THE IMPACT OF SMARTPHONE USE ON STUDENT LEARNING EXPERIENCE IN HIGHER EDUCATION IN SOUTH AFRICA

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By

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Preface

The field of mobile learning has received much attention and research in the scholarly community as stakeholders and policymakers seek ways to enhance the teaching and learning process. Some sections of this dissertation have been published with the latest publication receiving the best paper award at the 4th International Conference on the Internet, Cyber Security and Information Systems 2019.

Publications

Papers published based on this study:

1. Toperesu B, Van Belle J.P. & Turpin M. (2019) **Impacts and Satisfaction of Using Smartphones for Learning in a University Context.** Proceedings of 4th International Conference on the Internet, Cyber Security and Information Systems 2019, vol 12, pages 357—371

2. Toperesu B & Van Belle J.P. (2018) **Mobile Learning Considerations in Higher Education: Potential Benefits and Challenges for Students and Institutions**. Proceedings of the 14th International Conference on Mobile Learning, Lisbon, Portugal, pp 31-38. ISBN: 978-989-8533-76-0

3. Toperesu B. & Van Belle J.P. (2016). **Mobile Learning Management Issues in Higher Education: A Retrospective and Prospective Review**. Zacarias O.P. & Larsson C.W. (Ed.), Proceedings of the 5th International Conference on M4D Mobile Communication Technology for Development, Maputo, Mozambique, pp 44-54. Publ. Karlstad University Studies. ISBN 978-91-7061-723-0.

The recognition awarded to this research study and publication thereof by the scholarly community motivated and encouraged the author in that the field of study is still very relevant and persisting. Furthermore, this recognition confirmed the significance of this research study. The published works have been synthesised with this dissertation.

Dedication

This dissertation is dedicated to my father, Gibson Toperesu. You left us when I was just entering college. The hard times that I went through after you left us motivated me to work hard. Till we meet again, this is dedicated to you dad.

Thanks Giving

I would like to thank my wife Joyce, for standing by me at all times. Taking the knock from me not being available while I am busy with my studies. You have been encouraging me relentlessly to work hard and push through. I would like to also thank almighty God for the strength and grace to pull through this dissertation. Being a husband, a father and having a full-time job has not been an easy task but by His grace, I managed to pull through.

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I would like to acknowledge the input, assistance and contributions from the following people. Firstly, to Prof Jean-Paul Van Belle for helping with the direction of the project. His experience in research helped me especially in analysing the data. I would also like to acknowledge the support that I received from my two friends and colleagues in this Masters Programme. Farai Nyandoro Kunzvi and Brian Taurai Mhembere were very supportive and I can attest to the fact that our WhatsApp support group, 'Dukes of UCT' really had a positive impact on my learning.

Abstract

Background: The use of mobile devices for learning has been on the increase due to the availability of affordable data and free WiFi networks across institutions of higher learning. However, very few studies seek to understand if there is any impact that these devices have on a student's overall learning experience particularly from a developing country's perspective. **Objectives:** This research study determines the positive and negative impacts smartphone use has on a student's learning experience and whether this leads to overall satisfaction with mobile learning. **Methods/Approach:** Quantitative and qualitative data were collected through an online survey that was distributed via e-mail to a student body from the sample. Statistica software was used to analyse the quantitative data while Nvivo software was used to analyse the qualitative data. **Results:** With over 400 responses, we found evidence for some, but not all hypothesized positive and negative impacts. Additionally, there was very strong support for how these impacts contribute to the overall satisfaction of using a smartphone for learning, explaining more than 60% of the variance. **Conclusions:** We found that the overall positive satisfaction leads to differentiated, continued uses of the smartphone for learning.

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Chapter 1: Introduction

1.1 Purpose/Aim of the study

The purpose of this research study is to investigate the impact that smartphone use has on the overall learning experience of a student in higher education. This dissertation is mainly concerned about whether smartphone use can positively aid learning and in turn, enhance the learning experience for a student based on how they use the devices considering the various issues they may encounter. The main aim of this research study therefore is to present the types of impact smartphone use has on learning for students in higher education.

1.2 Main Problem

The phenomenon of mobile learning (mLearning) has been researched widely. The need to offer improved pedagogical approaches to enhance learning is seen as the biggest drivers for the increase of research in this field (Ally, Grimus, & Ebner, 2014). Distance learning and higher education institutions are the main ones pioneering and embracing mobile learning (Brown & Mbati, 2015). The benefits and advantages of mobile learning to both the student and the institution are many. To the student, mobile learning means the ability to learn from anywhere; it means being more productive and time-saving (Moreira, Pereira, Durão, & Ferreira, 2018). To the institutions, it means less demand for institutional resources such as desktop PCs and library books, it means more graduates and more enrolments figures especially through distance learning (Wai, Ng, Chiu, Ho, & Lo, 2016).

However, many challenges are hindering the adoption of mobile learning particularly in the African context where device ownership (laptops, tablet computers etc) is low due to many unable to afford one (Santos, 2015a). Institutional challenges are also inherent where the available bandwidth is inadequate, the learning material is not mobile friendly and security policies are inadequate to cater for diverse mobile devices connecting to their network (Ebba, 2015). Because of these issues and hindrances, the impact mobile devices have on the overall learning experience in higher education has not been clearly determined in recent studies.

In response to this problem, this research study seeks to determine the current impact types that a smartphone has on learning for a student in higher education. The research uses a deductive approach in determining the frequency of use of predefined applications and the impact this has on their learning considering the issues they experience and the level of satisfaction.

1.3 Rationale

This research study seeks to fill in the gap in the literature in that this study focuses only on smartphone use. Previous research studies which investigated the field of mobile learning generally looked at all mobile device types which included tablet computers and laptop computers (Kaliisa & Picard, 2017). The need to focus on smartphones is primarily because of the high rate of ownership among students in higher education. Previous studies found out that more than 90% of students in higher education own a smartphone (Kaliisa & Picard, 2017; Lau, Chiu, Ho, Lo, & See-To, 2017). In developing countries such as South Africa, this could be a starting point for enabling mobile learning as device ownership (particularly laptop and tablet computers)has greatly hindered progress in this field. Some students in poor countries share these mobile devices which would have either been provided by the institution or by their families. Brown and Mbati (2015) found out that sharing of a mobile device negatively impacts on mobile learning, on the other hand, if a device is owned by one person it enables a personalised experience.

1.4 Research Focus

The research study focuses on higher education students in a developing county context. We pull our sample from the University of Cape Town undergraduate and postgraduate students.

The study does not focus on a particular way of studying whether in class or out of class, whether formal or informal learning, but rather on the overall learning experience based on the use of smartphones in various learning aspects and processes. A conceptual framework was developed for this study which will be tested by the data collected. This will contribute to theory development in the field of smartphone-based learning. The potential benefits of the findings of this research study will be to the institutions and

governments of developing countries. Higher Education Management will gain an understanding of the various issues to be addressed that students encounter when trying to make use of their smartphones to gain access to learning material from these institutions. Greater insight into issues such as network access, mobile-friendly sites and material are raised.

This research study also looks at barriers such as data prices. Based on these findings, governments might need to look into regulating data prices from mobile service providers. Low data prices foster inclusion, enable economic growth and transformation (Ismail, Azizan, & Gunasegaran, 2016). Another option is to zero-rate some educational websites to allow for access without data.

Educators will benefit in that various ways that students collaborate will be discussed. One of the ways is to look into taping the discussion forums being used by students on platforms such as WhatsApp and Twitter. These have proved to be an integral part of student life on campus with many indicating a high frequency of use of such social media applications.

1.5 Mode of inquiry

A theoretical framework is used to formulate the research instrument questions and the open-ended questions will unearth new themes that were not previously identified and thus included in the final framework. The research used a mainly quantitative approach – an online questionnaire was developed as a means for data collection.

1.6 Context of the Study

The research study is situated in a South African context. The context of the research study is of particular importance to mention because various factors are depended on the economic and social setting of the respondents. Economic settings such as affordability of the devices, mobile data costs and government policies do play a major role in influencing the behaviour of the respondents with regards to smartphone learning.

1.7 Research Question

The main research question for this study is: What is the impact of smartphone use for learning in higher education?

1.8 Secondary questions:

Following the main research question, these are the sub-questions which will help answer the main question.

1. In what ways do students use smartphones for learning?
2. What are the positive impacts of smartphone use on learning?
3. What are the negative impacts of smartphones use on learning?
4. What challenges are experienced when learning from a smartphone?
5. How do the impacts (positive and negative) and issues impact on the overall satisfaction of students learning from their smartphones?

1.9 Research Objectives

The research objectives for this study are therefore the following:

1. Identify how students use their smartphones for learning.
2. Identify the positive Impacts of smartphone use on learning.
3. Identify the negative impacts of smartphones on learning.
4. To identify the challenges (barriers) of smartphone use for learning in a university context.
5. To determine the satisfaction of students when using smartphones in learning.

1.10 Assumptions and Limitations

The following assumptions are noted in this research study. Firstly, it is assumed that the respondents understand what a smartphone is and can distinguish between a smartphone and a feature or basic phone. The research outcome might be negatively affected if the majority of the respondents do not answer the questions accurately.

The research study is limited in that it was done at one academic institution in South Africa.

1.11 Contribution

This dissertation reports on a research study that investigated the use of smartphones and the impact of this use on the overall learning experience of students in higher education institutions in developing countries. The research was contextualised in South African and a sample drawn from the University of Cape Town. The outcomes of this research study are relevant to both academics and practitioners. To academics, the research study brings an understanding on the various ways that students are using their smartphones to learn. Academics may make use of the findings from this study to help them incorporate mobile learning in their pedagogical approaches.

To the practitioners, the research study offers insights into the challenges that beset students while trying to learn from anywhere. The need for cheaper mobile data, the need for mobile responsive/friendly material and the need for mobile compatible LMS are some of the findings from the research.

1.12 Dissertation outline

The dissertation is outlined as follows; firstly, a literature review is presented to find out what previous researchers have found in this field and identify the research gaps left. Then next, the research methodology used in this study is outlined. The theoretical framework is then presented and discussed in the following chapter. Finally, analysis, discussion and recommendations are presented in the final chapter.

Chapter 2: Literature review

2.1 Introduction

Mobile devices have become ubiquitous. Individuals are using mobile devices to store, process and retrieve information from anywhere at any given time. These devices have also become powerful communication tools in the wake of advanced communication networks such as LTE and WiFi. Users can seamlessly collaborate and share information across divides. Not surprisingly, mobile devices are now being used for learning as students integrate these devices with learning processes. Mobile handheld devices have become much cheaper and more accessible than computers (Hashemi, Azizinezhad, Najafi, & Nesari, 2011). Because of these factors, mobile devices are popular among university students and the youth in general.

The phenomenon of mobile learning, also commonly referred to as m-learning, emerged in recent years through the increased integration and adoption of mobile devices in learning. However, there is a lack of consensus on the true meaning of mobile learning as various scholars defined mobile learning in different contexts.

Geddes (2000 as cited in Hashemi et al., 2011) defines m-learning as, “the acquisition of any knowledge or skill through using mobile technology, anywhere, anytime.” (p. 2477). Ozdamli and Cavus (2011) describe mobile learning as a model which allows learners to obtain learning material from anywhere at any time using mobile technologies and the internet. It can be noted that the anywhere and anytime attributes are inherent in both definitions.

Kinash, Brand and Mathew (2012 as cited in Marzouki, Idrissi & Bennani, 2013) gave an explicit and elaborate definition of mobile learning. They define mobile learning as simply "the use of mobile devices that can connect to the Internet for educational contexts" (p.567). However, though this definition is most appropriate, the authors allude to the fact that questions may still abound and that no clear and precise definition can be obtained.

This study will however use the following definition as most suitable within the context of the study.

"The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning."(Hashemi et al., 2011 p.2478).

Various studies allude to the fact that mobile learning has become popular and suitable among university students as these devices become more affordable resulting in widespread ownership (Abachi & Muhammad, 2014; Santos, 2015). There has also been a lot of research studies done in the past decade of mobile learning (Baran, 2014). A meta-analysis literature review examining 144 mobile learning studies found that the research purpose of most studies on mobile learning focused on the effectiveness followed by the system design (Chee, Yahaya, Ibrahim, & Hasan, 2017). The review also found out that the most commonly used device for mobile learning is mobile phones and that mobile learning is being practised mostly at higher education institutions.

It is in this light that this research seeks to embark on research specifically in higher education institutions. This review of literature will first look at the key concepts inherent in the title of this research study before evaluating the phenomena of mobile learning in the context of other research studies already done. The review will then identify the gaps in literature which will help situate this study. The review will conclude by looking at the research models available and selecting the best model for this research study.

2.2 Key Concepts

Impact – This research study will investigate the impact that a smartphone has on a student's learning experience. By definition, impact is an effect or influence that something has on the other part. Elfeky and Yakoub (2016) argue that mobile learning devices influence students' learning experience both positively or negatively. This research study therefore will be looking at the positive effect that a smartphone has on a student's learning experience.

Smart Phone – A smartphone can be described as a mobile phone with additional computing functionality allowing for the ability to access digital media and the internet (Chen, Chen, & Lin, 2016). Features of a smartphone include the phone function, ability to connect to the internet, camera, and mobile apps which offer different functionality.

Learning –Driscoll (2000 as cited in Siemens, 2014), defines learning as, "a persisting change in human performance or performance potential…[which] must come about as a result of the learner's experience and interaction with the world" (p.2). This definition raises two important attributes of learning, i.e. a change of state and the learner's experience, the former being the result of the latter.

Learning can be classified into two types i.e. informal learning and formal learning. Informal learning is when an individual undertakes to develop themselves personally so that they can add value to themselves in their social standing. Informal learning is not linked to a program of study and does not follow a formal path but is carried out at will. Informal learning is often unanticipated and sometimes unacknowledged even by the leaner (Gikas & Grant, 2013). In this form of learning, mobile learning is perceived as playing a major role. A good example is when integrating a person in a foreign land. They can use their mobile devices at various locations and times to learn at their own pace (Ally, 2013).

Gikas and Grant (2013) define formal learning as, "where learners are engaging with materials developed by a teacher to be used during a program of instruction in an educational environment, highly structured, institutionally sponsored, and generally recognized in terms of a certificate." This study will look at this type of learning i.e. from a formal perspective as the study looks at how a smartphone impacts the student's formal learning experience at university. The study will uncover how students integrate their smartphones into their learning.

