E5) were rated slightly above average, with a mean of 4.06 out of 5 and a standard deviation of 1. 071.

Table 4. 5: Perceived Usefulness descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
E1: Smtphnes-encourage-collaborative	80	1	5	3.67	1.178
E2: Smtphnes-help-students-to-be-more-active- in-class	80	1	5	3.11	1.283
E3: Smtphnes-promote-autonomous-learning-among-students	80	1	5	3.48	1.018
E4: Smtphnes-help-students-to-do-their-learning-activities-quicker	80	1	5	3.43	1.088
E5: Smtphnes-allow-students-to-gain-access-to-up to date-information	80	1	5	4.06	1.071
E6: Smtphnes-are-a-effective-tool-for-students	80	1	5	3.95	1.054
E7: Smtphnes-provide-students-with-more-flexible	80	1	5	4.15	1.045
Valid N (listwise)	80				

4.2.6 Perceived Ease of Use

Table 4.6 presents results on the perceptions of academic staff on how smartphones can make it easy for students to do their school activities. This Table also includes the minimum, maximum, mean, and standard deviation, which classify the data of this study. As can be seen from the results presented in Table 4.6, the participants believe that smartphones can make it easy for students to search course materials (F8), with the highest mean of 4.13 out of 5, with the lowest standard deviation close of 0.919. Simultaneously, Table 4.6 indicates that the belief that smartphones can make it easier for students to engage in learning activities (F5) was given the lowest rating of 3.55 out of 5 and a standard deviation of 1.113.

Table 4. 6: Perceived Ease of Use descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
F1: Download-class-materials	80	1	5	3.99	1.196
F2: Work-with-different-school-apps	80	1	5	3.82	1.065
F3: Read materials	80	1	5	3.85	1.115
F4: Navigate-the-application-on-the-screen	80	1	5	3.85	.969
F5: Engage-in-school work	80	1	5	3.55	1.113
F6: Remember-how-to-perform-tasks	80	1	5	3.64	1.070
F7: Record-a-class-lecture	80	1	5	3.88	1.107
F8: Search-course-materials	80	1	5	4.13	.919
Valid N (listwise)	80				

4.2.7 Sharing

Table 4.7 illustrates the descriptive statistics on the perceptions of academic staff on the use of smartphones by students for sharing learning activities in class. This Table (4.7) includes the minimum, maximum, mean, and standard deviation, which gives us a classification of the data. Table 4.7 indicates that academic staff are of the view that students can use smartphones to share class information messages (G8), with the highest mean of 4.11 out 5 and the lowest standard deviation of 1.006. This Table also indicates that the academic staff has the smallest belief in smartphone usage to share hand-written notes (G1), with the lowest mean of 3.58 out of 5 and a higher standard deviation of 1.376.

Table 4. 7: Sharing descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
G1: Hand-written-notes	80	1	5	3.58	1.376
G2: Educational videos	80	1	5	3.69	1.218
G3: Screenshots	80	1	5	4.02	1.043
G4: In-discussion-forums...	80	1	5	3.71	1.081
G5: Downloaded books...	80	1	5	3.74	1.099
G6: Audio-recordings	80	1	5	3.90	1.098
G7: Learning-apps-and-games	80	1	5	3.90	1.074
G8: Class-information-messages	80	1	5	4.11	1.006
Valid N (listwise)	80				

4.2.8 Communication

Table 4.8 presents the perceptions of academic staff on the use of smartphones by students for communication on learning activities. This Table includes the minimum, maximum, mean, and standard deviation, which categorises the data of this study. Table 4.8 shows that the participants believe that students use smartphones to communicate with other students in most cases (H1), with the highest mean of 4.45 out of 5 and the lowest standard deviation of 1.042. This Table also shows that there are fewer participants who believe that students use smartphones to communicate with administrative staff (H3), with the lowest mean of 3.23 out of 5 and the highest standard deviation of 1.350.

Table 4. 8: Communication descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
H1: Students-and-other-students	80	1	5	4.45	1.042
H2: Students-and-lecturers	80	1	5	3.89	1.180
H3: Students-and-administrative-staff	80	1	5	3.23	1.350
H4: Students-and-parents	80	1	5	4.03	1.232
Valid N (listwise)	80				

4.2.9 Constructivist learning

Table 4.9 presents the perceptions of academic staff on the usage of smartphones by students in constructivist learning activities. This Table includes the minimum, maximum, mean, and standard deviation, which gives us a grouping of the data. Table 4.9 shows that most participants believe that smartphones can add excitement and motivation for students to learn more (I8), with the highest mean of 3.95 out of 5 and a standard deviation of 1.042. It also shows that the belief that smartphones would enable students to interact with their learning materials using the

language they are comfortable with (I4) was given the lowest mean rating by the participants of this study, with a mean of 3.68 out of 5, and a higher standard deviation of 1.251.

Table 4. 9: Constructivist learning descriptive statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
I1: By-doing-something-when-they-learn...	80	1	5	3.69	1.186
I2: By-allowing-them-to-discover-many-new-ways-of-learning	80	1	5	3.77	1.079
I3: By-allowing-them-to-get-involved-in-many-activities	80	1	5	3.81	1.045
I4: By-enabling-them-to -interact-with-the-learning-material	80	1	5	3.68	1.251
I5: By enabling-them-to-connect-what-they-are-learning	80	1	5	3.88	1.072
I6: By-enabling-them-to-connect-the-new-knowledge	80	1	5	3.86	1.099
I7: By-giving-them-enough-time-to-reach-their-learning	80	1	5	3.72	1.102
I8: By-adding-excitement-and-motivation-for-them	80	1	5	3.95	1.042
Valid N (listwise)	80				

When the highest means in Tables 4.1 to 4.9 are compared, it is noticeable that two are below 4.0, while all the others are above 4.0, as can be seen in Table 4.10. Although two of these means are below 4.0, they are still significantly higher than 2.5/5, which is 50%.

Table 4. 10: Comparative highest means

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Table 4.11: Students' attitude towards smartphones usage B1: Students-Postv-Attitude	80	1	5	4.41	1.076
Table 4.12: Facilitating conditions C6: If students'-friends-are-using-Smtphnes	80	1	5	4.05	1.054
Table 4.13: Performance expectations D4: Help-students-easily-retrieve-information-for-their-studies	80	1	5	3.98	1.125
Table 4.14: Perceived usefulness E7: Smtphnes-provide-students-with-more-flexible	80	1	5	4.15	1.045
Table 4.15: Perceived Ease of use F8: Search-course-materials	80	1	5	4.13	.919
Table 4.16: Sharing G8: Class-information-messages	80	1	5	4.11	1.006
Table 4.17: Communication H1: Students-and-other-students	80	1	5	4.45	1.042
Table 4.18: Constructivist learning I8: By-adding-excitement-and-motivation-for-them	80	1	5	3.95	1.042
Valid N (listwise)	80				

Trends supported by descriptive statistics

The trends supported by the descriptive statistics, i.e., mean, and standard deviation, are shown in Appendix B for each of the constructs.

Summary of the trends that are illustrated in Appendix B.

A. Variables for Independent Constructs

- A high level of support and agreement that students feel positive towards using smartphones for learning were measured.
- A high level of support and agreement that friends could influence students were measured.
- The support, but some disagreement about the ability to retrieve information was measured.
- A high level of support and agreement as to more flexible learning was measured.
- High support and agreement to some extent that smartphones could make it easy for students to search course materials were also measured.

B. Variables for Dependent Constructs

- A high level of support and agreement that students could use smartphones to share class information was measured.
- A high level of support and agreement that students could use smartphones to communicate with other students about learning was measured.
- Support and agreement that smartphones could add excitement and motivation for learning were measured.

4.3 Inferential statistics (correlations)

This section indicates inferential statistics that have been conducted in this study.

4.3.1 Hypotheses Testing

The previous section presented descriptive statistics on the Demographics of academic staff and their perceptions of each of the constructs of this study. This section measures the various hypotheses created in this study and subsequently ascertained whether the conceptual framework illustrated in chapter two (figure 2.1) properly explained the comprehensive objectives of the current research. To examine constructs for the Chi-square tests, the study used the highest mean on the 5-point Likert scale to represent the respective constructs.

4.3.1.1 Students' Attitude and use of smartphones as a constructivist learning tool

To determine whether there is any significant association between students' *Attitude* and usage of smartphones as a constructivist learning tool, the cross-tabulation of responses was done, and Chi-squares' p- values were used to measure any form of significance. The hypothesis tested here was:

H1: There is likely to be a significant statistical association between students' Attitude and usage of smartphones as a constructivist learning tool.

The results in Table 4.11 indicate that 7.5% of participants strongly disagree on the impact of *Attitude* towards using smartphones as a constructivist learning tool, while 36.3% of them fairly agree. Table 4.11 also indicates that 70% of respondents strongly agrees that students' attitude significantly associated with the use of smartphones as a constructivist learning tool, either for sharing, communication, and to conduct constructivist learning. Those who disagreed with the impact of students' attitude on smartphones as a constructivist learning tool accumulated 12.5 percent (12.5%). They fairly disagreed that students' attitudes associated with the use of smartphones as a constructivist learning tool. Table 1 below illustrates the summary of the Chi-square test results.

Table 4. 11: Students' Attitude and use of smartphones

I believe that:

Statements	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
Students have a positive attitude towards smartphones	3 3.8%	4 5.0%	6 7.5%	11 13.8%	56 70.0%
Students prefer learning from smartphones to learning from books	3 3.8%	8 10.0%	21 26.3%	27 33.8%	21 26.3%
Smartphones are fun for students.	3 3.8%	5 6.3%	4 5.0%	18 22.5	50 62.5%
Students would like to work with a smartphone in class.	4 5.0%	4 5.0%	14 17.5%	26 32.5%	32 40.0%
Smartphones would help students organize their work properly.	6 7.5%	10 12.5%	18 22.5%	20 25.0%	26 32.5%
Students would feel comfortable working with a smartphone.	4 5.0%	5 6.3%	17 21.3%	26 32.5%	27 33.8%
The use of smartphones would help to provide a better learning experience.	3 3.8%	9 11.3%	14 17.5%	29 36.3%	25 31.3%
Students would feel confident when asked to perform a new task on their smartphones.	3 3.8%	10 12.5%	10 12.5%	28 35.0%	29 36.3%
Lessons using smartphones as a tool would be enjoyable	3 3.8%	4 5.0%	11 13.8%	27 33.8%	35 43.8%

X^2 = 559.434 **df= 483** **P-value = 0.00**

From the Chi-square (X^2) test results illustrated above (Table 4.11), it is noted that the asymptotic significance (2-sided) P-value of the Pearson Chi-square test points to a significant statistical relationship between students' attitude and the use of smartphones as a constructivist learning tool. Hence, the current study accepts the hypothesis and concludes that there is a significant statistical association between students' attitude and use of smartphones as a constructivist learning tool, whether to share, communicate and construct their own learning.

4.3.1.2 Facilitating Conditions and use of smartphones as a constructivist learning tool

The second hypothesis is to determine whether there is a significant statistical association between facilitating conditions and smartphone usage as a constructivist learning tool. Results for the conducted crosstabulation and Chi-square test are illustrated in Table 4.12. The tested hypothesis was:

H2: There is likely to be a significant statistical association between Facilitating Conditions and usage of smartphones as a constructivist learning tool.