Experience – The experience encountered at universities while learning is mostly face-to-face where a lecturer teaches in a class and students have to be physically present in order to learn. Mobile devices with their mobility capabilities and supporting platforms can greatly enhance this learning experience (Elfeky & Yakoub, 2016). This research study is going to investigate how university students use their smartphones to support their overall learning experience in and outside the classroom.

2.3 Mobile Technology and Development

There has been a growing emphasis on using information and communication technologies (ICTs) for development in South Africa and other developing countries. ICTs

have been considered as crucial for development in society (Magunje, 2013). Mobile technology plays a contributory role as part of the development. People in developed countries are swiftly moving from desktop computers to mobile devices. However, this is not the case in developing countries. Ally (2013) notes that people in developing countries are going directly to acquiring mobile devices instead of first owning desktop computers. This is because of the attractive and affordable prices of mobile devices (Chen et al., 2016).

Mobile data in South Africa is considered to be generally expensive. Various arguments have arisen recently since the Competition Commission started hearings into the cost of data in South Africa. In a country where half the population is poor, some have argued that the high data costs have given rise to social exclusion as the poor are unable to access information. This has given rise to social media campaigns such as #DataMustFall which has become popular in South Africa.

At the time of writing this study, Vodacom, MTN, CellC and Telkom were the biggest cellular providers. The chart below shows Vodacom's data cost for a 1GB data bundle compared to the cost in other countries which it operates in.

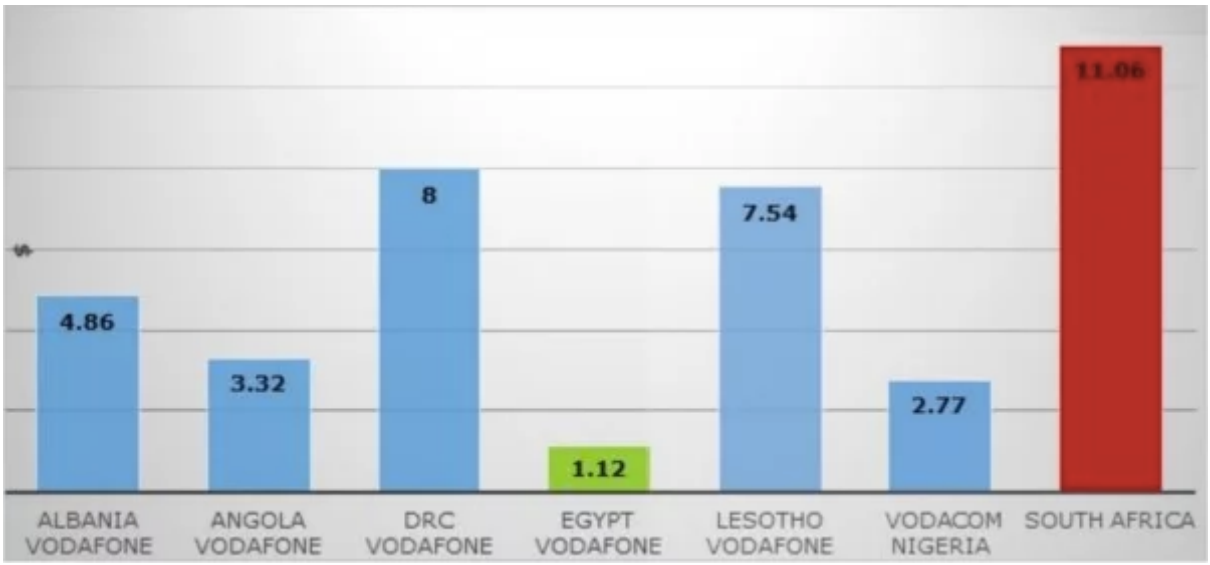


Figure 1: Vodacom's comparison of 1GB and 2GB data prices (Vermeulen, 2018)

We note that Vodacom's data prices are comparatively way higher than other countries. When data is expensive, users tend to disconnect their phones to limit the usage of data (Mathur, Schlotfeldt, & Chetty, 2015). This then leads to exclusion as one misses out to

access to information and updates. This research study will also seek to find out the views of students in higher education towards the cost of data. The research instrument includes a section to probe this information with the sole purpose of contributing to what has already been found out about this field.

The research study is also contextualised in a university as mobile phone use in education is most prevalent in higher education (Al-Emran, Elsherif, & Shaalan, 2016).

2.4 E-Learning vs M-Learning

Electronic learning, popularly known as e-learning, is the use of computers or electronic devices in the facilitation of learning. Various definitions exist which attempt to define this phenomenon. Guri-Rosenblit (2005) defines e-learning as, "the use of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters" (p.469). Another definition states that e-learning is "information and communication technologies used to support students improve their learning" (Ginns, Ellis, & Piggott, 2009, p.304). In both definitions, it can be noted that e-learning makes use of technologies. Interestingly, mobile devices are also technologies which fit into this criterion. However, when mobile devices are used for learning purposes the process is referred to as m-learning. The question then arises as to what differentiates the two.

Although e-learning and m-learning make use of information and communication technologies that connect to the internet, they both defer in the ways they are utilised. The main distinction is that e-learning tends to make use of fixed immovable computers or devices while m-learning makes use of mobile devices such as laptops, mobile phones and tablet computers.

2.5 Mobile Learning in High Education Institutions

Mobile devices have continued to advance and with better hardware and software being developed. These devices now have the same processing power as desktop computers and in some cases even supersede them. On the other hand, mobile networks have continued to advance offering better connectivity and network speeds. Mobile learning

in education has therefore become more attractive and a suitable option (Abachi & Muhammad, 2014).

Several studies have been done on mobile learning in higher education institutions. A meta-analysis literature review examining 144 mobile learning studies done between 2010 and 2015 found out that mobile learning is commonly practised in high education institution (Chee et al., 2017). This is because of the widespread ownership of mobile devices and the increased availability of wireless connections at higher education institutions (Hashemi et al., 2011). Recent research studies reveal that up to 96% of students in high education institutions own a mobile device and in some cases bring more than one mobile device to campus and in future, mobile device ownership will increase (Santos, 2015; Dahlstrom & Bichsel, 2014; Kobus, Rietveld, & Van Ommeren, 2013).

In most cases, the use of mobile devices for learning purposes in higher education institutions is aligned to their goals and mission or vision (Hashemi et al., 2011). Such goals include examples like the inclusion of different learning methods; reaching out to learners across geological locations etc.

The use of mobile devices in higher education institutions is viewed as a relevant development to higher education learning. To the learner, the benefits include the ability to access blended learning course material from anywhere and at any time and the ability to collaborate with peers (Kobus et al., 2013).To the institution, the main benefit is the relief of strain on the use of institutional computers as learner bring their own devices.

2.6 Mobile Learning Characteristics

Mobile learning has seven basic characteristics i.e. ubiquitous, blended, portable, private, interactive, collaborative, and instant. Figure 2 below gives an illustration of these characteristics.

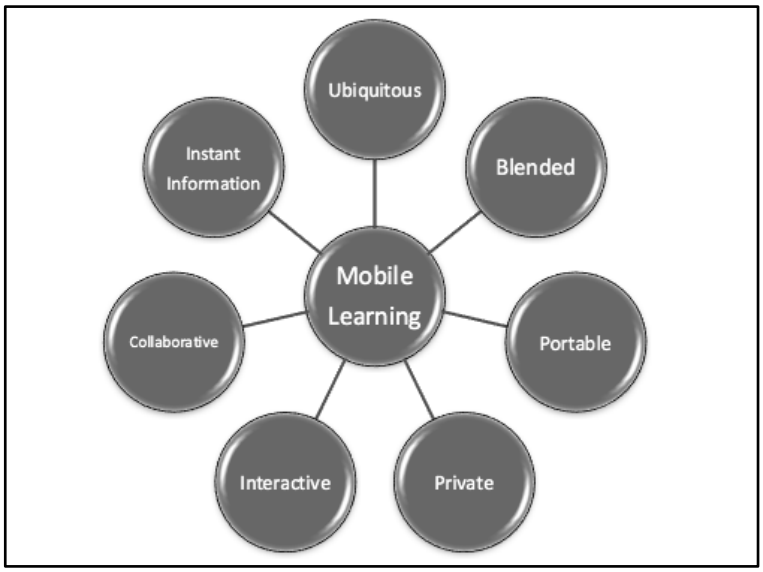


Figure 2: Basic Characteristics of mobile learning (Ozdamli & Cavus, 2011)

Ubiquitous refers to mobile learning as being available everywhere. This is probably the most important characteristic of mobile learning as mobile devices are portable. Blended mobile learning expands and provides enhanced learning content that includes the ability of the lecturer to receive feedback (S. Nykvist & Lee, 2013). Mobile learning is also characterised as private since the device is personal. Collaboration is also a key in mobile learning as learners mostly use mobile chat sessions to collaborate with their peers and share resources (Kobus et al., 2013).

2.7 Benefits of Mobile Learning

This section reviews the potential benefits of adopting a mobile learning approach in an institution. The identified potential benefits are listed in Table 1. There are two categories from this section i.e the benefits to the learner and benefits to the institution.

Table 1: Potential Benefits of Mobile Learning Adoption

Benefits to the learner	**Reference**
Affordability	Moldovan, Weibelzahl, & Muntean, 2014; Stanton, 2014; Vishwakarma, 2015; Baran, 2014
Efficiency	Alrasheedi & Capretz, 2013, 2015
Convenience	Briz-Ponce, Pereira, Carvalho, Juanes-Méndez, & García-Peñalvo, 2016; Gikas & Grant, 2013; Jackson, Sc, Gardens, & Da, 2016; Santos, 2015b
Benefits to the Institution	**Reference**
Scalability	Ally, 2013; Ebba, 2015; Elfeky & Yakoub, 2016
Ease of updating learning materials	Farley et al., 2015; Koole, 2009; Olalere Mudasiru, Bolanle Idayat, & Mary Bose, 2015; Ozdamli & Cavus, 2011
Lower Costs	Farley et al., 2015; Conejar, Chung, & Kim, 2015

2.7.1 Affordability

One of the main benefits to the learner is the affordability that comes with mobile devices (Vishwakarma, 2015). The prices of mobile devices compared to more robust technology such as desktop computers is much less. In developing countries like South Africa, the uptake of mobile phones far outweighs that of desktop PCs.

2.7.2 Efficiency

The efficiency which comes from accessing the information on the go is one of the benefits enjoyed by the learner (Alrasheedi & Capretz, 2015b). Mobile technologies qualities such as instant access can enhance face to face teaching bringing a more efficient means of learning (Guri-Rosenblit, 2005).

2.7.3 Convenience

Convenience can be attributed to the fact that the learner does not need to be confined to a certain location to learn. Learning can take place at any place and at any time (Jackson et al., 2016).

The benefits to the educational institution include scalable, easy to update and reduced IT costs.

2.7.4 Scalability

Affordability of the mobile devices becomes a benefit to the learning institutions as they can offer learning materials to more students. To accommodate more students, the institutions will only need to expand their network capabilities and increase educators to facilitate online content (Olalere Mudasiru et al., 2015). There will not be a need for more classroom facilities as an alternative to face to face interactions is offered through mobile devices. Thus education becomes more scalable (Ally, 2013).

2.7.5 Ease of updating

Learning material offered online is easy to update (Olalere Mudasiru et al., 2015). Mobile devices can update the material as soon as it is made available ensuring that learners use the latest available material. Mobile device features are advancing making the devices much more capable of performing many more functions quicker and efficient (Alrasheedi & Capretz, 2013).

2.8 Challenges of Mobile Learning

The challenges of adopting mobile learning are listed in Table 2. These challenges have also been placed under two broad categories i.e. challenges to the learner and challenges to the institution.

Table 2: Potential Challenges of Mobile Learning Adoption

Challenges to the learner	**Reference**
Privacy	Afreen, 2014; Alrasheedi & Capretz, 2015a; Elfeky & Yakoub, 2016; Emery, n.d.; S. Nykvist & Lee, 2013
Teacher perceptions	Ally, 2013; Alrasheedi & Capretz, 2015a; Alrasheedi, 2015; Gikas & Grant, 2013; Park & Chen, 2007; Santos, 2015b
Challenges to the Institution	
Security	Abachi & Muhammad, 2014; Ali & Arshad, 2015; Motiwalla, 2007; S. Nykvist & Lee, 2013; Santos, 2015b; Aloul, 2012
Optimization	Chitanana & Govender, 2015; S. S. Nykvist, 2012
Bandwidth	Abachi & Muhammad, 2014; Chitanana & Govender, 2015

2.8.1 Privacy

Academic information should be readily and publicly accessible. However, some personal information requires a level of privacy to be maintained. Privacy issues may also arise when students are contacted on their private mobile phones outside the school environment (Pimmer, 2015). Some mobile apps also present some privacy concerns as they may require additional access to user's data on the phone. This data may include, GPS location, phone contacts, email and messages access, photos and so on. Some apps do not warn users of this access each time it does make use of it but rather only requests or warn users when they install it (Pechenkina, 2017).

2.8.2 Perceptions

One of the challenges with mobile learning is people's perceptions and attitudes by using mobile technologies for education. Some educators feel that mobile devices cause too much distraction for learners, and or associate mobile device use during lectures with bad behaviour (Ally, 2013).

2.8.3 Security

Information security has remained a top priority among IT leaders globally as cybercriminals are on the increase and higher education institutions are no exception. Cybercrime can be described as any criminal activity where a computer or computer network is either a tool, place of crime, source of crime or is a target (Pozar, 2014). According to a leading security firm Symantec, the education sector is now the third most frequently breached public sector ("Internet Security Threat Report," 2015).

Different forms of threats do exist targeting institutional data, the network or personal data residing on an individual's devices. Some examples of information security threats include malware & virus infections, cyber fraud and hacking. As mobile devices become prevalent in universities, more and more mobile devices become susceptible to these threats. Smartphone hacking software is also now easily available online. This software is used to steal passwords and any personal information.

Another information security factor is that mobile devices can be lost or stolen. Once these mobile device land in the hands of criminals, if not secured, can lead to more harm

done to the institution or the network. Although this can be countered by remote wiping the devices that are stolen or lost, this responsibility lies in the owner in some cases as the device personally belongs to them. In most cases, educational institutions have no control over personal devices.

Other alternative ways of ensuring information security are available. The most common method is enforcing detection software. Programs that detect and filter infections using algorithms and signature-based matching techniques have been developed. These programs identify malware before it reaches the computer system or network (Zolkipli & Jantan, 2010). Further advancements in enterprise systems security include endpoint security. With endpoint security, each device must meet certain standards before it is granted access to the organisation's network. Examples of endpoint security include personal firewalls and antivirus software which is distributed, monitored and updated from the server (Rouse, 2011).

Awareness campaigns can also be done to raise awareness of criminal activities users need to be aware of. An increase in the number of phishing attempts shows that the target is now the user and cybercriminals seek to exploit their lack of knowledge. While organisation are increasing and advancing their security technologies, very little is being invested in increasing safety awareness among the general users consequently causing them to be the weakest link on the organisation's system (Aloul, 2012). Social awareness campaigns can be run to inform people of prevalent security issues. See Appendix 1 for an example of one such campaign run in October each year by the University of Cape Town.

Based on the dominance and persisting nature of information security and privacy as reflected in previous research studies, information security and privacy will continue to be a pressing issue for the next few years. IT leaders in higher education need to prioritise and focus on their security as more cyber-attacks are now coming to the education sector.

2.8.4 Optimisation

Optimising the technologies supporting learning is one of the identified top challenges for IT leaders in education. This is attributed to the fact that more and more devices are now accessing institutional resources. If unattended to, the devices will put a strain on

the available technologies possibly rendering them unusable. The main challenges to be addressed by most universities is the availability and efficiency of the network itself.

As digital natives take on higher education life, bringing along a myriad of mobile devices and using them to access online content, network saturation becomes an issue. Institutions did not envisage an influx of mobile devices. According to Nykvist (2012), most university networks were never built to accommodate a heavy load of devices. Technology managers in education have found themselves in a more reactive position as they reconfigure networks to accommodate as many devices as possible. As a means of addressing this problem, Chitanana and Govender (2015) propose that if proper application of policies is enforced, that will be reduced strain on the network.

2.8.5 Bandwidth

Bandwidth has also increasingly become a challenge in universities as students are exposed to vast amounts of data consuming online resources. Online learning resources such as YouTube have become popular among students. These sites allow for the creation and sharing of video resources. However, these resources have a big impact on the network in terms of bandwidth utilisation. Chitanana and Govender (2015) state that bandwidth is a valuable resource to the university which therefore needs to be managed properly. They further propose that for a university to effectively manage bandwidth, the following three critical elements need to be looked at carefully, i.e. visibility, monitoring and optimisation as shown in figure 3 below.

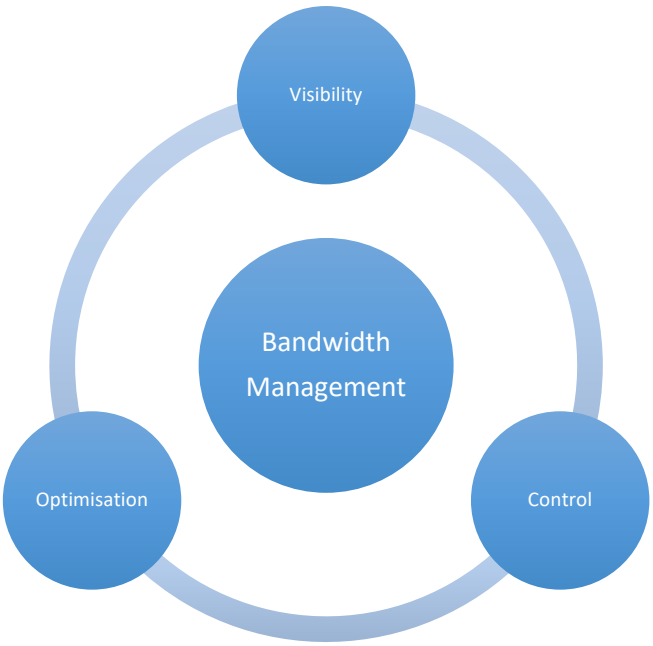


Figure 3: The Critical Interdependent Components of Bandwidth Management (Chitanana & Govender, 2015)

With visibility, the institutions should be able to identify the wireless devices that are connecting to their network. In other words, the devices need to be visible for policies to be enforced and network access revoked in cases of abuse. Visibility may also include the ability to monitor the applications that run on these devices. The visibility of the apps is relatively important as it allows for the implementation and or enforcement of some policies especially those relating to data usage (Chitanana & Govender, 2015).

Control refers to the network access control whereby the institution can control the level of access granted to its users or devices. Andrus (2013) as cited in (Chitanana & Govender, 2015) describes network access control (NAC) as allowing for the definition of the policies which control how users gain access to the network resources on the network. This is of particular importance to university settings with a wide range of users which includes guests and visitors who need to connect to the network.

Optimisation involves the identifying and prioritising of network access to critical applications. In a university setting these can be teaching or research applications. Most universities around the world are making use of learning management systems to deliver learning materials and students can use their mobile devices to access these materials

(Abachi & Muhammad, 2014). The resources may include lecture recordings which students through access to the network can download or stream at any time. Such applications can receive priority over others to have a better experience.

2.9 Smart Phone Use Cases in Higher Education

Mobile devices are used in various ways in everyday life. With the new generation of millennials, mobile devices including smartphones have become a part of their lives. Various use cases of smartphones in education have been identified. In the classroom, smartphones are being used to support learning. Clayton and Murphy (2016) assert that there is a need for a more open-minded approach from teachers on smartphone use in and outside the classroom.

Smartphones come with the capability to playback video recordings. This allows a learner to watch course-related videos during their spare time (Foen, Hassan, Nor, & Malek, 2017). Video apps like YouTube and Snapchat have proven to be popular among students in higher education. Lecturers are now considering YouTube as a learning resource as it contains most about anything from recent news articles to recent learning material (Al-Hunaiyyan, Alhajri, & Al-Sharhan, 2018; Clayton & Murphy, 2016). On the other hand, smartphones are also being used not only to playback already produced videos but also to record pictures and videos during lectures (Al Fawareh & Jusoh, 2017).

Kadry and Roufayel (2017) in their study on how to effectively use smartphones in the classroom found out that presenting learning material in video format aids in a better understanding of the topic. Leaners can understand difficult concepts when they watch and listen to videos. According to Dale's Cone of experience (see figure 4 below), people generally remember what they see, than what they only hear or read. When students could have these videos and watch them whenever they need to, it produces a positive impact on their learning.

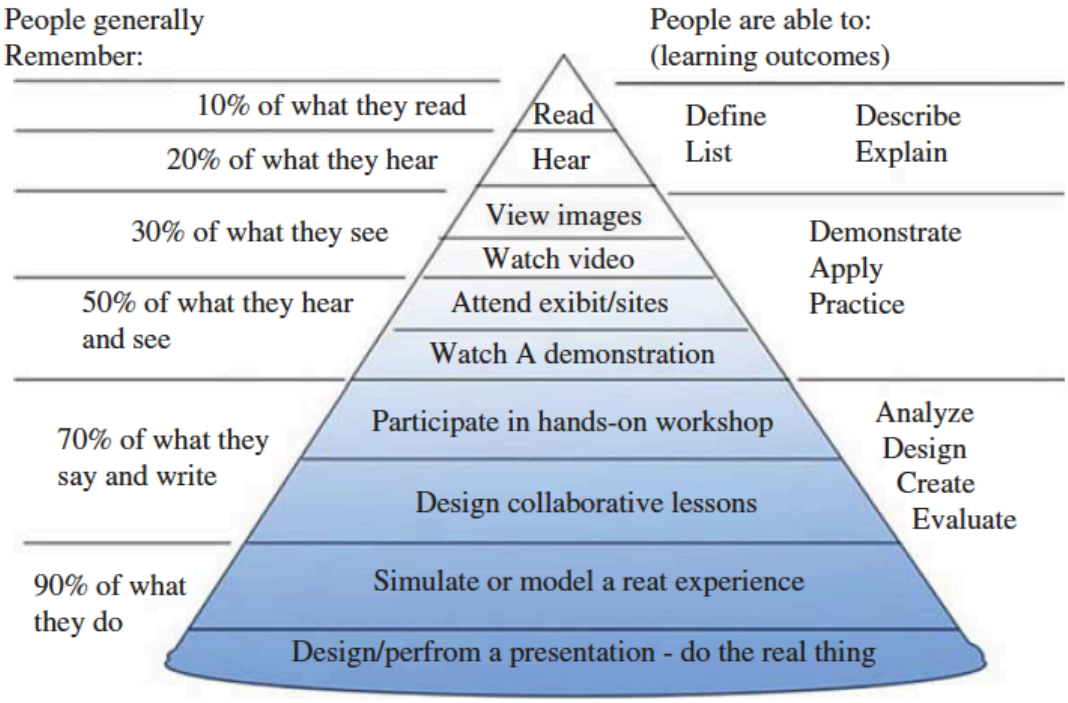


Figure 4: Dale's Cone of Experience (Davis & Summers, 2015)

Smartphones now come with an e-mail application and if one is not readily available, this can be easily be downloaded and installed from the relevant app store. With the advancement of internet and mobile device technologies, smartphones can now be used to effectively send and receive email communications. Students use their smartphone to quickly check emails about their assignments (Foen et al., 2017). Students also use their smartphones to email friends about classes and also to email their instructors (Han & Yi, 2019).

A calendar can be used as a supporting tool for learning. There are many ways that a calendar can be used however the main benefit of using the calendar on smartphones is the ability to receive event notifications instantly. Pechenkina's (2017) findings reveal that some universities are developing campus-specific mobile apps which feature a university calendar app among others. This calendar app allows for instant campus event updates and push-notifications.

Social Media also has been widely used in learning recently with more students taking a more social approach to learning (Oberst, Wegmann, Stodt, Brand, & Chamarro, 2016; Rozgonjuk, Kattago, & Täht, 2018). Positive and negative social media use has been discovered with positive uses including instant communication with peers via social apps like WhatsApp and Facebook (Hikmat & Mulyono, 2018). Some studies have shown how WhatsApp improves the learning outcomes for students who use it to communicate about their academic matters (So, 2016).

Internet browser is another smartphone feature that students use for their learning. According to Schiavi et al (2019), the most used smartphone application for information retrieval is an internet browser. However, Pechenkina (2017) found out that students use available apps to access learning content rather than the phone browser. Pachenkina's (2017) findings suggest that students prefer to use dedicated apps as they do not have to always sign into learning resource platforms. With a web browser, they would need to sign in every time they access learning resource platforms like LMS's such as Vula.

2.10 Research Gaps

The subject of Mobile learning has been extensively discussed in the literature (Briz-Ponce et al., 2016; Nykvist & Lee, 2013; Sharples, 2013; Ucisa, 2013), However, this researcher notes that very little research has been done in a developing country context particularly for research focusing on one specific device among the various mobile devices available. This study is going to focus on one particular mobile device which is a smartphone. The researcher believes that the impact will defer considerably deepening on the type of device being used by the student whether it be a mobile phone, tablet computer or laptop computer.

Previous studies have also emphasized the critical success factors of mobile learning (Alrasheedi & Capretz, 2013). The researcher notes that much research has been done on this and useful recommendations are available. However, there is a need to have more research focusing on the mobile device itself, rather than a holistic view. This study will fill this gap as it does look at specifically the smartphone and what satisfaction factors it carries that will enable a better learning experience.

The literature on the subject of the impact smartphone use has on learning is also limited in developing countries (Wu et al., 2012). This study seeks to address this gap by specifically looking at students in South African higher education institutions.

The researcher notes that there is a possibility of having different learning experiences primarily due to the level of education an individual is undertaking. However, research studies have not been specified in this regard (Wu et al., 2012). There is therefore a gap in the literature to be filled. Thus, the focus group of this study will be university first-year students.

2.11 Research Theory

2.11.1 Learning Theories

Various theories exist which show how people learn and develop knowledge. These theories help in understanding the various ways people learn. The most common theories are grouped into three categories namely behaviourism, cognitivism, and constructivism (Siemens, 2005).

Behaviourism theory proposes that the learner is passive and sensitive to the environment. The learner's behaviour is then shaped by the negative or positive changes in the environment (Siemens, 2005). Cognitivism came forth in the 1960s and replaced behaviourism as the main model for learning. Cognitivism states that knowledge is a result of mental constructions. It states that the mental processes which include memory and thinking need to be looked at in detail as these inner mental activities help to understand how people learn (Sincero, 2011). Constructivism, however, states that knowledge is constructed. It claims that learning is a process of constructing knowledge instead of gaining it as the learner takes past experiences and other factors such as culture into account (Siemens, 2005).

Siemens (2005) argues that the problem with these theories is that they were developed in a pre-technological era and thus fail to take any contribution from technology into account. He advances a theory called Connectivism which takes into account the use of technology. It takes into account various theory constructs and combines them with

social structures and technology to come up with a theory for the digital age. Connectivisim states that "Learning is a process that occurs within nebulous environments of shifting core elements – not entirely under the control of the individual" (Siemens, 2005 p. 5). The theory further claims that learning which is something found externally is focused on connecting separate information sets which enable us to learn more. Therefore when new tools are used, this will change how individuals work or function.

In this research study, connectivism is the theory that best describes how learning takes place when students use their smartphones. Learning takes place not entirely under the control of the individual as information is constantly shared to them through this device. This information can be in the form of messages received, information shared on social media etc. When all these separate information sets are connected, they enable the student to learn more.

2.12 Summary

The literature review evaluated the extent to which the subject of mobile learning has been researched. Various studies have set forth to uncover various aspects of this phenomenon. However, the review of the current studies reveals that not much research has been done on smartphone use among mobile devices. This is of particular importance as the experience may differ depending on the device type.

This literature review has highlighted the significance of mobile learning in education. Although the adoption of mobile learning is on the increase due to the consumerisation of WiFi & Cellular Data networks and the availability of cheap mobile devices, various challenges are being faced in trying to support mobile learning. The literature review has identified and listed such challenges.

The purpose of this research study is to investigate the impact of smartphones uses on students' learning experiences in South Africa. A review of previous studies done on mobile learning revelled that very little focus has been made in developing countries contexts.

Chapter 3: Research Theoretical Model

This chapter discusses the theoretical framework used for this research study. The individual constructs in the model are explained together with the hypothesis to be tested. Two theoretical models were considered for this research study namely The FRAME model and the Community of Inquiry model. Both models were not sufficient in addressing the subject under study and a conceptual framework was formulated.