Table 4. 12: Facilitating Conditions and use of smartphones

I believe that students will use smartphones for learning if:

Statements	Strongly Disagree	Fairly Disagree	Weakly Agree	Fairly Agree	Strongly Agree
There is a specific person or group that is available to assist them with smartphone difficulties.	12 15.%	11 13.8%	11 13.8%	22 27.5%	23 28.7%
Smartphones are compatible with other school devices they use.	7 8.8%	8 10.0%	13 16.3%	32 40.0%	20 25.0%
Smartphones have functions that they need to use in their learning.	7 8.8%	8 10.0%	13 16.3%	27 33.8%	25 31.3%
Students have adequate knowledge and skills to use smartphones.	4 5.0%	7 8.8%	16 20.0%	22 27.5%	31 38.8%
The institution provides students with the necessary resources to enhance smartphone learning.	8 10.0%	12 15.0%	18 22.5%	28 35.0%	14 17.5%
Students' friends are using smartphones.	3 3.8%	3 3.8%	15 18.8%	25 31.3%	34 42.5%
Students' lecturers recommend them using smartphones for learning.	6 7.5%	16 20.0%	14 17.5%	26 32.5%	18 22.5%
The operation costs of smartphones allow them to use it.	10 12.5%	10 12.5%	19 23.8%	19 23.8%	21 26.3%

X^2 = 647.602 df = 576 P-value = 0.00

Based on the above Table (4.12), more than 40 percent (42.5%) of academic staff strongly agreed that there is a significant statistical association between facilitating conditions and usage of a smartphone as a constructivist learning tool, whether for sharing, communication, and conduct constructivist learning. Also, 40 percent (40%) of respondents fairly agreed that facilitating

conditions impact smartphone usage as a constructivist learning tool. A small number of academic staff strongly disagreed that there is any form of relationship between facilitating conditions and smartphone usage as a constructivist learning tool, as they accumulate 12 percent (12.5%).

From the Chi-square (X^2) test results shown above, it is noted that the asymptotic significance (2-sided) P-value of the Pearson Chi-square test points to a significant statistical relationship between facilitating conditions and the use of smartphones as a constructivist learning tool. Hence, the current study accepts the hypothesis and concludes that there is a significant statistical association between facilitating conditions and usage of smartphones as a constructivist learning tool. In other words, these results seem to indicate that respondents agree that lack of resources can be a defining factor to the academic life of students as it can hinder them from constructing their own learning.

4.3.1.3 Performance Expectations and usage of smartphone as a constructivist learning tool

The third hypothesis is to determine whether there is any significant statistical association between performance expectations and smartphone usage as a constructivist learning tool. The crosstab and Chi-square test results are summarised in Table 4.13. The tested hypothesis was as follows:

H3: There is likely to be a significant statistical association between Performance Expectations and usage of smartphone as a constructivist learning tool

Table 4. 13: Performance Expectations and the use of smartphones

I expect that the use of smartphones by students can:

Statements	Strongly Disagree	Fairly Disagree	Weakly Agree	Fairly Agree	Strongly Agree
Improve their academic performance.	9 11.3%	6 7.5%	19 23.8%	30 37.5%	16 20.0%
Increase their productivity in the class.	8 10.0%	6 7.5%	17 21.3%	32 40.0%	17 21.3%
Make their learning more effective.	6 7.5%	5 6.3%	13 16.3%	37 46.3%	19 23.8%
Help them easily retrieve information for their studies.	4 5.0%	6 7.5%	9 11.3%	30 37.5%	31 38.8%
Improve their learning outcome.	6 7.5%	5 6.3%	19 23.8%	34 42.5%	16 20.0%
Enable them to accomplish tasks more quickly.	4 5.0%	6 7.5%	16 20.0%	29 36.3%	25 31.3%
Will increase their chances of improving their marks	7 8.8%	1 1.3%	24 30.0%	31 38.8%	17 21.3%
Improve their communication	7 8.8%	7 8.8%	16 20.0%	25 31.3%	25 31.3%

Improve their competence skills.	6 7.5%	9 11.3%	17 21.3%	29 36.3%	19 23.8%

X^2 = 806.402 df = 667 P-value = 0.00

Table 4.13 illustrates the Chi-square (X^2) test results obtained when performance expectations were measured against smartphone use as a constructivist learning tool. The results indicate that majority of academic staff agree with the significant association between performance expectations and smartphone usage as a constructivist learning tool, specifically for sharing learning activities, as it accumulated 46.3 percent (46.3%). On the other hand, those academic staff members who strongly disagreed with any form of association between performance expectations and smartphone usage to construct their own learning received 11.3 percent (11.3%).

Furthermore, from the observed Chi-square test results shown above, it is noted that the asymptotic significance (2-sided) P-value of the Pearson Chi-square test points to a significant statistical relationship between performance expectations and usage of smartphones as a constructivist learning tool. Hence, the current study accepts the hypothesis and concludes that there is a significant relationship between performance expectations and the use of smartphones as a constructivist learning tool. These results reiterate the belief of academic staff members on the utilisation of smartphones by students to pursue their academic activities, specifically when it comes to sharing these activities among themselves.

4.3.1.4 Perceived Usefulness and usage of smartphone as a constructivist learning tool

The fourth hypothesis is based on determining whether there is any significant statistical association between perceived usefulness and usage of smartphones as a constructivist learning tool. In that regard, Table 4.14 demonstrates a summarised Chi-square test. The hypothesis tested was:

H4: There is likely to be a significant statistical association between Perceived Usefulness and usage of smartphones as a constructivist learning tool.

Table 4. 14: Perceived Usefulness and use of smartphone

I believe that:

Statements	Strongly Disagree	Fairly Disagree	Weakly Agree	Fairly Agree	Strongly Agree
Smartphones encourage collaborative learning among students.	5 6.3%	11 13.8%	9 11.3%	35 43.8%	20 25.0%
Smartphones help students to be more active in class.	12 15.0%	15 18.8%	15 18.8%	28 35.0%	10 12.5%
Smartphones promote autonomous learning among students.	2 2.5%	12 15.0%	25 31.3%	28 35.0%	13 16.3%
Smartphones help students to do their learning activities quicker.	4 5.0%	12 15.0%	23 28.7%	28 35.0%	13 16.3%
Smartphones allow students to gain access to up-to-date information through the web.	3 3.8%	4 5.0%	13 16.3%	25 31.3%	35 43.8%
Smartphones are an effective tool for giving students immediate support and feedback.	3 3.8%	5 6.3%	13 16.3%	31 38.8%	28 35.0%
Smartphones provide students with more flexible access to learning, as it can be done anytime and anywhere.	3 3.8%	4 5.0%	8 10.0%	28 35.0%	37 46.3%

X^2 = 659.515 df = 552 P-value = 0.00

As indicated in Table 4.14, those respondents who strongly agreed that there is a significant statistical association between perceived usefulness and usage of smartphone as a constructivist learning tool accumulated 46.3 percent (46.3%), while those strongly disagreed that there is any impact between perceived usefulness and use of smartphone by students to construct their own learning, received 15 percent (15.0%).

From the observed statistics for Chi-square test results shown above, it is noted that the asymptotic significance (2-sided) P-value of the Pearson Chi-square test points to a significant statistical relationship between perceived usefulness and usage of smartphones as a constructivist learning tool. Hence, the current study accepts the hypothesis and concludes that there is a significant relationship between perceived usefulness and the use of smartphones as a constructivist learning tool. These results seem to emphasise the importance of smartphones as an extra tool that plays a significant role in helping students accomplish their desired learning results.

4.3.1.5 Perceived Ease of Use and usage of smartphone as a constructivist learning tool

The fifth and last hypothesis illustrates the Chi-square results obtained when the test was conducted to determine whether there is any form of a significant statistical association between perceived ease of use and usage of smartphones as a constructivist learning tool. The

summarised Chi-square test result for this last hypothesis is shown in Table 4.15. The tested hypothesis is as follows:

H5: There is likely to be a significant statistical association between Perceived Ease of Use and usage of smartphone as a constructivist learning tool.

Table 4. 15: Perceived Ease of Use and use of smartphone

I believe that smartphones make it easy for students to:

Statements	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
Download class materials.	6 7.5%	3 3.8%	12 15.0%	24 30.0%	35 43.8%
Work with different school apps.	3 3.8%	5 3.8%	20 25.0%	27 33.8%	25 31.3%
Read materials.	4 5.0%	5 6.3%	17 21.3%	27 33.8%	27 33.8%
Navigate the application on the screen.	2 2.5%	5 6.3%	17 21.3%	35 43.8%	21 26.3%
Engage in schoolwork.	7 3.8%	3 3.8%	24 30.0%	31 38.8%	15 18.8%
Remember how to perform tasks.	5 6.3%	4 5.0%	23 28.7%	31 38.8%	17 21.3%
Record a class lecture.	3 38%	9 11.3%	9 11.3%	33 41.3%	26 32.5%
Search course materials.	2 2.5%	1 1.3%	14 17.5%	31 38.8%	32 40.0%

X^2 = 656.021 df = 529 P-value = 0.00

The table mentioned above (Table 4.15) indicates that 43.8 percent (43.8%) of academic staff members strongly agreed that there is a significant statistical association between perceived ease of use and usage of smartphones as a constructivist learning tool for students. Interestingly, on the other hand, 38 percent (38%) strongly disagreed that perceived ease of use has an impact on the use of smartphones as a constructivist learning tool.

From the observed computations of the Chi-square test results illustrated above, it is noted that the asymptotic significance (2-sided) P-value of the Pearson Chi-square test points to a significant statistical relationship between perceived ease of use and usage of smartphones as a constructivist learning tool. Hence, this study accepts the hypothesis and concludes that there is a significant relationship between perceived ease of use and the use of smartphones as a constructivist learning tool.

4.4 Empirically tested model

After measuring the above hypotheses, a tested model was created to indicate an association of the study independent constructs to the dependent constructs and achieve the third objective of this study to validate a proposed model. The model is presented in figure 1.

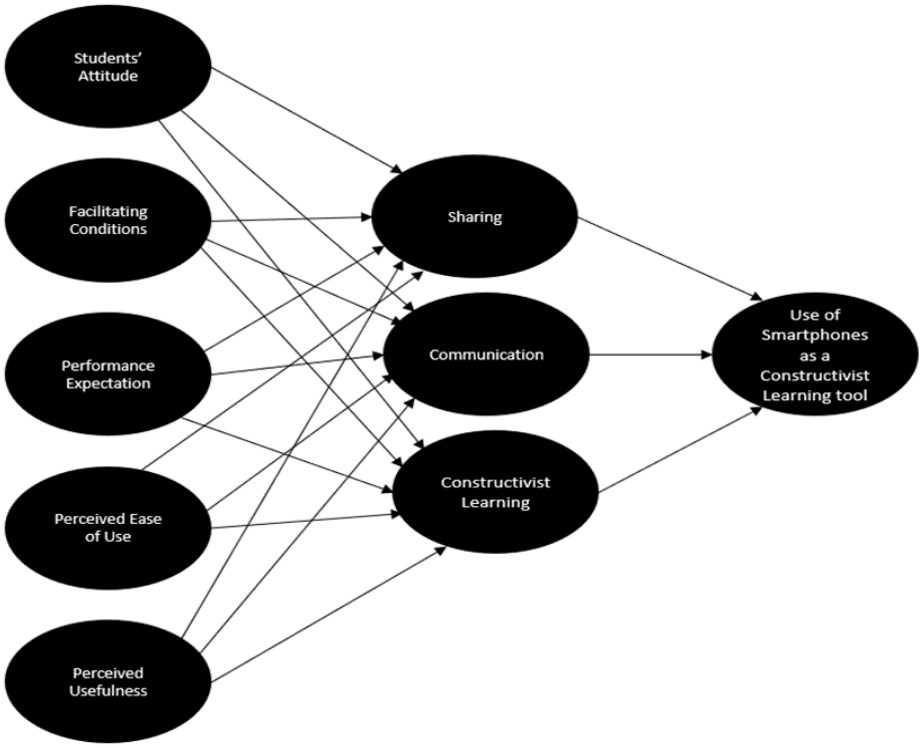

Figure 4. 1: Tested conceptual model

The results of the empirical tested model are summarised briefly by the following:

- There is a positive correlation between *Attitude* towards smartphones and all the dependent constructs (*Sharing, Communication*, and *Constructivist learning*) of this study.
- There is a positive correlation between *Facilitating Conditions* and all the dependent constructs (*Sharing, Communication,* and *Constructivist learning*) of this study.
- There is a positive correlation between *Performance Expectations* and all the dependent constructs (*Sharing, Communication, and Constructivist learning)* of this study.
- There is a positive correlation between *Perceived Ease of Use* and all the dependent constructs (*Sharing, Communication,* and *Constructivist learning*) of this study.