3.1 Theoretical Frameworks considered for the study

3.1.1 The FRAME Model

One of the research models identified for mobile learning is the FRAME model. "The Framework for the Rational Analysis of Mobile Education (FRAME) model describes mobile learning as a process resulting from the convergence of mobile technologies, human learning capacities, and social interaction" (Koole, 2009 p. 25). The model claims to address some issues that are inherent with traditional learning methods. It proposes to address issues such as information overload and challenges with collaboration. The model is best explained through the diagram in figure 5 below.

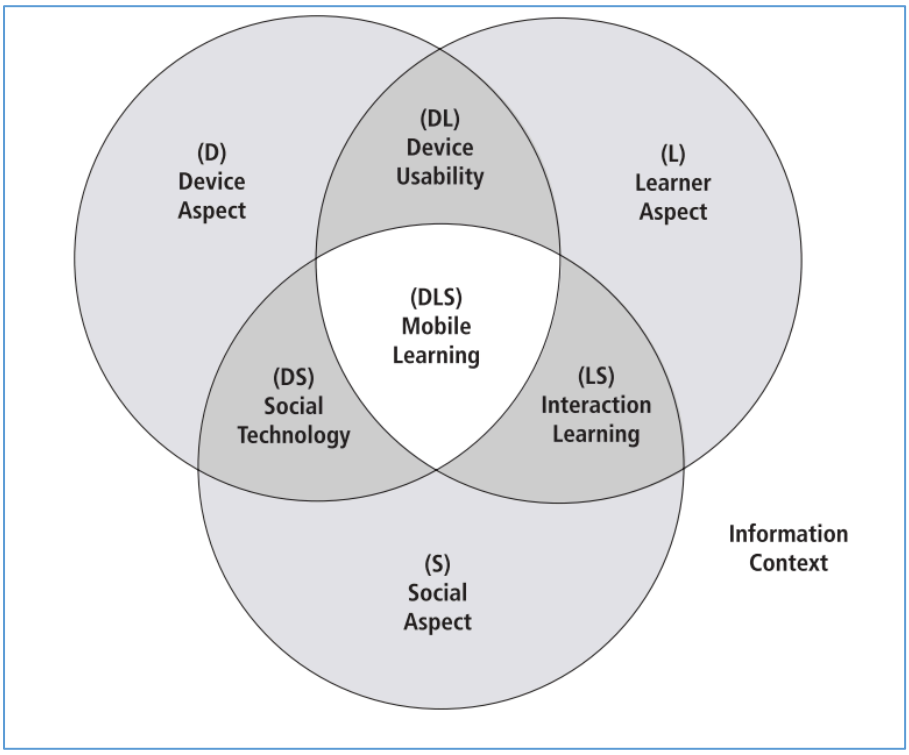


Figure 5: The FRAME model (Koole, 2009)

The circles depict three aspects of mobile learning which are the Device, Learner and Social aspects and where these circles intersect are where attributes from both aspects are represented. For instance, device usability is an attribute that belongs to both the device and the learner. Where all three circles meet shows the ideal mobile learning experience. Koole (2009) claims that by assessing the contribution of all the three aspects to this convergence (DLS), stakeholders will be able to design more effective mobile learning experiences.

3.1.2 Community of Inquiry

The Community of Inquiry model was developed by Garrison and Anderson (2003). The theory is intended to address learning in the 21st century. The Community of Enquiry (CoI) model focuses on the learning experience context and the various interactions that are behind the learning process. The model proposes that learning exists in a social context and learners are encouraged to take responsibility for their own learning (Garrison & Anderson, 2003).

The framework has three main elements which are social presence, cognitive presence and teaching presence (see figure 6 below). The social presence refers to the ability of the learners to establish themselves as real people in the learning experience by projecting personal characteristics which exhibit an emotional sense of belonging. Cognitive presence refers to the ability of learners to construct meaning through interaction and communication. The teaching presence involves the design, facilitation, structure and a process of learning to provide meaningful educational outcomes.

Collectively the interactions of the Cognitive, Social and teaching presence have an impact on the educational experience which sits in the middle of the framework. In the context of this research study, the educational experience implies the learning experience.

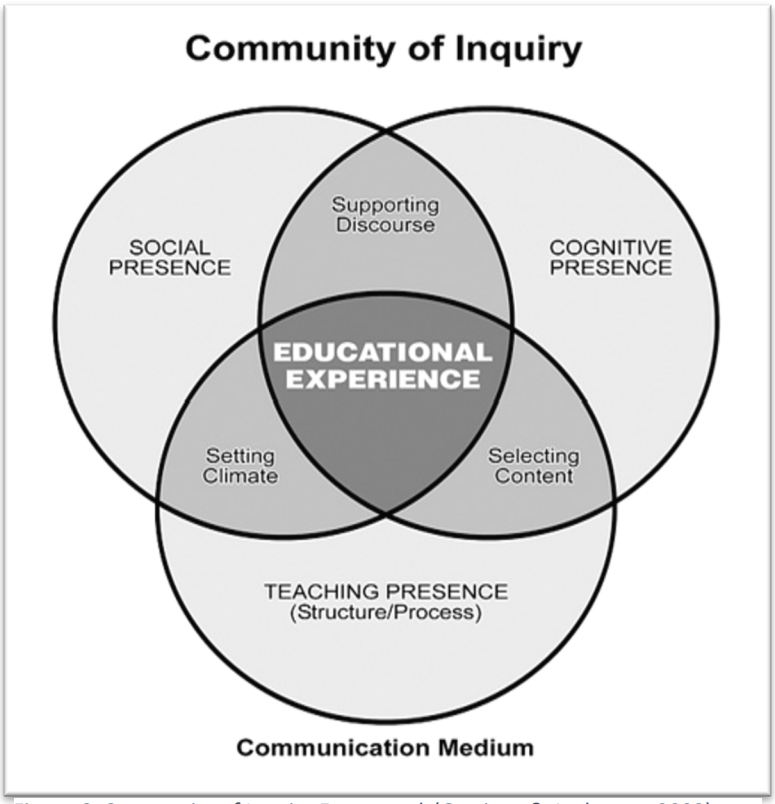


Figure 6: Community of Inquiry Framework (Garrison & Anderson, 2003)

3.1.3 Justification for the development of a Conceptual Model

The Framework for the Rational Analysis of Mobile Education (FRAME) model was the closest model for this research. Firstly, the FRAME model was designed specifically for mobile learning contexts (Koole, 2009). The model as aforementioned takes into account the technical characteristics of the mobile device together with social and personal aspects. It is necessary to look at the technical aspects of the smartphone being used by the student. These aspects can relatively have a contribution to the way the student uses the smartphone to learn and in turn affect their experience. These technical characteristics include the device's input and output characteristics, processing and storage capabilities, compatibility and upgradability. Koole (2009) claims that it is

imperative to look at these aspects or characteristics as the mobile device is the one which gives the interface between the learner and the learning tasks.

Learning aspects are also important to consider in this research study as they take into account the student's cognitive abilities, prior knowledge motivation etc. The learning aspect also shows how students use what they already know and mobile learning enhances this. Social aspects encompass the process of social interaction and communication. Learners should follow the rules of cooperation to communicate. This will enable them to exchange information, acquire knowledge, and sustain cultural practices (Koole, 2009).

The Community of Inquiry model was developed mainly for online learning research and has mainly been used in e-learning studies (Garrison, Anderson, & Archer, 2010). The model is not appropriate as mobile learning. The main focus of this research study is to find out how the learning experience is impacted by the use of smartphones. The model places emphasis on the teaching presence which will not be able to be covered by this study as the scope of the study allows for students and not teachers.

However various mobile learning studies have used the Frame model in recent information systems research (Butcher, 2016; Elfeky & Yakoub, 2016; Godfrey, 2016; Misra, Srivastava, & Abeles, 2016). Although there is no definitive figure of the model's use in information systems, initial searches suggest the model has been widely adopted.

3.2 Conceptual Framework developed

The conceptual model depicted below was developed. The model represents the links of the various constructs which include smartphone use, issues, satisfaction and positive and negative impacts. The researcher proposed that there is a link between all 4 constructs of the model which will be validated through testing of the hypothesis.

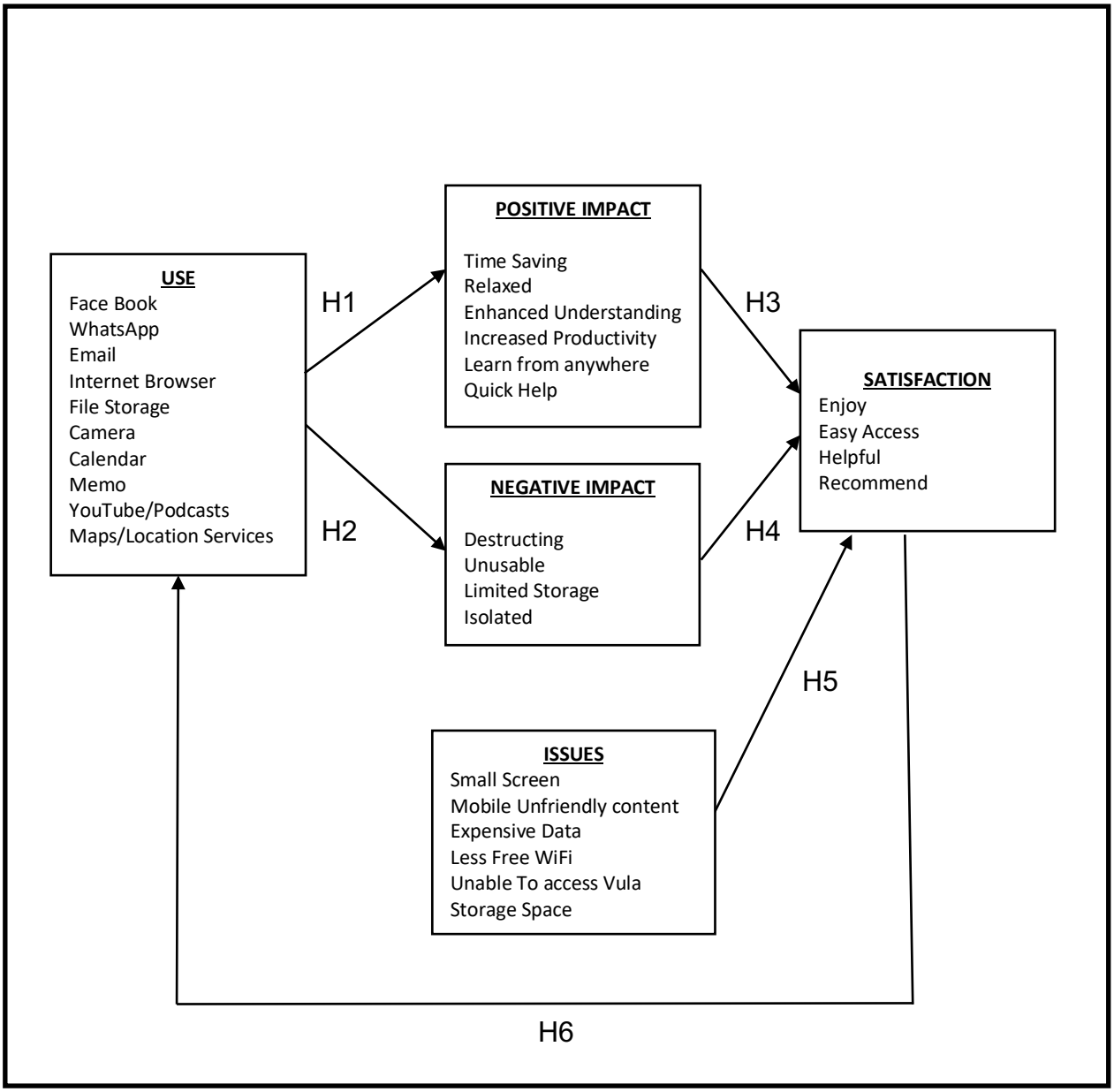


Figure 7: Theoretical Framework

We propose that any impact that a smartphone has on a student's learning is depended on how the student is using the smartphone. However, some issues that they encounter because of learning from a smartphone also might influence the level of impact or

outcomes. In the sections below, an explicit description is given for each of the constructs presented in the framework.

3.3 Definition of Constructs

Use: In reference to smartphones, use, in this case, can be defined as the various ways a user makes use of the device to enable or enhance their learning. Applications and or features on the smartphone allow for customisable use of the device to achieve particular results. The research study measured the use of common mobile applications from social apps to productivity and time management apps. The selection of the apps was guided by the works of Wai, Ng, Chiu, Ho, & Lo, (2016) who found out that web browser and email applications were the most frequently used apps for learning. The table below is a summary of their findings.

Table 3: Frequency of mobile app use for learning (Wai et al., 2016)

Frequency of using apps (in category)	Business	Education	Engineering	Weighted Average
Mass media (e.g., TV, Radio, Newspaper)	3.06	2.67	3.08	2.93
Dictation and translation	4.13	3.79	3.98	3.96
Social networking	3.73	3.72	3.55	3.67
Browser	4.44	4.33	4.18	4.32
E-mail / texting	4.25	4.38	4.00	4.21
Map and navigation	2.96	2.85	2.80	2.87
Document viewer (e.g., PDF reader)	4.25	4.15	3.95	4.12
Notes	3.60	3.10	3.48	3.39
Schedule / calendar	3.73	3.31	3.25	3.43
Video (e.g. YouTube)	3.15	3.03	2.95	3.04
School apps	2.38	2.28	2.30	2.32
Recorder	2.94	2.54	2.20	2.56
Calculator	3.54	2.95	2.98	3.18
Others	1.54	2.95	2.98	3.16

Note: Scale: 1 = Never, 5 = Always.

Most items/applications in the table above were adopted in this research study although some were renamed or rephrased to aid understanding of the questionnaire to respondents.

Issues: While students occasionally use their smartphones for learning activities, it emerged in previous studies that various issues are encountered. Negative issues particular to the device in use such as small screen, low battery life and inadequate storage space were identified previously (Baran, 2014; Kaliisa & Picard, 2017; Sarrab, Elbasir, & Alnaeli, 2016). However other non-device issues are also inherent such as expensive cellular data, low bandwidth and limited free WiFi (Baran, 2014). Other studies also cited psychological issues such as resistance to change and negative attitudes as barriers to enabling mobile learning (Karimi, 2016; Kim, Lee, & Rha, 2017).

This research study focused mainly on the device issues as the device is the main object of study psychological and human factors were not mainly considered though important.

Impact: Impact refers to the aspects that are affected by the use of the aforementioned application or features of a smartphone in learning activities. These aspects can be grouped into two, namely positive and negative impacts. Based on previous studies on mobile learning, the following impacts were pre-populated – Time-saving, increased productivity, enhanced learning, learn from anywhere, instant feedback and help (Hashemi et al., 2011; Iqbal & Yaqub, 2010; Ozdamli & Cavus, 2011; Vishwakarma, 2015). The aforementioned were grouped under positive impacts.

Some aspects were considered negative impacts as they hindered or disrupted the learning process/experience. Previous studies identified such impacts included being isolated and a smartphone destructing the learning activities through other applications such as social media apps (Binti & Hasan, 2015; Mahande, Susanto, & Surjono, 2017). This research study further incorporated aspects such as taking up too much storage from the device and frustrations due to unusable functions or features.

User Satisfaction: Satisfaction refers to those aspects that show that the user generally approves the use of smartphones in learning. User satisfaction will be measured through aspects such as the willingness to recommend to others and overall enjoyment (Ally et al., 2014; Khan, Al-Shihi, Al-Khanjari, & Sarrab, 2015).

3.4 Hypotheses

A set of hypotheses was proposed to show and explain the empirical relationship between the various constructs in the research framework. The hypotheses will be tried and either confirmed entirely or in part, or completely invalidated, which will prompt the further advancement of theory which at that point might be tried by further research (Saunders, Lewis, & Thornhill, 2009b). The following hypotheses will be tested.

Hypothesis 1: The greater the use of smartphone applications for learning purposes, the more the positive impact.

Null Hypothesis 1: Greater use of smartphone application for learning purposes has null or no positive impact.

Hypothesis 2: The greater the use of smartphone applications the more negative impacts will be experienced.

Null Hypothesis 2: The greater use of smartphone applications has positive impact experienced

Hypothesis 3: The higher the positive impact, the greater the user satisfaction with using smartphones for learning

Null Hypothesis 3: The higher the positive impact, the will be no or less user satisfaction with using smartphones for learning.

Hypothesis 4: The greater the negative impact the lower the user satisfaction.

Null Hypothesis 4: The greater the negative impact, the higher the user satisfaction.

Hypothesis 5: The more issues are experienced, the lower the user satisfaction.

Null Hypothesis 5: The more issues are experienced, the more the user satisfaction.

Hypothesis 6: The greater the user satisfaction with the smartphone as a learning device, the more it will (continue to) be used.

Null Hypothesis 6: The greater the user satisfaction with the smartphone as a learning device, the less it will be used

CHAPTER 4: Research Methodology

In the previous chapter, the researcher carried out a literature review to better understand what the current research says about this topic and what future directions are required to proceed with investigations. This chapter sought to outline the research method used to guide through this research study. The purpose of a research design is to guide and plan the process of conducting a study (Myers, 2009).

4.1 Research Philosophy

The way in which a researcher chooses to answer the research questions is influenced by the underlying philosophical stance that the researcher takes, while research questions shape the assumptions being investigated (Orlikowski & Baroudi, 1991; Saunders et al., 2009b)There are two ways that a researcher is influenced in conducting his research and that is the ontological stance and the epistemological stance. This researcher is influenced by the fowling stances that he took.

4.1.1 Ontology

This research study took an objectivism ontological stance. Ontology refers to the assumptions that the researcher holds of how the world works. Ontology influences how the researcher thinks about the world view (Saunders et al., 2009b). There are two aspects of ontology and that is objectivism and subjectivism (Orlikowski & Baroudi, 1991).

Subjectivism maintains that social actors are a part of the reality that is created as a result of their perceptions and actions towards the existence of that reality (Saunders et al., 2009b). However, objectivism proposes that much of the world reality exists independent of social actors.

4.1.2 Epistemology

Positivism is the epistemological stance that is taken in this research study. Epistemology refers to what contributes to acceptable knowledge in a particular research field (Saunders et al., 2009b). Epistemology is mainly concerned about the views surrounding the sources, nature, processes and interpretation of knowledge (Crotty, 1998). There are

three main epistemological standpoints namely, positivistic, interpretivist and critical realist.

This researcher took a positivism epistemological stance. Positivism works with an observable social reality and provides law like generations as its findings (Saunders et al., 2009b). This researcher acknowledges that the impacts identified may not be conclusive. Other positivistic attributes that this researcher employed remaining separate from the subject and using an abductive approach.

4.2 Research Purpose

There are three classifications of research purpose i.e. exploratory, descriptive and explanatory (Saunders et al., 2009b). The purpose of this research is explanatory as the researcher is explaining satisfaction by means of relationships between variables. Although the field of mobile learning is constantly receiving much attention from researchers, mobile technology is constantly advancing and thereby unleashing new ways of learning. Research in this field therefore needs to be constantly reviewed.

4.3 Research Approach

The research approach used in this study is deductive. Deductive approach is when the researcher develops propositions or hypotheses using existing theory or theoretical framework. These propositions or hypotheses are then tested, after which they are then accepted or rejected (Bhattacherjee, 2012). This research study conducted an in-depth literature review which resulted in the formulation of a conceptual model which has five constructs. This 0model led to the development of a set of hypotheses which was then tested using statistical methods to reject and /or to accept as presented in the findings sections of this dissertation. This allowed for the research questions to be answered and the research objectives to be met.

4.4 Research Strategy

The strategy used in this research study is an online survey. Various strategies can be used in undertaking research which includes case studies, action research, grounded theory, experiment etc.

4.5 Research Time Horizon

This research is cross-sectional given the short period of study. Saunders refers to a cross-sectional study as, "study of a particular phenomenon (or phenomena) at a particular time" (Saunders et al., 2009, p. 155). This research determines the impact of a smartphone on a student's learning experience at a point in time.

4.6 Population

The population is university students in South Africa. The researcher is based in South Africa and through convenience has situated the research in South Africa. When a researcher considers a population for a study, they are mainly concerned with the complete set of cases a sample will be taken from (Bhattacherjee, 2012). A target population, however, is a specific sample of a pool of cases to be studied. In this study, the target population is the University of Cape Town students. The University of Cape Town was selected because of ease of access to respondents.

The researcher would have extended the target population to include other universities in South Africa but due to time and financial constraints was not able to do so. However, the researcher acknowledges that the demographics of students at South African universities do differ, in some cases significantly due to the location and cost to study. Financial factors such as affordability of the devices, mobile data costs and institutional support do play a major role in influencing the behaviour of the respondents with regards to smartphone learning. Some universities do however share common similarities with the university of cape worn in terms of student demographics and cost of study. Universities such as the Stellenbosch University, Wits University and the University of Pretoria all share common similarities with the University of Cape Town.

4.7 Sample

The sample was taken from students at the University of Cape Town. The sampling frame was the over 20 000 students from various faculties and at various stages of their studies at this university. The sample was the 403 students which responded to the questionnaire. Random sampling was used for the online questionnaire. An online questionnaire was uploaded to a survey platform called Qualtrics. The researcher gained access to this platform through the commerce faculty's licence for students. An email

invite was sent out to the student population inviting students to participate in the study by answering the online questionnaire. Data collected through the online survey was analysed by statistical techniques such as factor analysis, regression and correlation analysis. Open-ended questions were analysed using thematic analysis.

4.8 Ethical Issues

Candidates participated in this research study voluntarily. The purpose of the study was explained in the cover letter in the email that was sent out to students (see appendix 3). The details of participants and their affiliations were treated as highly confidential and no identifiable information was published in this study. The researcher made use of aliases where necessary.

An anonymous survey link was distributed via internal e-mail to the body of students across the sample. The survey did not require any identifiable information such as names or student numbers. It was completely anonymous. This was done to encourage free and open participation without fear of victimisation.

An application to engage students in this research was submitted to the Ethics In Research Committee of the faculty of commerce. Approval was subsequently granted (See Appendix 4).

4.9 The Instrument

The instrument used in this research study is a questionnaire. The questionnaire was carefully drafted to present the sections of the questionnaire and the questions under each section (see Appendix 2). The questionnaire was then transferred to Qualtrics. Qualtrics is a platform which allows for distribution and analysis of surveys online.

The questionnaire was derived from the research framework. This is particularly because this research study followed a deductive approach to enquiry. Based on the conceptual framework presented in chapter 3 (see Figure 4), the questionnaire was divided into 5 sections. Each section was derived from the 5 constructs of the framework (with the

outcomes construct split into two i.e. positive and negative outcomes). Below is a brief description of each section;

Section one: In this section, all the demographics questions were presented. These included the gender of the participants as this would be used to ascertain if the results were not biased to one particular gender type. We also asked the responder's ethnicity, level of study, faculty and year of study all with the same objective of checking bias of respondents. The last two questions in this section related to the device itself that the students are using. We particularly asked for the type of phone and the size of the screen the phone has to ascertain if there is a link between the use and device features.

Section two: This section had questions which interrogated the student's use of the actual phone in terms of their learning. On a Likert scale of 7, the participant was asked to rate the frequency of use of some of the applications available on smartphones such as e-mail, Instant Messaging apps, Calendar etc. The participants had to rate a total of 9 predetermined smartphone applications. An open-ended question was posed for the student to state which application from these 9 is most important to them including a small motivation as to why they say so. The last optional open-ended question probed other ways in which students used their phones for learning.

Section three: Outcomes of the use of smartphones in learning were recorded under this section. A 7-point Likert scale was again used to collect the responses from participants.

Section four: This section collected responses on the negative outcomes students have when using smartphones for learning.

Section five: The issues that students experience when using smartphones for learning were recorded under this section. About 9 possible barriers were predetermined and participants were asked to rate these through a Likert scale of up to 7.

Section six: This last section sought to measure the overall satisfaction of students with using their smartphone for learning. In this same section, two open-ended questions were included to probe further input that might not have been addressed through the pre-populated list of questions.

4.10 Data Collection

Data collection was carried out after the finalisation of the research instrument and uploading the questionnaire to an online platform called Qualtrics. This platform allowed for the generation of an anonymous hyperlink which was used in the invitation to participate e-mail that was distributed to the research sample. Before the data was collected, the research study had to be approved by the faculty of commerce's research ethics committee and approved by the department of student affairs at the University of Cape Town.

After all, approvals had been granted, the department of student affairs then sent out an e-mail on behalf of the researcher to all students requesting them to participate using the invitation letter that was prewritten by the researcher (see appendix 3).

When the initial e-mail was sent out to the student population, a total of 69 responses were recorded. Various factors including the timing of sending out the e-mail could have contributed to the shortfall in the responses. The researcher then had to send out the invitation again at a later stage. A second e-mail invitation was sent out to the student body and a total of 430 more responses were recorded to make the new total of 499 responses.

After the responses were recorded, they were exported into Microsoft Excel as a CSV file for cleaning of the data. A total of 96 responses were excluded as there were incomplete leaving a total of 403 responses to be used for the analysis.

The open-ended questions were then separated from the responses and placed in a different spreadsheet. This was done to allow for uploading of the quantitative data into Statistica 13 for analysis. The quantitative data was then coded from 1-7 based on the scale that was provided in the questionnaire.

4.11 Data Analysis

The research comprised of both quantitative and qualitative data. Qualitative data was collected using the open-ended questions from the online questionnaire

Statistica 13 was chosen for the analysis of the quantitative data because it is the one that the department of information systems uses, and training of the software was provided to the researcher by the same department. Also, a site licence for the software is available to all students and staff who need to use it. Descriptive statistics were carried out then we tested for construct validity using Cronbach's alpha. We the ran regression and correlation analysis.

Correlation is the measure of the extent to which two variables are related to each other. The role of a correlation coefficient is to reveal and quantify the strength of a linear relationship between two variables under consideration (Saunders, Lewis, & Thornhill, 2009a). The correlation coefficient (represented by letter r) takes a value between -1 and +1 dependent on the existing relationship (Saunders et al., 2009a). The value of -1 represents a perfect negative relationship while +1 represent a perfect positive relationship.

A perfect negative relationship means that as the values of one variable increases, those of the other variable decreases. It represents a perfect inverse relationship between the variables.

A perfect positive relationship means that a change in one variable will result in a corresponding change in the other variable. On the other hand, the value of 0 reveals that the variables do not have any relationship or association.

To rely on correlation, the researcher needs to consider the probability of the correlation coefficient having occurred by chance alone (Saunders et al., 2009a). If the probability is very low (usually less than 0.05) then it is considered statistically significant (Saunders et al., 2009a). If the probability is greater than 0.05 then the relationship is not statistically significant (Saunders et al., 2009a).

Nvivo software was used to analyse the open-ended responses of the questionnaire. After cleaning the data, the open-ended questions were separated from the closed-ended questions and transferred into a new spreadsheet. These responses were then imported into Nvivo 13 software.

Thematic analysis was then carried out on the data. Thematic analysis makes use of coding of themes from the data (Braun & Clarke, 2006). The data was coded in two ways. Firstly the researcher carried out selective coding in selecting the themes to group. Some categories were grouped and combined into core categories. Open coding was thee used to identify new themes which emerged and were not categorised. Thus the open coding process focusses on identifying, naming and categorising new phenomena found in the text which is then described to produce new meaning. The process involved assigning labels to emerging themes and highlighting phrases that brought up new phenomena which the questioner instrument did not address.

CHAPTER 5: DATA ANALYSIS

The previous chapter presented the research design used to undertake this research study. In this chapter, we employ the techniques described before to analyse the survey data collected from 480 students.

The main objective of this study is to determine the impact a smartphone has on a student's learning experience. Secondary objectives include identifying the uses of mobile devices in learning and identifying the issues experienced on these devices while learning.

Both quantitative and qualitative analysis techniques were used to analyse the data. As part of the quantitative analysis, descriptive statistics was carried out to help understand the type of respondents for the survey (Bhattacherjee, 2012). The data was then tested for internal consistency and constructs validity. Inferential statistics i.e. correlation and regression analysis was then used to describe and make inferences about the population.