- There is a positive correlation between *Perceived Usefulness* and all the dependent constructs (*Sharing, Communication,* and *Constructivist learning*) of this study.

4.5 ANOVA results and Pearson correlation tests

This section presents the ANOVA results and the Pearson correlation tests conducted in this study.

4.5.1 ANOVA results

This section presents the ANOVA test results that were conducted after the analysis has been done in this study. According to Howarth (2017, p.1), Analysis of Variance (ANOVA) is "a method of decomposing the total variation displayed by a set of observations (as measured by the sums of squares of differences from the mean) into components associated with defined sources of variation". This test is useful as it determines whether any of the identified means are statistically significantly unique from one another. This is supported by Kim (2017) for whom ANOVA is used when analysing the difference between the constructs of a study.

ANOVA tests were conducted between each demographic variable against the research constructs. The results of this ANOVA test are separated into two categories: the first category includes the ANOVA test results between demographic variables and dependent constructs. In contrast, the second consists of the ANOVA test results between the demographic variables and independent constructs. The results of these ANOVA tests are presented from Appendix C to F. To avoid the consumption of space and time, the variables of *Demographics* and other dependent constructs where no correlations were found were omitted, and only those demographic variables with correlation or statistical significance when they were compared to dependent constructs, independent constructs are included here. Full Tables can be found in Appendix C to F…

4.5.1.1 ANOVA test results between Demographics and dependent variables.

After the ANOVA analysis was conducted, no kind of statistical significance between *Demographics* and *Sharing* could be found. The same applies to the relationship between *Demographics* and *Constructivist learning* as no kind of statistical significance could be found. In the absence of significance between the constructs mentioned above, only the statistical significance found between Demographics and Communication (dependent construct) is reported. Appendix C presents the statistical analysis of departments to see which department was correlated the most with *Communication.*

The results in Appendix C indicate that Information and Corporate Management is the department that obtained the highest mean with 16.78. This simply means that the academic staff of Information and Corporate Management are the ones that believe the most that students use smartphones for communication in their school activities. Appendix D demonstrates the statistical significance that was found between the department and *Communication* with one-way ANOVA. The reader is reminded that these Tables are presented from Appendix C to F.

4.5.1.2 ANOVA tests result between the Demographics and independent constructs.

After the ANOVA analysis was conducted between *Demographics* and the independent constructs, the study found a statistical significance between employment and *Perceived Usefulness* (see Appendix F). Appendix E represents the mean of all the employment variables (permanent and contract) to identify which employees received the highest rating from the participants. The Table in Appendix E shows that permanent employees received the highest mean with 27.07. According to Appendix F, there is a correlation between employment and *Perceived Usefulness* with permanent academic staff with a significance of 0.048. The results in the Table illustrated in Appendix E and F indicate that permanent employees who participated in this study believed that smartphones are useful for students' academic activities.

4.5.2 Pearson's correlation test results

This section presents the results of the Pearson's correlation coefficients (r) for all research variables of the independent constructs and the variables of the dependent constructs with their significance level of 0.01 (two stars **). According to Xu and Deng (2017), Pearson correlation measures the existence and strength of a linear relationship between two constructs. Xu and Deng (2017) further indicated that if $p < 0.05$, there is a statistically significant relationship between the two tested constructs.

The Pearson correlation results of all the research independent constructs against their dependent constructs were tested in the following category: all independent constructs against their dependent constructs (*Sharing, Communication,* and *Constructivist learning*), followed by the correlation between independent constructs themselves. Pearson's correlation found a correlation between all the independent constructs and dependent constructs of this study, similar to the relationship between independent themselves.

4.5.2.1 Pearson's correlation test between all independent constructs against Sharing (dependent construct)

Table 4.16 presents Pearson's correlation results between all independent constructs and *sharing*. The results illustrated in Table 4.16 show a correlation between all independent constructs and *Sharing* (dependent construct). The results of the Pearson correlation tests depicted in Table 4.16 can be summarised as follows in terms of confirming the relationship between all independent constructs against their dependent construct (*Sharing*):

- **Attitude towards smartphones**: Pearson's r correlation is 0.390, and the p-value is equal to 0.000. From the results of the correlation analysis of academic staff's perceptions, it is concluded that there is a weak positive correlation between *Attitude* towards smartphones and *sharing*. In other words, according to the academic staff's point of view, if students have a positive attitude towards smartphones, they will be willing to use them for sharing school activities.

- **Facilitating conditions:** Pearson's r correlation is 0.409, and the p-value is equal to 0.000. It is therefore concluded that there is a moderate positive correlation between *Facilitating conditions* and *sharing*. This shows that, according to the point of view of members of the academic staff, if facilitating conditions are good, students can use smartphones for sharing school activities.

- **Performance expectations:** Pearson's r correlation is 0.439, and the p-value is equal to 0.000. It confirms that there is a moderate positive correlation between *Performance Expectation* and *Sharing*. This shows that, according to the academic staff members, if students expected smartphones to enhance their performance, they will use them to share their learning resources.

- **Perceived usefulness:** Pearson's r correlation is 0.568, and the p-value is equal to 0.000. So, it is safe to conclude that there is a strong positive relationship between *Perceived Usefulness* and *Sharing*. This shows that, according to the academic staff members, the more students find smartphones useful, the more they can use them for sharing school activities.

- **Perceived ease of use:** Pearson's r correlation is 0.661, and the p-value is equal to 0.000. From the correlation analysis results, it is concluded that there is a very strong positive

correlation between *Perceived Ease of Use* and *Sharing*. Thus, according to academic staff members' point of view, the more students find smartphones easy to use, the more they will use them for learning.

Table 4. 16: Pearson's correlation results for independent constructs against Sharing

Independent constructs measuring Sharing (dependent construct)	Pearson Correlation(r)	P	N
Attitudes towards smartphones	.390**	.000	80
FacilitatingConditions	.409**	.000	80
PerformanceExpectations	.439**	.000	80
Perceived Usefulness	.568**	.000	80
Perceived Ease of Use	.661**	.000	80
**. Correlation is significant at the 0.01 level (2-tailed).			

4.5.2.2 Pearson's correlation test between all independent constructs and Communication (dependent construct)

Table 4.17 presents Pearson's correlation results between independent constructs and dependent constructs, specifically, *Communication*. The results demonstrated by Table 4.17 show that there is a correlation between all independent constructs of this study and *Communication* (dependent construct). The results of the Pearson correlation tests depicted in Table 4.17 can be summarised as follows in terms of confirming the relationship between all independent constructs against dependent construct (*Communication*):

- **Attitude towards smartphones**: Pearson's r correlation is 0.368, and the p-value is equal to 0.001. From the correlation analysis results, it is therefore concluded that there is a weak positive correlation between *Attitude* towards smartphones and *Communication*. In other words, according to the academic staff's point of view, if students have a positive attitude towards smartphones, they will be willing to use them for communicating school activities.
- **Facilitating conditions:** Pearson's r correlation is 0.414, and the p-value is equal to 0.000. So, it is concluded that there is a moderate positive correlation between *Facilitating Conditions* and *Communication*. This shows that, according to the academic staff members, if facilitating conditions are good, students can use smartphones to enable communication in school.

- **Performance expectations:** Pearson's r correlation is 0.388, and the p-value is equal to 0.000. It confirms that there is a weak positive correlation between *Performance Expectation* and *Communication*. This shows that, according to the academic staff members, if students find smartphones good in terms of increasing their performance, they will use them for communication reasons.

- **Perceived usefulness:** Pearson's r correlation is 0.497, and the p-value is equal to 0.000. So, it is safe to conclude that there is a strong positive relationship between *Perceived Usefulness* and *Communication*. This shows that, according to the point of view of members of the academic staff, the more students find smartphones useful, the more they will use them for communication processes.

- **Perceived ease of use:** Pearson's r correlation is 0.527, and the p-value is equal to 0.000. From the correlation analysis results, it is concluded that there is a very strong positive correlation between *Perceived Ease of Use* and *Communication*. Thus, according to academic staff members' point of view, the more students find smartphones easy to use, the more they will use them for learning.

Table 4. 17: Pearson's correlation results for independent constructs and Communication

Independent constructs measuring Communication (dependent construct)	**Pearson Correlation(r)**	**P**	**N**
Attitudes towards smartphones	.368**	.001	80
Facilitating Conditions	.414**	.000	80
Performance Expectations	.388**	.000	80
Perceived Usefulness	.497**	.000	80
Perceived Ease of Use	.527**	.000	80
**. Correlation is significant at the 0.01 level (2-tailed).			

4.5.2.3 Pearson's correlation test between all independent constructs and Constructivist learning (dependent construct)

Table 4.18 demonstrates Pearson's correlation coefficient between all independent constructs and *Constructivist learning* (dependent construct). These results show that there is a relationship between all the independent constructs and *Constructivist learning*. The results of the Pearson correlation tests depicted in Table 4.18 can be summarised as follows in terms of confirming the

relationship between all independent constructs against their dependent construct (*Constructivist learning*):

- **Attitude towards smartphones**: Pearson's r correlation is 0.364, and the p-value is equal to 0.001. From the correlation analysis results, it is concluded that there is a weak positive correlation between *Attitude* towards smartphones and *Constructivist learning*. In other words, according to the academic staff's point of view, if students have a positive attitude towards smartphones, they will be willing to use them to construct their learning.

- **Facilitating conditions:** Pearson's r correlation is 0.543, and the p-value is equal to 0.000. Therefore, it is concluded that there is a very positive correlation between *Facilitating Conditions* and *Constructivist learning*. This shows that, according to the academic staff members, if facilitating conditions are good, students can use smartphones to construct their learning.

- **Performance expectations:** Pearson's r correlation is 0.610, and the p-value is equal to 0.000. It confirms that there is a very positive correlation between *Performance Expectation* and *Constructivist learning*. This shows that, according to the academic staff members' point of view, if students find smartphones as a tool that can help them enhance their academic performance, they will use them to construct their learning.

- **Perceived usefulness:** Pearson's r correlation is 0.601, and the p-value is equal to 0.000. So, it is safe to conclude that there is a very strong positive relationship between *Perceived Usefulness* and *Constructivist learning*. So, it is safe to conclude that according to the point of view of members of the academic staff, the more students find smartphones useful, the more they will use them for constructing their learning.

- **Perceived ease of use:** Pearson's r correlation is 0.659, and the p-value is equal to 0.000. From the correlation analysis results, it is concluded that there is a very strong positive correlation between *Perceived Ease of Use* and *Constructivist learning*. Thus, according to academic staff members' point of view, the more students find smartphones easy to use, the more they will use them to construct their learning.