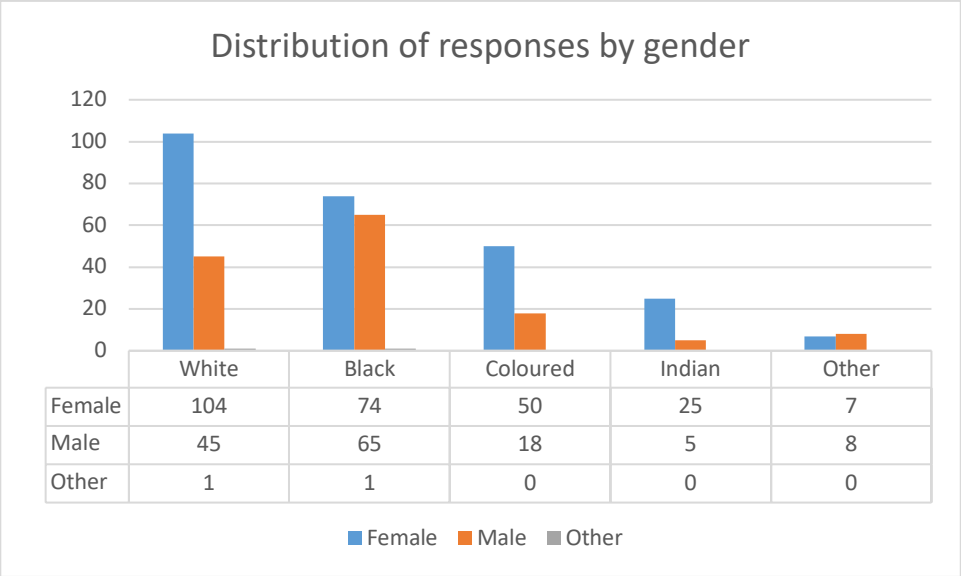
To analyse the open-ended questions, we used thematic analysis to identify the common themes.

5.1 Descriptive Statistics

The participants were asked to provide some demographical data which included their gender, race, year of study, type of phone they use and its screen size. This data helped to understand the participants better and what could have influenced their responses.

Gender and Ethnicity

In terms of the students who responded, 65% were female and 35 % were male while less than 1% preferred not to be identified with any gender grouping. The table below shows the gender of the participants against their respective race.

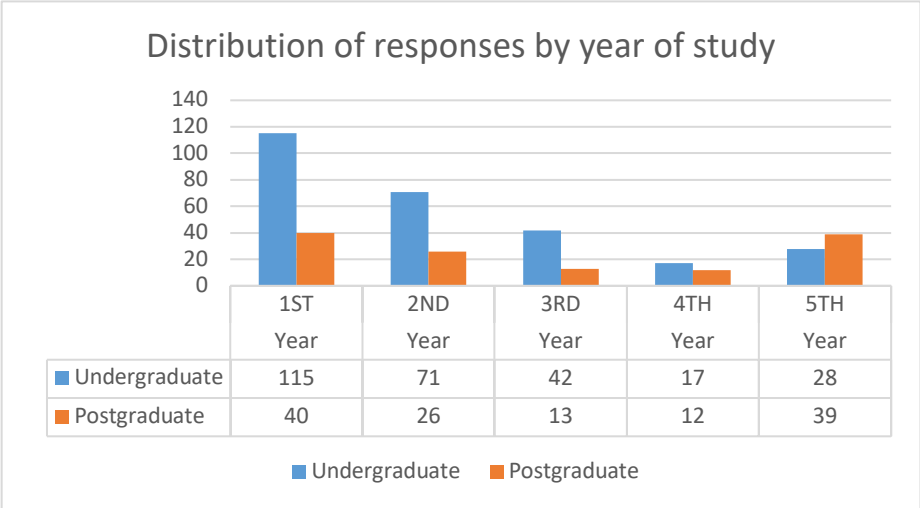


	White	Black	Coloured	Indian	Other
Female	104	74	50	25	7
Male	45	65	18	5	8
Other	1	1	0	0	0

Figure 8: Distribution by Gender

Year of study

A total of 273 students who responded were doing their undergraduate program of study and were at various levels in terms of their year of study. The remaining 130 students fall under postgraduate studies.



	1ST Year	2ND Year	3RD Year	4TH Year	5TH Year
Undergraduate	115	71	42	17	28
Postgraduate	40	26	13	12	39

Figure 9: Distribution by year of study

Type of phone

Most students had a smartphone totalling 396 compared to 7 students who indicated that they own a feature phone. These 7 students were included in the analysis because feature phones do offer some of the functionality. This means that over 98% of university students own smartphones. Such findings like these can help aid understanding in terms of enabling learning options on smartphones.

Previous studies also note that smartphone ownership is widespread amongst students in higher education institutions (Conejar et al., 2015; Dahlstrom & Bichsel, 2014; Kobus et al., 2013). This is particularly the case as millennials have now reached a higher education level (Kathryn & Parsons, 2016).

Phone Screen Size

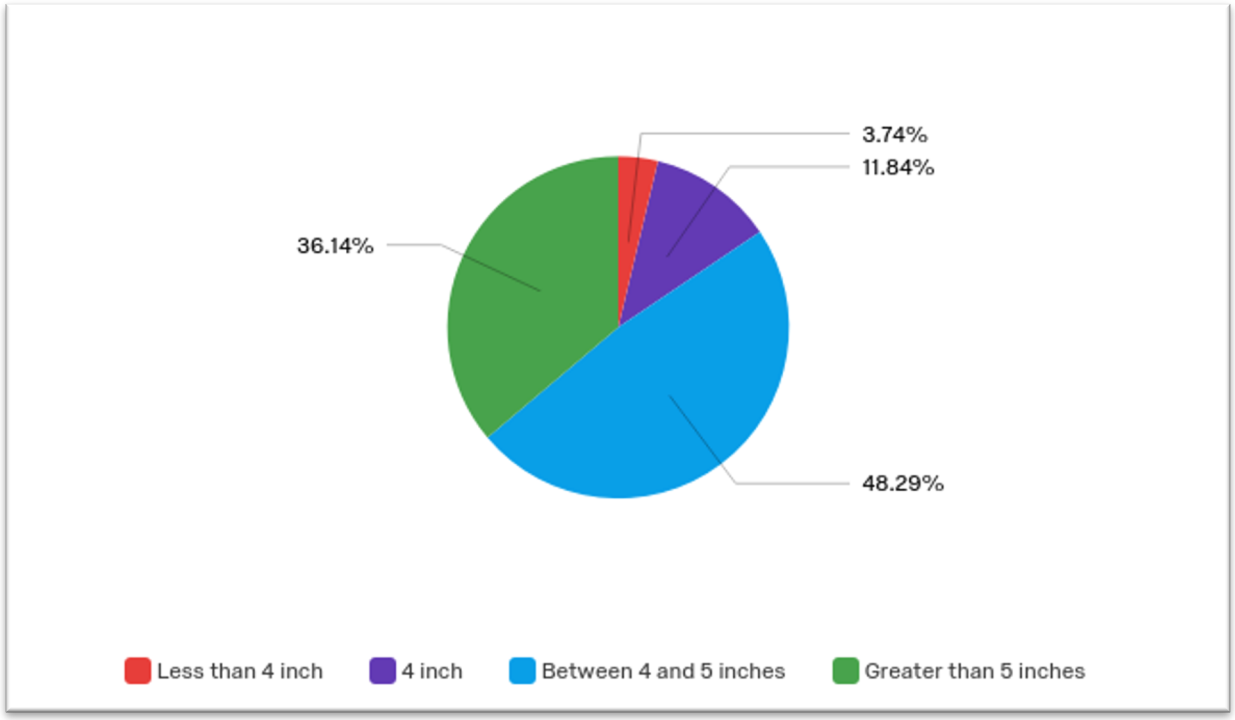


Figure 10: Phone Screen Size

The chat above categorises the phone screen sizes of the participants into four main categories i.e the screen sizes of less than 4 inches, 4 inches, between 4-5 inches and those greater than 5 inches. From this graph, it can be noted that most participants have phone sizes of between 4 inches and 5 inches.

Frequency of use of mobile applications for learning.

Participants were asked how frequently they made use of some of the mobile features on their phones in relation to their learning. A 7 point Likert scale was used. The responses were recorded and have been presented in a stacked bar chart below sorted by weighted averages.

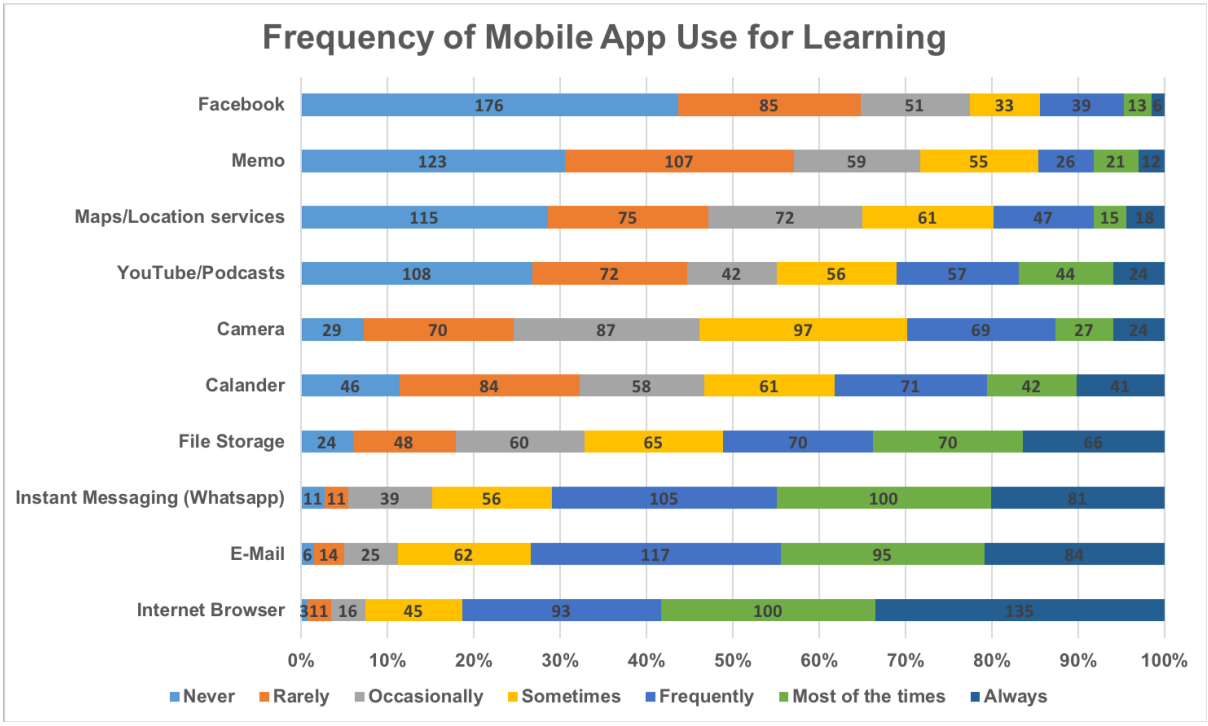


Figure 11: Frequency of Mobile App Use for learning

Internet browser topped the list as the most used app by students with more than 80% of students recording that they make use of the app for their learning. This affirms the claim that students mostly use web browsers on their smartphones to quickly access websites with course-related learning material (Kuznekoff & Titsworth, 2013). This includes accessing LMS which does not have a dedicated mobile app. The chat also reveals that students rarely use social media apps for learning. Facebook had the majority of students who confirmed that they never use it for learning. Interestingly some students frequently use WhatsApp for learning. This confirms previous scholarly findings which reveal that WhatsApp is the most popular messaging app amongst students which they also use to ask questions and collaborate amongst themselves through WhatsApp study groups (Al-Emran et al., 2016).

The popular video app YouTube appears not to have a good uptake by students when it comes to learning as over 25% of students never use it all. This might be due to the fact that there might not be relevant videos relating to their study content which has been published in video format (García-Peñalvo & Conde, 2014). Also, another factor is that the cost of mobile data might be hindering students from accessing data-intensive apps.

Positive Impacts

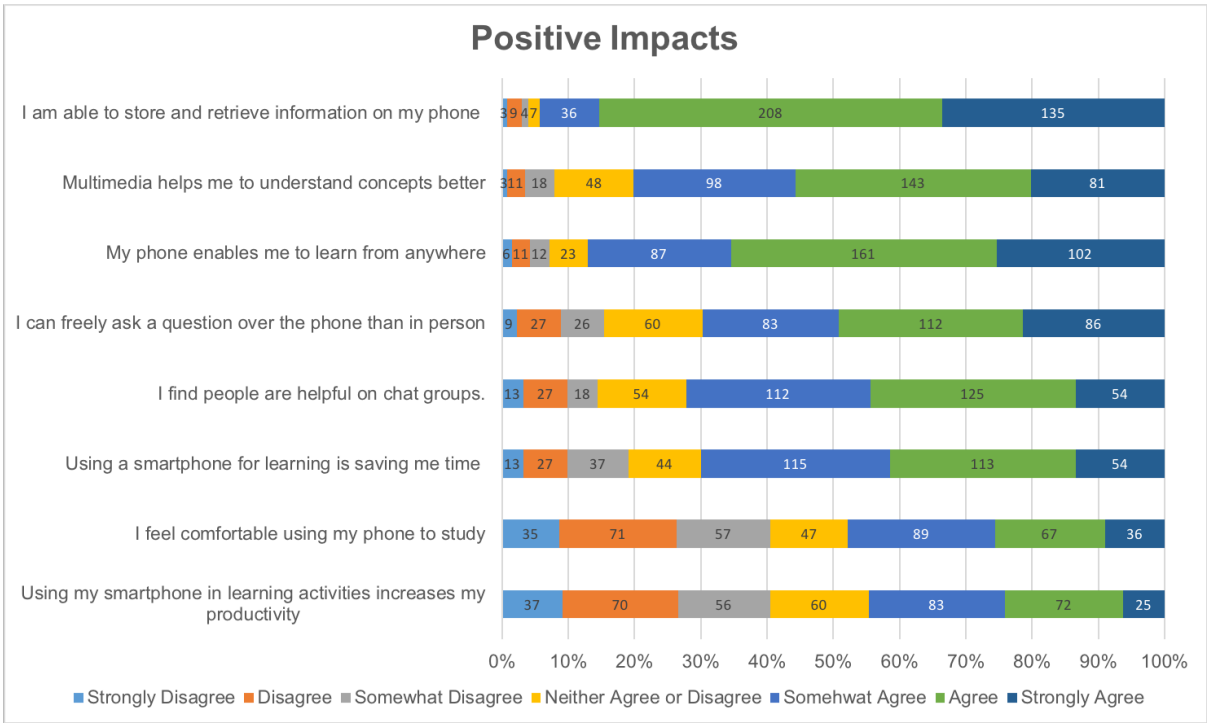


Figure 12: Positive Impact

The research questionnaire had a section with a set of questions which sought to understand how positively smartphones are impacting on their learning. The chart above reveals some of the findings under this section. It can be noted that respondents agreed to most of the questions posed to them while the rest mostly were positively skewed on the somewhat agree, agree and strongly agree options.

Negative Impacts

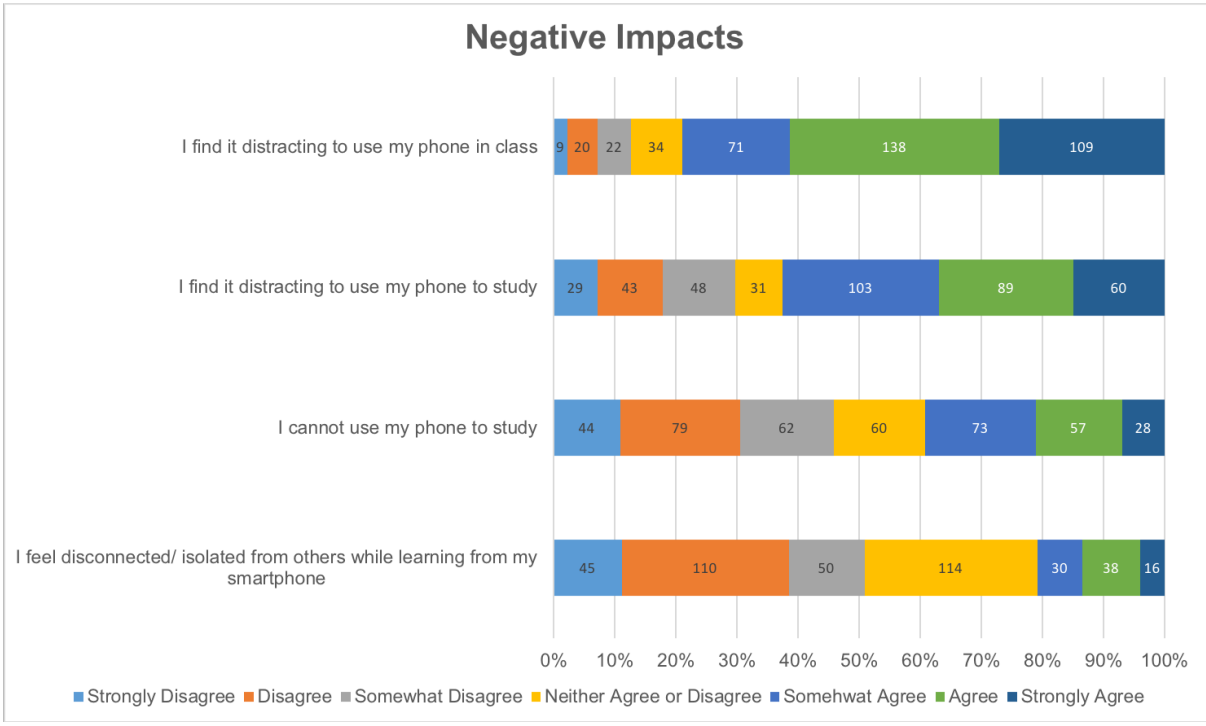


Figure 13: Negative Impacts

Some questions on the research instrument sought to uncover the negative impacts of learning on smartphones. Some negatives which came out strongly are that students find mobile phones distracting while studying with very few disagreeing. Previous research also found out that mobile phone use for learning by students could be distracting with some students preferring to learn from their computers rather than phones (Magunje, 2013).

Issues

The issues that were encountered by students while learning on their smartphones mainly included access to mobile data. Most students strongly agreed that they depend on free WiFi to access learning material from a smartphone. Fortunately, free WiFi on campus is adequate to meet this need as agreed to by 104 students as depicted in the stacked bar chart in Figure 12.

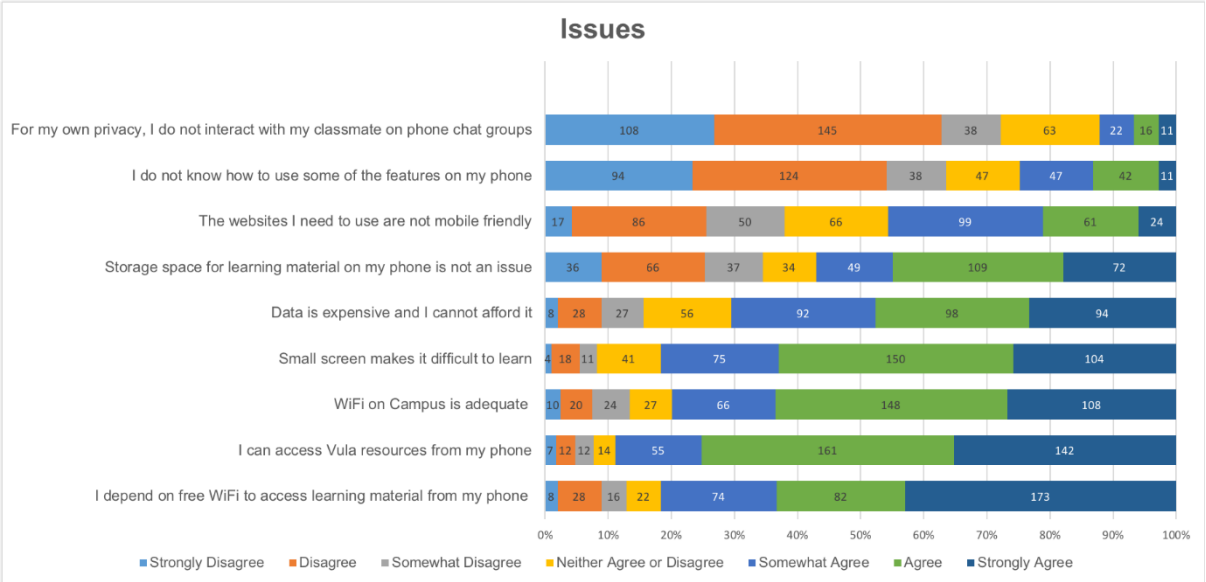


Figure 14: Issues

Dependency on free WiFi connections by students is still very high. As noted in the literature, this can be attributed to the fact that mobile data in South Africa is still considered to be very expensive compared to other countries. Mobile data in South Africa is considered to be generally expensive. In a country where half the population is poor, some have argued that the high data costs have given rise to social exclusion as the poor are unable to access information. This has given rise to social media campaigns such as #DataMustFall which became popular in South Africa.

More than 70% of the students confirmed that they cannot afford to buy mobile data thus the dependency of free WiFi by students. Although the university has installed WiFi across campus, there are still very few students who think that WiFi on campus is not adequate. According to Chitanana and Govender (2015), some spaces at universities cannot cope with the high demand of mobile connections to the available access points. At UCT, in particular, some students experienced intermittent WiFi connection at the document centre during peak periods.

Free WiFi connections need to be available in spaces where students frequent such as their places of residency during commuting to and from campus. The benefits of using a smartphone for learning are negated if the students don't gain access to free WiFi connections in the spaces they frequent.

Students generally agreed to the fact that they can access Vula resources from their smartphones. However, a very small percentage of these disagree. This is due to the fact

that there is no dedicated app for the Vula LMS. The university needs to develop a dedicated Vula app that will be optimised for small screens. The table also reveals that some websites that students use or access from their smartphones are not mobile-friendly.

Storage space on smartphones has been generally acceptable with most students agreeing that they can store their learning material on their smartphones.

Satisfaction

User satisfaction is generally high for most aspects of learning. Most students agreed that they can access learning materials from their smartphones which is of importance in enabling mobile learning from a smartphone.

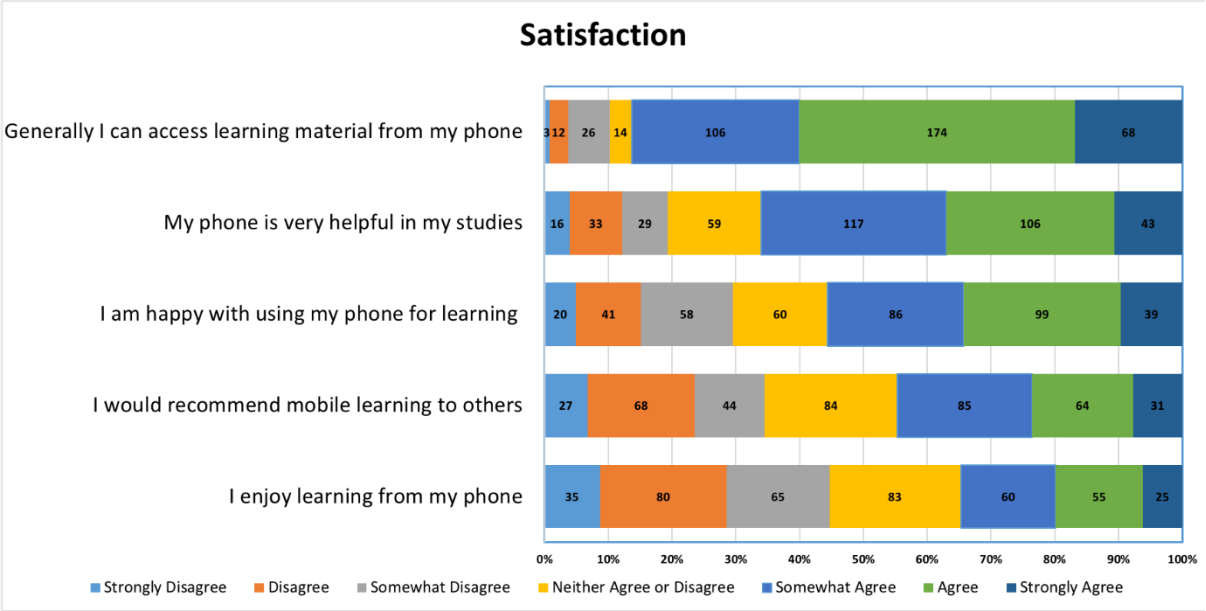


Figure 15: Satisfaction

5.2 Exploratory Factor Analysis

The purpose of exploratory factor analysis (EFA) is to determine the nature of the constructs influencing the set of responses and reveal any latent variables that may cause covariance in the manifest variables. The objective of EFA on this study was therefore to reveal any additional latent variables and determine construct validity.

Exploratory Factor analysis was run on all the constructs (See appendix 5). The loadings were >5 and done with an Eigen Value of 0.8 and Verimax Normalised.

Factor Analysis: Frequency of Use

On the frequency of use construct, we had a total of three loadings for the 10 items tested. Firstly, the frequency of use of Facebook, Instant Messenger, Camera and Maps loaded under one factor. This is because these applications are all social applications and participants would have viewed them as the same. These application uses were all grouped into one construct called social.

More productive tools apps such as email, browser, storage and calculator all loaded on the same factor. These were grouped under a new construct called Tools

Memo did not load onto any factor and was consequently removed from the analysis. YouTube loaded on its factor and a new construct was created called Video.

Factor Analysis: Positive Impact

The questions which referred to the positive impacts on smartphone use on students loaded onto three factors. Time, comfort, productivity and anywhere all speak to one construct which is Location. Ask questions and chat groups loaded onto the same factor and a construct called Support was formed.

Enhanced understanding loaded onto its factor and a third construct was created and titled understanding.

Factor Analysis: Negative Impact

Negative impact had two loadings in total. Destructing in class was loaded onto its own factor called Class. Distraction and Phone was grouped into one construct which was called Distraction. Isolated did not load onto any factor was removed from the analysis

Storage could not have been viewed as a negative impact but rather an issue as it also appeared under the issues construct and paired with Issue Storage. Therefore, this test item was moved from the negative impacts and included under the issues construct.

Factor Analysis: Issues

The issues construct had mainly four factors on to which the test items loaded. The following constructs were created based on the factor loadings. Screen size, Mobile unfriendly, Data Connection and Vula (LMS).

Campus Wi-Fi loaded separately from the other data connection variables due to the way the question was phrased. This variable was therefore excluded from the analysis.

Factor Analysis: Satisfaction

Satisfaction construct had all its items loading on the same factor except for one item which loaded together with Vula under issues. Three constructs were created under this cluster i.e. helpful, enjoy and recommend.

5.3 Data Reliability

The variables were tested for internal consistency using the Cronbach's alpha test. This test was used to determine if the variables are consistent and thus dependable (Bhattacherjee, 2012). According to Gliem and Gliem (2003), it is important to verify the internal consistency between variables and affirm that any Cronbach alpha value of above 0.7 is acceptable. However in exploratory studies, a Cronbach alpha value of 0.6 is acceptable (Fornell & Larcker, 1981). Exploratory Factor analysis was carried out to determine which test items loaded together and which ones needed regrouping (see Appendix 5).

The table below was feather refined based on the factor analysis that was done. Sub constructs/variables were created based on the factor loadings displayed for the factor analysis done on that particular construct alone. Cronbach Alpha reliability test was then run on each of the sub-constructs and the results of the test are displayed in the table below.

Table 4: Revised Cronbach Alpha Test Results

Cluster	Construct	Test Items	Cronbach's Alpha
Smart Phone Use	Productive Tools	4	0.8
	Social Media	4	0.7
	Video/ Podcasts	1	N/A
Positive Impact	Location	4	0.8
	Support	2	0.6
	Understanding	1	N/A
Negative Impact	Class	1	N/A
	Distraction	2	0.8
Issues	Screen Size	1	N/A
	Mobile unfriendly content	1	N/A
	Data Connection	2	0.6
	Vula Incompatibility	1	N/A
Satisfaction	Satisfaction	4	0.9

Negative Impact had only one test item which loaded onto a separate factor (see Table 4) therefore Cronbach Alpha test could not be run on it as at least two test items are required to run the test (Gliem & Gliem, 2003). Satisfaction had all its test items loading onto one factor (see Table 18).

The research theoretical framework was redefined following the invalidating of some of the initial test items from the research. The figure below shows the relationship between the new constructs in the new framework.