Table 4. 18: Pearson's correlation results for independent constructs and Constructivist

Independent constructs measuring and Constructivist learning (dependent construct)	Pearson Correlation(r)	P	N
Attitudes towards smartphones	.364**	.001	80
Facilitating Conditions	.543**	.000	80
Performance Expectations	.610**	.000	80
Perceived Usefulness	.601**	.000	80
Perceived Ease of Use	.659**	.000	80
**. Correlation is significant at the 0.01 level (2-tailed).			

4.5.2.4 Pearson's correlation test between independent constructs themselves

Pearson's correlation test results between independent constructs themselves are presented in Appendix G because it is huge. The results from the Table in Appendix G indicate that there is a strong direct relationship even between the independent constructs of this study.

The overall summary of the Pearson Correlation (r) between the independent constructs and the dependent constructs is shown in Table 4.19.

Independent constructs: *Attitude, Facilitating Conditions, Performance Expectations, Perceived Usefulness, Perceived Ease of Use*.

Dependent constructs: *Sharing, Communication, and Constructivist learning*.

Pearson correlations were used to measure the relationships between each of the independent constructs and the dependent constructs from Table 4.16 to Table 4.18. Table 4.19 is a summary of the relationships with $r > 0.4$

Table 4. 19: Significant Correlations

Independent Construct	Dependent Construct	Correlation (r)
Facilitating Conditions	Sharing	0.409
Performance Expectations		0.439
Perceived Usefulness		0.568
Perceived Ease of Use		0.661
Facilitating Conditions	Communication	0.414
Perceived Usefulness		0.497

Perceived Ease of Use		0.527
Facilitating Conditions	Constructivist Learning	0.543
Performance Expectations		0.610
Perceived Usefulness		0.601
Perceived Ease of Use		0.659

4.6 Factor analysis test

This section presents a factor analysis that has been performed on the constructs and the Likert-scale variables of this study. According to Wu (2018), factor analysis is a statistical technique used to define variability between observed, correlated variables in terms of a possibly lower number of unobserved variables. This agrees with the statement made by Taherdoost *et al.* (2014), for whom the factor analysis is the vital tool that is used in the development, refinement, and evaluation of tests, scales, and measures.

This study used the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity to test the suitability of the data collected from this survey for structure detection. According to Bucci, Luna, Viloria, García, Parody, Varela, and López (2018), the KMO measure can be defined as the statistics highlighting the proportion of variance in someone's constructs, which might be the result of the underlying factor. High values (close to 1.0) in KMO indicate that factor analysis perhaps is useful in someone's data. In contrast, if the value is low (0.50), the results indicate that factor analysis possibly will not be useful (Shamsudin, Ali, and Shabi, 2019). Barranco-Camargo, Usta-Agamez, López-García, Jurado-López, Zabala-Caraballo, and Ramos-Clason (2019) suggest that Bartlett's test of sphericity examines the hypothesis that a correlation matrix is an identity matrix that would highlight that the constructs are not related, and therefore are not suitable for structure detection. Smaller values (< 0.05) of the significance level indicate that factor analysis might be useful with the given data (Barranco-Camargo *et al*., 2019).

4.6.1 Constructs along with KMO and Bartlett's value

According to Ertugrul-Akyol (2019), Kaiser-Meyer-Olkin (KMO) and Bartlett's tests are used to test and examine the adequacy of sampling and suitability of data for factor analysis before the extraction of constructs. Table 4.20 presents the constructs of this study, along with Kaiser-Meyer-Olkin (KMO) and Bartlett's values that were found after the factor analysis test.

According to Table 4.20, the construct with the highest KMO value is the *Perceived Ease of Use*, with 0.744. At the same time, the construct with the lowest KMO value is *Facilitating Conditions* with 0.461. *Performance Expectations, Perceived Usefulness, Perceived Ease of Use*, and *Constructivist learning* would be most suitable for factor analysis to detect structure because the results for Bartlett's test of sphericity in Table 4.20 show that all the constructs of this study are statistically significant, as all have values of 0.000.

Table 4. 20: Constructs along with KMO and Bartlett's value

Constructs	KMO value	Bartlett's value
Attitude towards smartphones	0.462	0.000
Facilitating conditions	0.461	0.000
Performance expectations	0.632	0.000
Perceived usefulness	0.703	0.000
Perceived ease of use	0.744	0.000
Sharing	0.576	0.000
Communication	0.509	0.000
Constructivist learning	0.692	0.000

4.6.2 Rotated Component Matrix

This section presents the principal component matrix values for each variable within each construct of this study, as described by the previous Table 4.20. Table 4.21 illustrates the key outputs of the principal component analysis with all the variables of this study under their constructs and the extractions. This extraction indicates the proportion of variance for each construct that the factors can explain. This is supported by Effendi, Matore, Khairani, and Adnan (2019), according to whom extractions are the estimations of the variances in each construct accounted for by the components. It is noteworthy that, except for the small number of extraction values in Table 4.21 that are around 0.6, most of these extraction values are high, i.e., close to 1.0, which shows that the extracted variables represent the constructs well.

Table 4. 21: The key outputs of principal components analysis

Component Matrix	
***Attitude* toward smartphones**	**Component**
	1
	Extractions
Students have a positive attitude towards smartphones.	0.839
Students prefer learning from smartphones to learning from books.	0.644
Smartphones are fun for students.	0.781
Students would like to work with a smartphone in class.	0.770
Smartphones would help students organize their work properly.	0.797
Students would feel comfortable working with a smartphone.	0.811
The use of smartphones would help to provide a better learning experience.	0.809
Students would feel confident when asked to perform a new task on their smartphones.	0.744
Lessons using smartphones as a tool would be enjoyable.	0.797
Component Matrix	
Facilitating Conditions	**Component**
	1
	Extractions
There is a specific person or group that is available to assist them with smartphone difficulties.	0.677
Smartphones are compatible with other school devices they use.	0.800
Smartphones have functions that they need to use in their learning.	0.729
Students have adequate knowledge and skills to use smartphones.	0.867
The institution provides students with the necessary resources to enhance smartphone learning.	0.737
Students' friends are using smartphones.	0.687
Students' lecturers recommend them using smartphones for learning.	0.716
The operating costs of smartphones allow them to use it.	0.756
Component Matrix	
Performance Expectations	**Component**
	1
	Extractions
Improve their academic performance.	0.771

Increase productivity in the class.	0.818
Make their learning more effective.	0.832
Help them easily retrieve information for their studies.	0.793
Improve their learning outcome.	0.829
Enable them to accomplish tasks more quickly.	0.803
Will increase their chances of improving their marks.	0.832
Improve their communication.	0.774
Improve their competency skills.	0.812
Component Matrix	
Perceived Usefulness	**Component**
	1
	Extractions
Smartphones encourage collaborative learning among students.	0.702
Smartphones help students to be more active in class.	0.665
Smartphones promote autonomous learning among students.	0.731
Smartphones help students to do their learning activities quicker.	0.719
Smartphones allow students to gain access to up-to-date information through the web.	0.849
Smartphones are an effective tool for giving students immediate support and feedback.	0.798
Smartphones provide students with more flexible access to learning, as it can be done anytime, anywhere.	0.746
Component Matrix	
Perceived Ease of Use	**Component**
	1
	Extractions
Download class materials.	0.785
Work with different school apps.	0.812
Read materials.	0.867
Navigate the application on the screen.	0.841
Engage in schoolwork.	0.738
Remember how to perform tasks.	0.791
Record a class lecture.	0.818
Search course materials.	0.789
Component Matrix	

Sharing	**Component**
	1
	Extractions
Handwritten notes.	0.775
Educational videos.	0.844
Screenshots.	0.869
In discussion forums, educational blogs, or news feeds.	0.774
Downloaded books, lecture notes, and/or articles.	0.757
Audio recordings.	0.829
Learning apps and games.	0.780
Class information messages.	0.836
Component Matrix	
Communication	**Component**
	1
	Extractions
Students and other students.	0.787
Students and lecturers.	0.760
Students and administrative staff.	0.726
Students and parents.	0.725
Component Matrix	
Constructivist learning	**Component**
	1
	Extractions
By doing something when they learn instead of simply absorbing what is being transmitted to them.	0.833
By allowing them to discover many new ways of learning when using their smartphones to learn.	0.845
By allowing them to get involved in many activities that strongly engage the thinking process in their minds.	0.856
By enabling them to interact with the learning material in the language that they are most comfortable with.	0.851
By enabling them to connect what they are learning with things that are happening in their life.	0.737
By enabling them to connect the new knowledge to their existing knowledge.	0.816
By giving them enough time to reach their learning goals.	0.846

By adding excitement and motivation for them to learn more.	0.731

4.6.3 Regression

This section presents the regression analysis results between the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Attitude towards Smartphone, Performance Expectations, and Perceived Usefulness*) and dependent constructs (*Sharing, Communication, and Constructivist learning*) of this study. Tables 4.22, 4.23, and 4.24 illustrate the regression results between all independent constructs and *Sharing* (dependent construct) in terms of model summary. Tables 4.25, 4.26, and 4.27 demonstrate the regression results between all independent constructs and *Communication* (dependent construct) in terms of model summary. Tables 4.28, 4.29, and 4.30 illustrate the regression results between all independent constructs and *Constructivist learning* (dependent construct) in terms of model summary.

4.6.3.1 Regression results between all independent constructs and Sharing

Table 4.22 provides R and R^2 values. The R-value is 0.687, which indicates a high degree of correlation between the independent constructs and their dependent construct, *Sharing*. The R^2 value indicates the magnitude of the total variation in the dependent construct, *Sharing*, and it can be explained by the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations, and Perceived Usefulness*). In this case, R^2 = 0.472, which means that the independent constructs explain 47.2% of the dependent construct (*Sharing)* in the population. R^2 is also an estimation of the effect size, which at 0.472 (47.2%) indicates the medium effect size, according to Cohen's (1988) classification.

Table 4. 22: Linear regression table

Model Summary									
					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.687	.472	.435	5.688	.472	12.874	5	72	.000
a. Predictors: (Constant), *PerceivedEaseofUse, FacilitatingConditions, SmartPhoneAtt, PerformanceExpectations, PerceivedUsefulness*									
b. Dependent Construct: *Sharing*									

Table 4.23 shows the p-value, which illustrates the statistical significance of the regression model that was performed. In this case, the p-value is equal to 0.000, which indicates that the regression model significantly predicts the independent constructs (*Perceived Ease of Use*, *Facilitating Conditions, Smartphone Attitude, Performance Expectations,* and *Perceived Usefulness*) as a good fit for the data.

Table 4. 23: Linear regression table

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2082.648	5	416.530	12.874	.000
	Residual	2329.570	72	32.355		
	Total	4412.218	77			
a. Dependent Constructs: *Sharing*						
b. Predictors: (Constant), *PerceivedEaseofUse, FacilitatingConditions, SmartPhoneAtt, PerformanceExpectations, PerceivedUsefulness*						

Table 4.24 presents the coefficients table, which gives us the necessary information to predict *Sharing* from the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations,* and *Perceived Usefulness*), as well as to determine whether these independent constructs contribute statistically significantly to the model by looking at the "Sig." column. According to Table 4.24, *Perceived Ease of Use* is the only independent construct that significantly contributes to the model, as the p-value is equal to 0.000.

Table 4. 24: Linear regression table

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.727	3.733		1.534	.129
	SmartPhoneAtt	-.019	.119	-.018	-.157	.876
	FacilitatingConditions	.132	.115	.119	1.141	.258
	PerformanceExpectations	-.117	.115	-.136	-1.017	.312
	PerceivedUsefulness	.288	.177	.228	1.626	.108

	PerceivedEaseofUse	.594	.144	.543	4.121	.000
a. Dependent Construct: *Sharing*						

4.6.3.2 Regression results between all independent constructs and Communication

Table 4.25 provides R and R^2 values. The R-value of 0.583 shows the simple correlation indicating a high degree of relationship between the independent constructs and the dependent construct *Communication*. The R^2 value indicates the highest degree of the total variation in the dependent construct, *Communication*, and it can be explained by the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations,* and *Perceived Usefulness).* In this case, R^2 = 0.340, which means that the independent constructs explain 34% of the dependent construct (*Communication*) in the population. R^2 is also an evaluation of the effect size, which at 0.340 (34%), indicates the medium effect size, according to Cohen's (1988) classification.

Table 4. 25: Linear regression table

Model Summary									
					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.583	.340	.294	3.265	.340	7.415	5	72	.000
a. Predictors: (Constant), *PerceivedEaseofUse, FacilitatingConditions, SmartPhoneAtt, PerformanceExpectations, PerceivedUsefulness*									
b. Dependent Construct: *Communication*									

Table 4.26 illustrates the regression model, which, in this case, predicts the significance of *Communication* as a dependent construct, as we can see the p-value of 0.000. This p-value illustrates the statistical significance of the regression model that was done. In this case, the p-value is equal to 0.000, which indicates that the regression model significantly predicts the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations, and Perceived Usefulness*) as a good fit for the data.

Table 4. 26: Linear regression table

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	395.130	5	79.026	7.415	.000
	Residual	767.332	72	10.657		
	Total	1162.462	77			
a. Dependent Construct: *Communication*						
b. Predictors: (Constant), *PerceivedEaseofUse, FacilitatingConditions, SmartPhoneAtt, PerformanceExpectations, PerceivedUsefulness*						

Table 4.27 presents the coefficients table, which gives us the necessary information to predict *Communication* from the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations, and Perceived Usefulness*), as well as to determine whether these independent constructs contribute statistically significantly to the model by looking at the "Sig." column. According to Table 4.27, as is the case with the dependent construct *Sharing, Perceived Ease of Use* is the only independent construct that significantly contributes to the model, as the p-value, which is 0.048 and, therefore, could be considered equal to 0.000.

Table 4. 27: Linear regression table

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.890	2.143		1.816	.074
	SmartPhoneAtt	.015	.068	.027	.215	.830
	FacilitatingConditions	.099	.066	.174	1.494	.140
	PerformanceExpectations	-.035	.066	-.079	-.529	.598
	PerceivedUsefulness	.169	.102	.261	1.665	.100
	PerceivedEaseofUse	.167	.083	.297	2.014	.048
a. Dependent Construct: *Communication*						

4.6.3.3 Regression results for all independent constructs and Constructivist learning

Table 4.28 provides R and R^2 values. The R-value shows a simple correlation value of 0.762, which indicates a high degree of correlation between the independent constructs and the dependent construct, *Constructivist learning*. The R^2 value indicates the highest degree of the total variation in the dependent construct, *Constructivist learning*, and it can be explained by the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations, and Perceived Usefulness*). In this case, R^2 = 0.580, which means that the independent constructs explain 58% of the dependent construct, constructivist learning, in the population. R^2 is also an evaluation of the effect size, which at 0.580 (58%), indicates the large effect size, according to Cohen's (1988) classification.

Table 4. 28: Linear regression table

Model Summary									
					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change (p-value)
1	.762[a]	.580	.551	5.068	.580	19.901	5	72	.000
a. Predictors: (Constant), *PerceivedEaseofUse, FacilitatingConditions, SmartPhoneAtt, PerformanceExpectations, PerceivedUsefulness*									
b. Dependent Construct: *Constructivist learning*									

Table 4.29 illustrates the regression model, which, in this case, predicts the significance of the dependent construct, *Constructivist learning*, with a p-value of 0.000. The p-value illustrates the statistical significance of the regression model that was performed. In this case, the p-value is equal to 0.000, which indicates that the regression model significantly predicts the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations,* and *Perceived Usefulness*) as a good fit for the data.

Table 4. 29: Linear regression table

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig. (P-value)
1	Regression	2555.921	5	511.184	19.901	.000[b]
	Residual	1849.374	72	25.686		
	Total	4405.295	77			
a. Dependent Construct: *Constructivist learning*						

b. Predictors: (Constant), *PerceivedEaseofUse, FacilitatingConditions, SmartPhoneAtt, PerformanceExpectations, PerceivedUsefulness*

Table 4.30 presents the coefficients table, which gives us the necessary information to predict *Constructivist learning* from the independent constructs (*Perceived Ease of Use, Facilitating Conditions, Smartphone Attitude, Performance Expectations,* and *Perceived Usefulness*), as well as to determine whether these independent constructs contribute statistically significantly to the model by looking at the "Sig." Column. According to Table 4.30, three independent constructs significantly contribute to the model. The first one is *Facilitating Conditions* with 0.005, followed by *Performance Expectation* with 0.46, and the last one is *Perceived Ease of Use* with 0.002. This is the only dependent construct (*Constructivist learning*) with more than two independent constructs that are significantly contributing to the model.

Table 4. 30: Linear regression table

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.693	3.326		1.110	.271
	SmartPhoneAtt	-.178	.106	-.167	-1.675	.098
	FacilitatingConditions	.295	.103	.267	2.868	.005
	Performance Expectations	.209	.103	.243	2.033	.046
	Perceived Usefulness	.189	.158	.150	1.200	.234
	PerceivedEaseofUse	.408	.128	.373	3.175	.002
a. Dependent Construct: *Constructivist learning*						

4.7 Summary

This chapter presented the data analysis results of this study. The reliability and validity of all the variables and their constructs were tested and confirmed. Reflecting on the results presented in this chapter, the following was noted: based on the descriptive statistics, a few more females participated in this study, with 50 percent selecting females in the survey. On the other hand, most academic staff are from South African origin, with Blacks the maximum number followed by Indians, and most of them are between 41-50 years old. Most of them are from the Department of Information Technology and were lecturers in terms of their ranking. The overwhelming majority

of academic staff members strongly agree that they believe students have a positive attitude towards smartphones. They also agreed that smartphones could make students' learning more effective. This study further performed inferential tests. The inferential tests results revealed that all the independent constructs have an impact on the usage of smartphones for learning by students either by communicating, sharing, or when they are constructing their learning. The next chapter will discuss the findings of this chapter (4) compared to those from existing empirical studies on the factors affecting the use of smartphones as a constructivist learning tool.

CHAPTER 5: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The previous chapter presented the findings of this study. This included the results for the reliability and validity of the data gathering instrument, questionnaire results, descriptive and inferential statistical results, Chi-square, factor analysis, and regression-based on the questionnaire-based survey results. The participants were members of the academic staff from five departments of the Faculty of Accounting and Informatics at the Durban University of Technology (DUT) in KwaZulu-Natal, a province of South Africa. The perceptions of the participants on the factors that could affect the use of smartphones as a constructivist learning tool by students were measured, and the results were presented.

This chapter is dedicated to the discussion of these findings and their relation to other existing empirical studies, as highlighted by chapter two, on the factors that affect the use of smartphones as a constructivist learning tool by students. At the end of this chapter, research gaps and recommendations are indicated to improve smartphone usage as a constructivist learning tool, equally for the future and other research purposes.

5.1 Discussion on the findings of the reviewed studies

This study identified 59 factors from the reviewed studies described in the literature, which is composed of 30 different authors. These 59 factors were classified into several groups resulting in 6 categories (*Demographics, Attitude towards smartphones, Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, and Performance Expectations*) to reduce redundancy and to form the constructs that were used to develop a model in this study. Of these 59 factors, 45 were found to correlate, whether positive or negative, with the use of smartphones for learning. In comparison, 14 factors were found not to have any form of correlation with the use of smartphones for learning (measurements of these factors are presented in Table 2.1 in chapter two). Overall, results relating to the factors mentioned above, both those showing a relationship and those that do not, combined with literature, found that the use of smartphones has an impact on students' learning activities. These studies are illustrated in Appendix H.

5.2 Discussion of the findings of this study

This study found that the majority of participants believe that smartphones can be used for constructivist learning, communication, and sharing academic-related activities. The results are discussed below according to the constructs of the proposed model.

5.2.1 Construct: Attitude towards the use of smartphone

The results of the current study on this construct indicated that although there was general agreement that students find smartphones to be fun and have a positive attitude towards using smartphones as a constructivist learning tool, a lower level of agreement was found that smartphones could make a positive contribution towards organising students' work. This is interesting since we know that the tools available on smartphones could be used to schedule submission dates for tasks, group meetings for collaboration, and assessments, all of which contribute to organising their work. This is supported by Ahmed (2016), according to whom many smartphone tools help students to record notes via photo, text, or audio recording and help them facilitate school work together to accomplish their common goal. This current study did not measure the use of the smartphone by individual academic staff members, so one possible explanation could be that those members of staff who did not support this aspect also did not use smartphones to help manage their schedules.

5.2.2 Construct: Facilitating Conditions

As for *Facilitating Conditions,* the results revealed that most academic staff members believe that if students' friends (peers) are using smartphones, they (students) will attempt to use smartphones to construct their learning, either by sharing or communicating with other students. However, the same results show that even if an institution provides students with the necessary resources, it may not influence them to use smartphones as a constructivist learning tool. The impact of the provision of the resources needed for students to enhance their learning was rated lower by participants. These results also indicated that if students have adequate knowledge and skills to use smartphones, they can have the interest to use them to construct their learning, which signifies the importance of skills and knowledge when it comes to utilisation of smartphones.

5.2.3 Construct: Performance Expectations

The results about *Performance Expectations* indicated that although most academic staff members agreed that smartphones could help students easily retrieve information for their studies, a minimal agreement was found on the belief that smartphones will improve students' academic performance. The general agreement on the belief that smartphones can help students easily retrieve information for their studies is one of the interesting parts of this study because we know that the available learning platforms for smartphones can allow students to pursue their learning in many ways. This indicates the power of smartphones in learning in terms of supporting students. The minimal level of participants who believe that smartphones can improve students'

academic performance supports the notion that access to information does not automatically translate to improved performance. This is supported by Davie and Hilber (2017) for whom personal resources can help any individual, however, everyone must play his part to leverage such resources. Similarly, Godwin-Jones (2017) claims that smartphones do not automatically result in more learning; students must try to work with the system to achieve the desired results. However, it is worth noting that smartphones provide the option to leverage such resources, while the absence of smartphones limits the student to existing resources.

5.2.4 Construct: Perceived Usefulness

The results for *Perceived Usefulness* indicated that although participants generally agreed that smartphones would provide students with more flexible access to learning, a lower level of agreement was found on the view that smartphones would help students to be more active in class. This is fascinating because smartphones allow applications that can play a significant role in assisting students in constructing their learning, such as Evernote software, which can be installed on a smartphone device and enable individuals to simplify many of their tasks. This includes crafting notes, taking photos, and allowing someone to record voice notes (which would not be practical in class). It also provides access to online applications such as Coursera, which offers various lessons and classes that somebody can take on a particular topic related to what is being discussed in class. Although this study did not measure this, a small number of those who disagree with the belief that smartphones would help students to be more active in class may be as a result of them favouring using traditional ways of teaching, such as lecturers being the source of knowledge instead of learners constructing their knowledge (see Table 4.14 in chapter 4). The belief that smartphones would provide more flexibility to students in terms of creating their learning highlights the recognition of smartphones for learning by the participants.

5.2.5 Construct: Perceived Ease of Use

As for *Perceived Ease of Use*, the results indicated that most academic staff members believe that smartphones would make it easy for students to search course materials to pursue their learning either by sharing or communicating. Simultaneously, a lower level of agreement was found on the belief that smartphones would make it easier for students to engage in schoolwork. Smartphones' portability might be one of the reasons why academic staff members believe that it would make learning more accessible for students to search for course materials. The lower level of agreement, which was found on the perceptions that smartphones would make it easier for students to engage in schoolwork, maybe due to practical constraints in using smartphones for

learning, since in large classes, they might take advantage to use their smartphones for non-academic activities as the lecturer might not be able to see all of them. So, it would be crucial for those conducting the lectures to monitor the process and ensure that smartphones are being used in class for learning purposes rather than other social activities. Outside of class, there is no control, and this is not measurable.

5.2.6 Construct: Sharing

For *Sharing*, the results revealed that academic staff members believe that students can use smartphones to share class information, messages, and work. In contrast, the belief that students can use smartphones to share hand-written notes was rated lower by the participants. This is interesting because several smartphone applications allow scanning/photographing notes and sharing them without much effort.

5.2.7 Construct: Communication

The results on the use of smartphones for *Communication* by students indicated that most participants believe that students use smartphones to communicate with other students. At the same time, a lower level of agreement on the use of smartphones to communicate with the administrative staff was also discovered. Possibly, students are more comfortable working with classmates, sometimes to accomplish their common goals. The lower level of agreement that was found on students' communication with administrative staff maybe because the administrative staff usually communicate with students through other platforms like emails and Learning Management Systems.

5.2.8 Construct: Constructivist learning

In terms of *Constructivist learning*, the results indicated that although there was general agreement that smartphones can add excitement and motivation for students to learn more, a lower level of belief that smartphones would enable students to interact with their learning materials using the language they are comfortable with was found. As English is the language of instruction, all study material is provided in English, which could possibly influence the possibility of interacting in a language of choice.

5.3 Empirically tested model

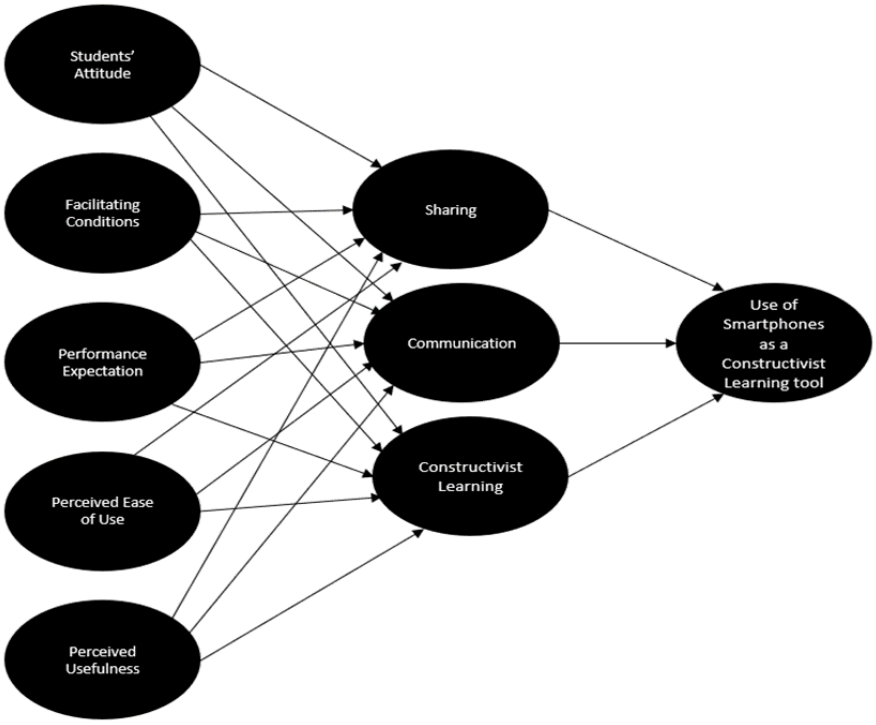

Figure 5. 1: Visual representation of the model in figure 3.1 and 4.1

5.4 The relation of the study results to the research aims, objectives, and questions

This study was conducted to understand whether academics believe that students can use smartphones to construct their learning since various smartphone problems have been identified in the literature as one of the leading causes of distractions amongst students, more specifically when they are learning. These distractions include a concern proclaimed by Helstowski (2021), where obsessions with smartphone devices were found among students during classes, where they send and receive entertainment messages while they are in class. This is supported by Atherley, Hu, Teunissen, Hegazi, and Dolmans (2021) for whom students use their smartphones to share inappropriate content or cause distractions during classes. These distractions are at the core of the motivation for this study, which aimed at creating a model depicting the relevant factors affecting the use of smartphones as a constructivist learning tool by students.

5.4.1 Aim

The aim of this study was to create a model depicting the relevant factors affecting the use of smartphones as a constructivist learning tool by students. This aim was achieved, as a model showing the pertinent factors that have an impact on the use of smartphones as a constructivist learning tool by students was created (see figure 2.1 in chapter two).

5.4.2 Objectives

The first objective of this study, which is to identify from the literature the factors that could affect the use of smartphones as a constructivist learning tool, was achieved through a comprehensive literature review (chapter two), where several factors affect the use of smartphones by students were identified.

The second objective of this study, which was to construct a model that identifies the constructs impacting the use of smartphones for constructivist learning, was also accomplished. A conceptual model was created (see figure 2.1 in chapter two) based on the factors found. Nine constructs were identified, variables to measure each construct were identified, and a questionnaire was developed based on the constructs and variables. After the questionnaire-based survey was completed, the data were analysed to pursue the third objective of this study, to empirically test the model. The structural model estimation based on the conceptual model (Figure 4.1), tested by the survey, showing the significance of each factor, indicates that all the independent constructs have an impact on the use of smartphones as a constructivist learning tool, either for communication and or sharing academic-related activities.

5.4.3 Research Questions

In terms of research questions, this study has managed to answer all of them, as the factors that could affect the use of smartphones as a constructivist learning tool have been identified in Chapter Two. Based on the factors identified, a model for maximizing factors that enable the use of smartphones for constructivist learning by students was constructed (see figure 2.1). The third research question has also been answered, as the model was empirically tested to check the accuracy of the relationships reflected in a model (see figure 4.1 in Chapter 4)

5.4.4 Summary

This study found that *Demographics,* such as academic departments, *Attitudes* towards smartphones, *Facilitating Conditions*, *Perceived Ease of Use*, *Perceived Usefulness*, and *Performance Expectations* all have an impact on the use of smartphones as a constructivist

learning tool. This shows that, according to the perceptions of members of the academic staff, if the constructs mentioned above are not considered, there is a possibility that students may not successfully use smartphones to construct their learning, either by communicating or sharing their academic-related activities. This agrees with the existing literature, where more than two-thirds of them agreed that these constructs have an impact on the successful usage of smartphones for learning purposes.

5.5 Contribution of this study

This study provides a model for successfully advancing the use of technology in learning in a world dominated by the ubiquitous use of technology. Especially in a world struggling to cope with the impacts of Covid-19 on teaching and learning strategies, this study provides direction to those who embark on harnessing the power of smartphones to continue to provide quality education.

By quantifying the significance of each factor as a result of the structural model estimation based on the results for the conceptual model (Figure 4.1), academics were able to:

- Confirm that these constructs are significant.
- Rank these constructs and ensure the constructs with the highest impact receives appropriate attention.
- Successfully change the way students interact with technology to prepare better their graduates for the real world, where the use of technology is growing in leaps and bounds.

5.6 Recommendations for future research

This section suggests areas of future research on the factors affecting the use of smartphones as a constructivist learning tool. Possible reasons for some of the surprising responses from participants could provide a different picture and change the ranking of the constructs in terms of their impact. These suggestions are provided below according to the constructs of this study and the results that were found.

5.6.1 Attitude of students towards smartphones usage as a constructivist learning tool

This study found that there is a correlation between *Attitude* and the use of smartphones for either *Constructivist learning, Communication*, and/or *Sharing*, as well as a positive relationship when it was measured against all other independent constructs, which is something that the reviewed existing literature could not find. Therefore, this study recommends more research to be conducted on the relationship between *Attitude* and the use of smartphones as a constructivist

learning tool and to confirm the findings further and possibly enhance understanding around this construct and its impact on the use of smartphones for *Constructivist learning*. This will also help in measuring the relationships between other independent constructs. Even though the current research found that the participants believe students have a positive attitude towards smartphones, those participants who believed that students have a negative attitude on smartphones possible they do not use smartphones proficiently.

Research to maximise ways to improve students' attitudes is needed so that students can be determined to use smartphones for learning purposes, possibly utilising a strategy suggested by Higgins *et al.* (2019), for whom raising awareness can be one of the key elements to improve one's attitude towards technology. They reiterated that stakeholders and those in charge must develop awareness groups and activities to alert students about the technology, as it might propel them to use it for learning.

5.6.2 Performance Expectations when using smartphones for constructivist learning

This study found a positive correlation between *Performance Expectations* and all the dependent constructs (smartphones for *Sharing, Communication,* and *Constructivist learning*) and a positive relationship when it was measured against all other independent constructs. This is something that reviewed literature did not find. Therefore, it is recommended that more research be conducted on the relationship between *Performance Expectations* and the use of smartphones as a constructivist learning tool.

However, while the current study found that the academic staff members believe that *Performance Expectations* have an impact on the use of smartphones as a constructivist learning tool by students, this study also advocates the need to maximise the expectation levels among students so that they might see the need to utilise smartphones as a constructivist learning tool. Possible by following a strategy proposed by Ahmed (2016) who advocates the importance of declaring smartphones benefits to students. This includes benefits like easy access to electronic learning resources, messaging, push-pull communication, audio, video, text chatting with colleagues or staff, and virtual reality environments either on-line or off-line. These platforms can help students improve their learning performance and might enhance their expectations, either performance-wise, when they use smartphones for learning-related activities.

5.6.3 Facilitating Conditions on the usage of smartphones for constructivist learning.

This study found a positive correlation between *Facilitating Conditions* and all the dependent constructs and a positive relationship when it was measured against all other independent constructs. The existing literature review could not find these findings. Therefore, it is recommended that more research be conducted on the relationship between *Facilitating Conditions* and the use of smartphones as a constructivist learning tool.

Even though the current study found that academic staff members believe that *Facilitating Conditions* impact the use of smartphones as a constructivist learning tool by students, the findings seem to indicate that students who do not have adequate facilities are less likely to use smartphones to construct their learning. Therefore, it is suggested that there is a need to do more research on whether enhancing facilitating conditions in the institutions might help students utilise smartphones as a constructivist learning tool, possibly by following a strategy proposed by Dhiman *et al.* (2019).

Dhiman *et al.* (2019) indicated that institutions need to have the necessary resources to facilitate the adoption of mobile devices in learning. This is supported by Maruping *et al.* (2017) cited by Jeon *et al.* (2018) for whom technical infrastructure that exists in the institution can influence an individual's likelihood of using technology.

5.6.4 Perceived Ease of Use of smartphones as a constructivist learning tool.

This study found a positive correlation between *Perceived Ease of Use* and all the dependent constructs and a positive relationship when it was measured against all other independent constructs. This is something that the existing literature could not find. More research needs to be conducted on the relationship between *Perceived Ease of Use* and the use of smartphones as a constructivist learning tool. While the current study found that the members of academic staff believe that *Perceived Ease of Use* has an impact on the use of smartphones as a constructivist learning tool by students, the results seem to indicate that those participants who do not believe that students would find smartphones an easy learning tool to use, possibly may not use them. It is, therefore, suggested that there is a need to convince students about the ease of use of smartphones for learning so that they might be interested in utilising them to construct their learning. Possibly by employing a strategy suggested by Lee, Choi, Rho, Kim, and Choi (2018) who indicated that if the system is perceived as easy to use and useful, a students would have a

positive attitude towards the system, which would propel the students' intentions to use the system.

5.6.5 Perceived Usefulness of smartphones as a constructivist learning tool.

This study found a positive correlation between *Perceived Usefulness* and all the dependent constructs and a positive relationship when measured against all other independent constructs, which is something the reviewed literature could not find.

Therefore, it is recommended that more research be conducted on the relationship between *Perceived usefulness* and the use of smartphones as a constructivist learning tool. Although the current study found that the academics believe that *Perceived Usefulness* positively influences the use of smartphones as a constructivist learning tool by students, the findings seem to indicate those who do not see the smartphone as a useful tool might not use it for learning. This suggests a need to convince students about the usefulness of smartphones so that they might be interested in using them to construct their learning. Possibly by using a strategy proposed by Adekunle and Ejechi (2018). According to Adekunle and Ejechi (2018), smartphones can be a useful tool in education by doing two distinctive activities possible: first, to capture the ideas or real examples where and when they are generated or observed; secondly, to share the captured work objects with more knowledgeable people, promoting conversation and discussion.

5.7 Conclusion

Chapter 1 of this study presented the structure of this thesis, which included the background and context of this research. The research problem was outlined, as well as the aim, objectives, and research questions. This chapter also highlighted an overview of the possible contribution of this study. It then concluded by the structure of this thesis.

Chapter 2 discussed constructivist learning and provided an overview of smartphones as a constructivist learning tool. It continued with an in-depth review of possible factors affecting the use of smartphones by students. After discussing the factors mentioned above, it also identified nine constructs that were later used to create a theoretical model to support the second objective of this study. This model was supported by the existing theories and models.

Chapter 3 provided an insight into the research design of this study in terms of its population, sampling, data collection, and data analysis methods.

Chapter 4 presented the results and analysis of this study. This chapter firstly confirmed the reliability and validity of the questionnaire. It then presented the analysis of the results using: descriptive and inferential statistics (ANOVA and Pearson's correlation test), factor analysis test, and evaluate a proposed model by presenting empirical tested model estimation, showing the significance of each construct in figure 4.1.

Lastly, **Chapter 5** summarised the findings of this study, highlighted its contribution, as well as provided possible future research avenues.

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Appendix A: Questionnaire

The following statements are expressions of academic staff opinions concerning about the use of smartphones for learning by students. Please tick (✓) where applicable.

A. Demographics (Independent Variable)

A.1. Department

IT		Auditing and Taxation		Management Accounting		Information and Corporate Management		Financial Accounting	

A.2. Age

Under 30 years		30-40 years		41-50 years		51-60 years		Above 60 years	

A.3. Gender

Male		Female		Prefer not to say	

A.4. Ethnic group

Black		Coloured		White		Indian		Other (specify)	
								Prefer not to say	

A.5. Employment

Permanent		Contract	

A.6. Citizenship

South Africa		Expatriate		Prefer not to say	

A.7. Rank

Junior Lecturer		Lecturer		Senior Lecturer		Associate Professor		Full Professor	
								Other (specify)	

B. Attitude towards smartphones I believe that:	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
B.1 Students have a positive attitude towards smartphones					
B.2 Students prefer learning from smartphones to learning from books					
B.3 Smartphones are fun for students.					
B.4 Students would like to work with a smartphone in class.					
B.5 Smartphones would help students organize their work properly.					
B.6 Students would feel comfortable working with a smartphone.					
B.7 The use of smartphones would help to provide a better learning experience.					
B.8 Students would feel confident when asked to perform a new task on their smartphones.					
B.9 Lessons using smartphones as a tool would be enjoyable.					

C. Facilitating conditions I believe that students will use smartphones for learning if:	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
C.1 There is a specific person or group that is available to assist them with smartphone difficulties.					
C.2 Smartphones are compatible with other school devices they use.					
C.3 Smartphones have functions that they need to use in their learning.					
C.4 Students have adequate knowledge and skills to use smartphones.					
C.5 The institution provides students with the necessary resources to enhance smartphone learning.					
C.6 Students' friends are using smartphones.					
C.7 Students' lecturers recommend them using smartphones for learning.					
C8 The operation costs of smartphones allow them to use it.					

D. Performance expectations I expect that the use of smartphones by students can:	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
D.1 Improve their academic performance.					
D.2 Increase their productivity in the class.					
D.3 Make their learning more effective.					
D.4 Help them easily retrieve information for their studies.					
D.5 Improve their learning outcome.					
D.6 Enables them to accomplish tasks more quickly.					
D.7 Will increase their chances of improving their marks					
D.8 Improve their communicative					

E. Perceived usefulness I believe that:	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
E.1 Smartphones encourage collaborative learning among students.					
E.2 Smartphones help students to be more active in class.					
E.3 Smartphones promote autonomous learning among students.					
E.4 Smartphones help students to do their learning activities quicker.					
E.5 Smartphones allow students to gain access to up-to-date information through the web.					
E.6 Smartphones are an effective tool for giving students immediate support and feedback.					
E.7 Smartphones provide students with more flexible access to learning, as it can be done anytime and anywhere.					

F. Perceived ease of use I believe that smartphones make it easy for students to:	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
F.1 Download class materials.					
F.2 Work with different school apps.					
F.3 Read materials.					
F.4 Navigate the application on the screen.					
F.5 Engage in schoolwork.					
F.6 Remember how to perform tasks.					
F.7 Recording a class lecture.					
F.8 Search course materials.					

G. Sharing I believe that students use their smartphones to share:	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
G.1 Handwritten notes.					
G.2 Educational videos.					
G.3 Screenshots.					
G.4 In discussion forums, educational blogs, or newsfeeds.					
G.5 Downloaded books, lecture notes, and/or articles.					
G.6 Audio recordings.					
G.7 Learning apps and games.					
G.8 Class information messages.					

H. Use of smartphones for communication on learning activities. **I believe that students use smartphones for communication between:**	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
H.1 Students and other students.					
H.2 Students and lecturers.					
H.3 Students and administrative staff.					
H.4 Students and parents.					

I. Use of smartphones for the practice of constructivist learning activities **I think smartphones help students to construct knowledge for learning on their own:**	**Strongly Disagree**	**Fairly Disagree**	**Weakly Agree**	**Fairly Agree**	**Strongly Agree**
I.1 By doing something when they learn instead of simply absorbing what is being transmitted to them.					
I.2 By allowing them to discover many new ways of learning when using their smartphones to learn.					
I.3 By allowing them to get involved in many activities that strongly engage the thinking processes in their mind.					
I.4 By enabling them to interact with the learning material in the language that they are most comfortable with.					
I.5 By enabling them to connect what they are learning with things that are happening in their life.					
I.6 By enabling them to connect the new knowledge to their existing knowledge.					
I.7 By always giving them enough time to reach their learning goals.					
I.8 By bringing the excitement and motivation to them to learn more.					

Appendix B: Trends supported by descriptive statistics

The Overall Results of Descriptive Statistics

CONSTRUCT	VARIABLE	Highest/Lowest Mean out of 5	Standard Deviation (SD)	CONCLUSIONS: High mean and SD close to 1= high agreement among participants with the statement
Independent Constructs and their Variables				
***Attitudes* towards smartphones as a learning tool**	Students have a positive attitude towards using for learning	4.41	1.076	A high level of support and agreement that students feel positive towards using smartphones for learning.
	Help students organize their work	3.62	1.267	Greater variation in opinions on whether smartphones could help students organize their work better.
Facilitating Conditions	If students' friends are using Smartphones for learning	4.05	1.054	A high level of agreement that friends could influence students.
	The institution provides the necessary resources	3.35	1.223	Significant disagreement on whether the provision of resources would lead to students using smartphones for learning.
Performance Expectations	Help students easily retrieve information for studies	3.98	1.125	Some disagree with the ability to retrieve information, but the high mean shows support.
	Improve their academic performance	3.47	1.222	Significant disagreement among participants on whether smartphones would

				improve academic performance.
Perceived Usefulness	Provide students with more flexible access to learning	4.15	1.045	A high level of agreement as to more flexible learning.
	Help students to be more active in class	3.15	1.283	Significant disagreement among participants on whether smartphones would help students to be more active in class.
Perceived Ease of Use	Can make it easy for students to search course materials	4.13	0.919	High support and agreement to some extent that smartphones could make it easy for students to search course materials.
	Can make it easier for students to engage in schoolwork	3.55	1.113	Less support and limited agreement that smartphones can make it easier for students to engage in schoolwork.
Dependent Constructs and their Variables				
Sharing	Use to share class information	4.11	1.006	A high level of support and agreement that students could use smartphones to share class information.
	Use to share hand-written notes	3.58	1.376	Some support, but significant disagreement that students could use smartphones to share hand-written notes.
Communication	Use to communicate with other students	4.45	1.042	A high level of support and agreement that students could use smartphones to communicate with other students about learning.

	Use to communicate with administrative staff	3.23	1.350	Some support but significant disagreement that students could use smartphones to communicate with administrative staff
Constructivist learning	Can add excitement and motivation	3.95	1.042	Support and agreement smartphones could add excitement and motivation for learning.
	Would enable students to interact with their learning materials using the language they are comfortable	3.68	1.251	Less support and significant disagreement that students could use smartphones to interact with their learning materials using the language they are comfortable with.

Appendix C: Statistical analysis for the Department and Communication

ANOVA TESTS

Communication								
					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
IT	34	15.59	3.066	.526	14.52	16.66	9	20
Auditing and Taxation	8	15.50	3.117	1.102	12.89	18.11	10	20
Management Accounting	11	16.64	3.585	1.081	14.23	19.05	11	20
Information and Corporate Management	18	16.78	2.647	.624	15.46	18.09	12	20
Financial Accounting	9	12.00	6.982	2.327	6.63	17.37	4	20
Total	80	15.59	3.847	.430	14.73	16.44	4	20

Appendix D: One- way ANOVA results for the Department and Communication

ANOVA						
Departments	**Communication**					
IT						
Auditing and Taxation						
Management Accounting		Sum of Squares	df	Mean Square	F	Sig.
Information and Corporate Management	Between Groups	153.496	4	38.374	2.833	.030
Financial Accounting	Within Groups	1015.892	75	13.545		
Total		1169.388	79			

Appendix E: Statistical results for the Employment type and Perceived Usefulness

Perceived Usefulness								
					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Permanent	43	27.07	5.035	.768	25.52	28.62	11	35
Contract	37	24.43	6.690	1.100	22.20	26.66	8	35
Total	80	25.85	5.968	.667	24.52	27.18	8	35

Appendix F: ANOVA test results for Employment type and Perceived Usefulness

ANOVA						
Employment Type	**PerceivedUsefulness**					
		Sum of Squares	df	Mean Square	F	Sig.
Permanent	Between Groups	138.328	1	138.328	4.032	.048
Contract	Within Groups	2675.872	78	34.306		
Total		2814.200	79			

Appendix G: Pearson's correlation results for independent constructs themselves

		SmartPhone Att	FacilitatingConditions	PerformanceExpectations	PerceivedUsefulness	PerceivedEaseofUse
SmartPhoneAtt	Pearson Correlation	1	.496**	.558**	.538**	.545**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	79	78	79	79	79
FacilitatingConditions	Pearson Correlation	.496**	1	.460**	.452**	.481**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	78	79	79	79	79
Performance Expectations	Pearson Correlation	.558**	.460**	1	.726**	.653**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	79	79	80	80	80
PerceivedUsefuIness	Pearson Correlation	.538**	.452**	.726**	1	.708**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	79	79	80	80	80
PerceivedEaseofUse	Pearson Correlation	.545**	.481**	.653**	.708**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	79	79	80	80	80

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix H: Table that illustrate the reviewed studies

AUTHOR (S)	METHODOLOGY	PLACE/COUNTRY	FINDINGS
Mahammad and Abdolreza (2017)	Survey	Iran	• Use of smartphone for general purposes by students (USGPS) • Students' age
Lifen and Alejandro (2016)	Experimental study	Spain	• Students 'positive attitude towards learning (SPATL) • Students' engagement (SE) • Students' academic performance (SAP)
Eunice and Sarfoah (2017)	Survey	Ghana	• Students' performance expectation (SPE) • Students 'effort expectation (SEE) • School facilitation conditions (SFC) • Peer pressure from friends (PPF) • Lecturer's role (LR)
Johnson and Radhakrishnan (2016)	Experimental study	United Arab Emirates	• Students' learning purposes (SLP) • Gender (G)
Esmaeili and Eydgahi (2015)	Experimental study.	USA	• Students' attitude toward using a smartphone (SATUS) • Students' Intention (SI) • Students' social influence (SSI) • Students' self-efficacy (SSE) • Students' anxiety (SA) • Students' perception of the usefulness of smartphone (SPUS) • Students' perception of smartphones' ease of use (SPSEU) • Facilitating condition (FC)

			• Students' effort expectancy (SEE) • Students' performance expectance (SPE)
Cano (2012)	Survey	Spain	• Students' educational applications (SEA).
Basil and Jarrah (2017)	Mixed method	Kuwait	• Gender (G) • Students' Learning Activities (SLA)
Gavali et al., (2017)	cross-sectional study	India	• Gender (G) • Type of learning application (TLA) • The usefulness of smartphones (US) • Students' attitude towards the use of smartphones (SAUS)
Bikumalla et al., (2017)	cross-sectional study	India	• Study level/year of study (SL) • Learning purposes (LP)
Cheung (2013)	Survey	Hong Kong	• Learner aspects (LS) • Online interactions (OI) • Mobile device features (MDF) • Dependence and sharing (DS) • Reference groups (RG) • Storage and weight (SW)
Almahfud (2014)	descriptive study	Saudi Arabia	• Students' learning purposes (SLP) • Gender (G)

EL-Hamid and EL-Fattah (2017)	cross-sectional design	Nigeria	• Students' collaborative learning (SCL) • Students' autonomous learning (SAL)
Ibrahim et al., (2014)	Survey	Nigeria	• Gender (G) • Year of study (YS)
Ismail et al., (2015)	mixed-method design	Turkey	• Gender (G) • Length of students' smartphone usage (LSSU)
Emran Hossain (2015)	exploratory study	Bangladesh	• Gender (G) • Age (A) • Level of study (LS) • Students' place of origin (SPO) • The usefulness of smartphone (US)
Ahmed (2016)	Survey	New Zealand	• Performance expectancy (PE) • Effort expectancy EE) • Social influence (SF) • Facilitating conditions (FC) • Price (P) • Habit (H)
Jack Tessier (2013)	Experimental study	USA	• Students' learning activities (SLA) • Students' perception of smartphone use (SPSU)
Khrisat and Mahmoud (2013)	Survey	Saudi Arabia	• Use of mobile phone for English learning (UMPEL)
Yong et al., (2016)	Survey	South Korea	• Attitude towards smartphone use (ATSU) • Social norms (SN) • Facilitating conditions (FC)

Lynsey Gore (2010)	Survey	USA	• Students Access to learning material (SALM))
Tajudeen et al., (2013)	Survey	Nigeria	• Perceived usefulness (PS) • Perceived ease of use (PEU) • Facilitating condition (FC) • Perceived enjoyment (PE) • Student behavioural intention (SBI) • Student attitude (SA)
Twum (2014)	Mixed method	Ghana	• Gender (G) • Students' kind of university (SKU) • Students' age (SA) • Students' academic satisfaction (SAS) • Students' academic performance (SAP) • Lecturers' gender (LG) • Lecturers' kind of universities (LKU) • Lecturers' number of years spent lecturing (LNYSL) • Lecturers' qualification (LQ)
Elias and Hosea (2017)	Mixed methods approach.	Tanzania	• Use of smartphone in school (USS)
Prieto (2015)	Survey	Spain	• Use of smartphone for learning (USL)
Ketheeswaran and Mukunthan (2016)	Survey	Sri Lanka	• Use of smartphones (US)
Manju and Mishra (2017)	Survey	India	• Use of smartphones in school (USS)
Singh and Parameswaran (2017)	survey	Malaysia	• Use of Smartphone for Academic Purpose (USAP)

Fawareh and Jusoh (2017)	Survey	Saudi Arabia	• Use of smartphones in school (USS)
Edonkumoh (2015)	Survey	Nigeria	• Medical apps and e-textbooks (MAET)
Alharthi (2016)	Survey	Saudi Arabia	• Teachers' attitude towards smartphone learning (TATSL)

Appendix I: Letter of Information

Letter of Information

Title of the Research Study: Examining the perceptions of academic staff on the factors that are affecting the use of smartphones as a learning tool by students
Principal Investigator/s/researcher: Mr. Sithembiso Dyubele (BTech in Information Technology)
Co-Investigator/s/supervisor/s: Dr. Delene Heukelman

Dear participant,

We would like to start by raising our great appreciation for your availability to participate in this study whose aim is to examine the perceptions of academic staff on the factors that are affecting the use of smartphones as a learning tool by students. This study is inspired by the fact that the existence of smartphones amongst students in the school have been found to be problematic where students have shown an obsession with their devices during classes, send or receive entertainment messages during a class period, isolation from teachers, and unable to pay attention to the class activities they are doing.

As an academic staff from one of the five departments under the faculty of accounting and informatics at the Durban University of Technology in Kwazulu-Natal province of the Republic of South Africa, you are authorised to participate in this study. You have been randomly selected amongst academic staff members of your faculty. Please give us between 20 to 30 minutes of your time to fill the questionnaire that will be handed to you. This questionnaire is the main data collection instrument for this survey of approximately ninety-two academic staff members. You will be required to fill a questionnaire that will take you approximately 20 to 30 minutes to finish in your office. This data will then be captured and analysed in SPSS to model the correlations between the different variables that are measured by the questionnaire. Your involvement with this study will end once you have offered in your questionnaire even though you are welcome to check the overall findings of the study after their publication.

Your contribution to this study is risk-free both in terms of your psychological health and in terms of your physical health. On the other hand, you are not expected to cover any costs towards this study; and even though you are not expected to gain any direct financial or non-financial benefit from this study, please be ensured that your participation will contribute to the advancement of knowledge on the perceptions of academic staff on the factors that are affecting the use of smartphones as a learning tool by students. It will also aid the student who is conducting this study to finish his master's degree and to write one publication.

You can voluntarily pull out your participation from this study either for non-compliance, illness, adverse reactions, or for any other reasons; and be reassured that such a decision will not attract any adverse consequences.

The data collected from your participation in this study will be treated with extreme confidentiality in the sense that its storage will be anonymous for five years after which it will be shredded. Electronic data will also be stored with a password for five years on a DVD-RW and it will be deleted afterwards.

We are pleased to inform you that your participation in this study is covered by an indemnity that is provided by DUT should you be a victim of any research-related injury or adverse reaction.

Please contact me on 076 756 6242, or my supervisor on 031 373 5692, or the DUT Institutional Research Ethics Administrator on 031 373 2375. You may also address all your complaints to Prof. C E Napier who is the DUT Director for Research and Postgraduate Support (Tel: 031 373 2577 or Email: carinn@dut.ac.za)

Appendix J: Consent

Consent

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Mr. Sithembiso Dyubele, about the nature, conduct, benefits, and risks of this study
  Research Ethics Clearance Number: _____,
- I have also received, read, and understood the above written letter of information regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials, and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____ _____ _____ _____

Full Name of Participant **Date** **Time** **Signature/ Right Thumbprint**

I, Mr. Sithembiso Dyubele herewith confirm that the above participant has been fully informed about the nature, conduct, and risks of the above study.

Sithembiso Dyubele_____ _____

_____

Full Name of Researcher **Date** **Signature**

Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Appendix K: Introduction to Research Ethics

TRREE

Zertifikat

Certificat

Certificado

Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Sithembiso Dyubele

a complété avec succès - has successfully completed

Introduction to Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2021/03/06

CID : pIYac3IlMad

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue Continuing Education Programme
Programmes de formation continue

Ce programme est soutenu par - This program is supported by :

European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20170310]

Appendix L: Research Ethics Evaluation

Zertifikat
Certificado
Certificat
Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Sithembiso Dyubele

a complété avec succès - has successfully completed

Research Ethics Evaluation

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2021/03/06

CD : GXBFR2T5GM

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
Continuing Education Programme
Programmes de formation continue

Ce programme est soutenu par - This program is supported by :

European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20170310]

Appendix M: Informed Consent

Zertifikat
Certificado
Certificat
Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Sithembiso Dyubele

a complété avec succès - has successfully completed

Informed Consent

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2021/03/06

CID : a2CXVETCI7

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
Continuing Education Programme
Programmes de formation continue

Ce programme est soutenu par - This program is supported by :

European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20170310]

Appendix N: Permission to Conduct Research at the DUT

Directorate for Research and Postgraduate Support
Durban University of Technology
Tromso Annexe, Steve Biko Campus
P.O. Box 1334, Durban 4000
Tel.: 031-3732576/7
Fax: 031-3732946

26th March 2019

Mr Sithembiso Dyubele
c/o Information Technology
Faculty of Accounting and Informatics
Durban University of Technology

Dear Mr Dyubele

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that the Institutional Research and Innovation Committee (IRIC) has granted full permission for you to conduct your research "Examining Perceptions of Academic staff on the Factors Affecting the use of Smartphones as a Constructivist Learning Tool".

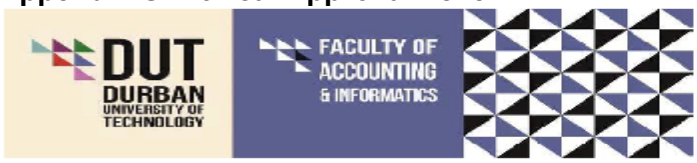
The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

We would be grateful if a summary of your key research findings can be submitted to the IRIC on completion of your studies.

Kindest regards.
Yours sincerely

PROF CARIN NAPIER
DIRECTOR (ACTING): RESEARCH AND POSTGRADUATE SUPPORT DIRECORATE

Appendix O: Ethical Approval Level 2



Faculty Research Office
Durban University of Technology
25 February 2019

Mr S. Dyubele
Student Number: **21855020**
Degree: MICT
Email: 21855020@dut4life.ac.za
Dear Mr Dyubele

ETHICAL APPROVAL: LEVEL 2

Your email correspondence in respect of the above refers.
I am pleased to inform you that the Faculty Research Committee (FRC) at its meeting on 24 January 2019, has granted preliminary permission for you to conduct your research "***Examining Perceptions of Academic staff on the Factors Affecting the use of Smartphones as a Constructivist Learning Tool***".

You are required to present this letter to the DUT research office to obtain full approval. Please also note that each of your questionnaires must be accompanied by a letter of information and a letter of consent for each participant, as per your research proposal.

A summary of your key research findings may be submitted to the FRC on completion of your studies.

Kindest regards.
Yours sincerely,

Dr Delene Heukelman
Faculty Research Coordinator (Acting)