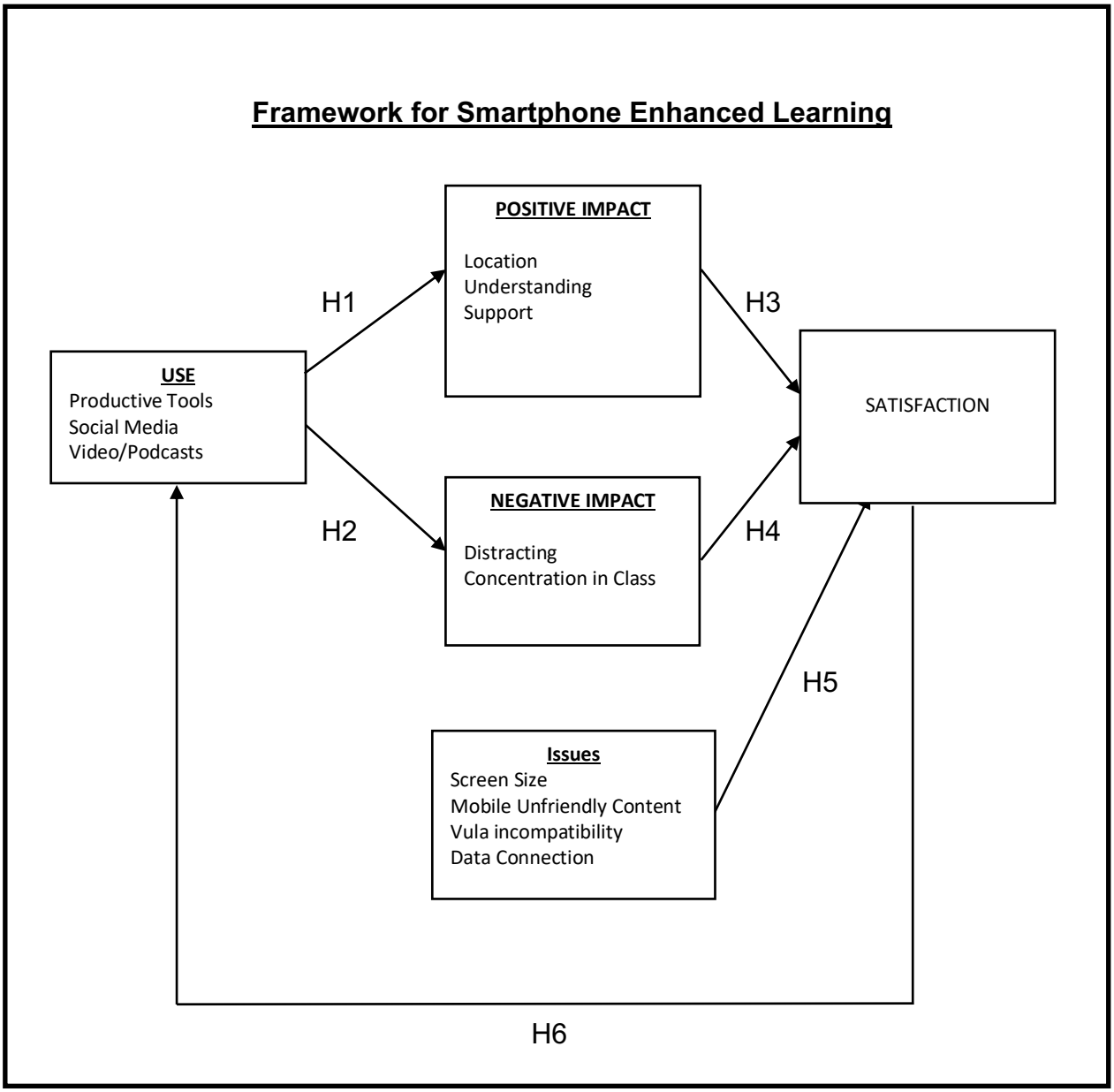


Figure 16: Revised Theoretical Framework

5.4 Hypothesis Testing

1. **Hypotheses 1 & 2: Smartphone use results in either positive or negative impacts.**

To test our first and second hypothesis, several multiple regression tests, each one using the three use cases (use of smartphone tools, social media and for videos) as independent variables with the various negative and positive impacts as respective dependent variables. The following table shows the p-values for each of the 3 identified smartphone use cases (independent variables) per regression (each impact is a separate regression/column).

Table 5: Influence of smartphone use case on learning impacts (p-values/R^2)

Regression for → Smartphone use ↓	Learn anywhere (location) (+)	Better understanding (+)	Better support from others (+)	Distracting (-)	Less concentration in class (-)
As a tool	**0.0000*** **	**0.0000*** **	0.1006	**0.0003*** **	**0.0023** **
For social/communication	**0.0017***	0.4207	**0.0059***	0.6680	0.7689
For video	0.1978	0.1533	0.4331	**0.0167***	0.0817
R^2	*0.1489*	*0.0822*	*0.0464*	*0.0897*	*0.1175*
Adjusted R^2	*0.1426*	*0.0752*	*0.0393*	*0.0712*	*0.0995*

* = p<0.05; ** = p<0.01; ***=p<0.001

From the analysis, it is clear that the functional use cases of a smartphone influence the positive or negative impacts differentially. For instance, the various smartphone tools used (calendar, browser, calculator) are significant antecedents on most impacts but the social/communication uses of smartphones (instant messaging, email, Facebook) only relate significantly on the 'learn anywhere, anytime' and the 'getting support from others' impacts.

The use of smartphone video functionality only has a significant negative impact (distraction during lectures). This is particularly so because a video requires one's mind to fully focus on it. We also note that functional use as a tool also causes distraction and less concertation during a lecture. A study by Kuznekoff and Titsworth (2013) found that students who use smartphones in lectures are generally distracted and write down and

remember less information, in turn, performing less than students who do not use their smartphones in class.

Thus Hypotheses 1 and 2 are supported but only weakly so, given that the actual correlation coefficients (bottom two rows) are very low – only 4 to 14% of the variance is explained. It must be noted that the lack of explanatory power of the impacts (low adjusted r^2) remains even when demographic variables are used as additional antecedents.

2. **Hypotheses 3, 4 and 5: Smartphone impacts and issues influence satisfaction of the smartphone as a learning aid.**

These hypotheses were tested in one go using multiple regression with the satisfaction construct as the dependent construct. In addition to the positive and negative impacts, as well as the four identified issues, we also included 5 demographic variables as possible antecedents. Table 6 summarizes the regression.

Table 6: Influence learning impacts and issues on smartphone learning use satisfaction

N=402	Regression Summary for Dependent Variable: Satisfaction R= .79035466 R²= .62466048 Adjusted R²= .61108231 F(14,387)=46.005 p					
	b*	Std.Err. of b*	b	Std.Err. of b	t(387)	p-value
Intercept			1.647	0.764	2.154	0.031
Gender	-0.076	0.033	-0.229	0.097	-2.353	0.019
Program	0.031	0.033	0.099	0.103	0.955	0.339
Year	-0.041	0.033	-0.041	0.032	-1.278	0.201
Phone Type	0.031	0.033	0.352	0.369	0.953	0.341
Phone Screen Size	0.001	0.031	0.002	0.064	0.029	0.976
Positive Impact (Location)	0.514	0.047	0.562	0.051	10.912	0.000
Positive Impact (Support)	0.131	0.033	0.145	0.037	3.907	0.000
Positive Impact (Understanding)	0.001	0.036	0.001	0.040	0.030	0.975
Negative Impact Class	-0.032	0.038	-0.030	0.035	-0.854	0.393
Negative Impact Distraction	-0.238	0.046	-0.205	0.039	-5.214	0.000
Issue (Screen Size)	-0.045	0.033	-0.047	0.035	-1.361	0.174
Issue (Content)	-0.035	0.034	-0.030	0.029	-1.033	0.302
Issue (Data)	0.029	0.033	0.031	0.035	0.890	0.373
Issue (Vula)	0.080	0.033	0.087	0.035	2.464	0.014

The positive impacts of being able to learn anytime/anywhere (PosLocation) and being able to get support from other students or teachers (PosSupport) positively influence learner satisfaction lending strong but partial support to Hypothesis 3. The distractive nature of the device has a significant negative effect on learner satisfaction, partially supporting Hypothesis 4. Most issues (screen size, lack of appropriately formatted content, data costs) don't seem to affect satisfaction except that the ability to access the University's Learning Management System using a mobile adds further satisfaction. Thus Hypothesis 5 must be rejected given that, although students experience certain issues (see figure 5), these issues don't affect satisfaction. Interestingly, satisfaction is also gender-biased with women reporting overall marginally but statistically significantly *lower* satisfaction levels. The overall power of the model to explain student satisfaction with the smartphone as a learning tool is surprisingly high, with a R2 of 0.625 (adjust R^2=0.611) i.e. more than 60% of the variance in student satisfaction is explained by the hypothesized antecedents. However, the model could be made more parsimonious by just selecting the significant variables.

3. Hypothesis 6: The greater the user satisfaction with the smartphone as a learning device, the more it will be used.

The correlation table in Appendix 6 depicts a detailed Pearson correlation analysis of the variables. All correlations marked in red are significant at a 95% significance level ($p<0.05$).

The correlation of satisfaction with smartphone use is significant and above 25%: use as a tool is highest (0.312), with use for social/communication functions (0.267) and use of video functionality (0.264) also relatively high. The correlation does not imply causality; however, when the use case factors are included in a multiple regression with the other variables (see previous section), the overall explanatory power (R^2 value) of the regression equation increases by less than 1% (R^2=.637; adjusted R^2=0.620). Thus, the causal relationship can be assumed to go the other direction i.e. satisfaction leads to (continued) use of those functions that contribute to the learning impacts.

5.5 Qualitative Data Analysis

The research instrument had a section with open-ended questions which sought to uncover some of the areas that were not completely addressed in the survey. The analysis of these responses was done using thematic analysis and the guidelines proposed by Braun and Clarke (2006).

The students were asked which of the mobile applications was most important in their learning and the results were quantified and presented in the table below.

Table 7: Most important Mobile Applications for learning

Application	COUNT
Internet Browser	289
Email	122
Instant Messaging (e.g. WhatsApp)	112
YouTube / Podcasts	60
Sound Recorder	16
File Storage	15
Camera	5
Facebook	3
Memo	3
Calendar	2
Maps/Location Services	1

We note that the 3 most important mobile application students use from their smartphones for learning are internet browser, email and instant messaging. This compares well with the quantitative findings on the frequency of use of the applications which reveal that the most frequently used apps used by students were also an internet browser, email and instant messaging respectively (see Table 18).

Internet Browser

We find that Internet Browser emerges to be the most important mobile application for enhancing learning by students followed by email and WhatsApp respectively. YouTube also has a number of users. Some themes also emerged from the responses gathered on the frequency of use of mobile applications. Themes identified include Easily Accessible, Quick help and Constant updates.

One theme that was dominant from the responses on the internet browser was keeping up-to-date. It emerged that students use the internet browser to do a quick search for new information.

> *"Internet browser to keep up to date with new information in the medical field and access important websites such as medscape and uptodate." Res ID107*

> *"Internet browser in order to go through academic papers and find interesting articles based on my studies." Res ID 109*

The reason why students use internet browser from their smartphones is because of ease of access to it, unlike laptop and desktop computers as revealed in the comments below.

> *"Internet Browser - I use it when a laptop or desktop is not accessible, and I have some information that I want to find." Res ID 126*

> *"Internet browsing - helps with looking up things I do not know quickly especially if i do not have access to a laptop with internet connectivity." Res ID 132*

In some cases, students use internet browsers from their smartphones to get definitions of new concepts or to seek clarity on areas that they are not aware of.

> *"Browser, I can search for terms I don't know or access vula or any other learning sites from my phone." Res ID 187*

> *"Internet browser is most important because it helps me get clarity on concepts I was not sure about during class. I am able to Google definitions easily and because it is so fast I can research many topics at the same time. I also use the internet to log on to Vula so I can download lecture slides on my phone and study wherever I want." Res ID 354*

E-mail

The second highly used app emerged to be the e-mail application. The predominant theme that emerged from the use of email by students is mainly for receiving campus updates as shown in these comments;

> *"Email, it keeps me up to date with campus/class/ exam break downs /changes/ important info etc." ID123*

> *"Email because I receive updates on organizational aspects of my studies." ID104*

Some senior students, however, use email app to set up meetings as stated by this postgraduate student.

> *"Email - for organizing meetings when I am not at my laptop." ID198*

Students also use the e-mail application on their smartphones to communicate with their lecturers

> *"Email is most important to me because I need it to check if I have gotten any emails from lecturers and anything to do with assignments." ID 341*
>
> *"Email. I receive all my important notifications via email and it's the one medium that I can use to connect with lecturers/other student." ID 159*

However, most students depend on the email app on their smartphones to get official updates on their studies instantly without the need for the student to loginto their email on the computer. This is made possible because the smartphones have a notification feature which instantly notifies the user if there is a new message.

> *"Email. I usually see notifications and communication about my studies on my phone first, via email." ID363*
>
> *"Email - it allows me to stay in touch with my academic life at all times." ID418*
>
> *"Email - immediate knowledge and access of important communications." ID 436*

The above statements reveal a common theme of communication between the student and the university. Most institutions send their official communications to students via e-mail. This also includes official communications from lectures and departments. Having an email application on a smartphone setup to receive university emails ensures that the students instantly gets communication as and when it is sent to them.

However, we note that student's do not necessarily communicate with one another using e-mail but rather communicate which each other using social media platforms. The most common social media app that students use to communicate which each other is WhatsApp.

WhatsApp

WhatsApp also emerged to be one of the most important apps that students use on their smartphones for learning. However, the aspect of learning that it is mostly used for is communication with other students about academic updates, support and collaboration among others.

> *"Whatsapp as to be able to check answers and questions between peers as well as to keep up to date with any information i may or may not have missed." ID 282*
>
> *"WhatsApp. I need to be able to ask my peers for help." ID 131*

However, students use WhatsApp to get more information about campus updates from other students.

> *"whatsapp for finding out where tuts and lectures are and when they're cancelled, and organising group projects etc." ID 108*

Sound Recorder

The next most important feature or app on smartphones that students use for their learning is the sound/voice recorder. Some students mentioned that they used the sound recorder app on their smartphones to record lectures and refer back to the sound clips for better understanding and revision. It is interesting to note that the sounder recorder app was not listed on the actual research questionnaire but emerged as one of the main ways that students use their smartphones in learning. When asked to state the most important app on their phones some students had this to say about the sound recorder;

> "*Probably email and sound recorder. I sometimes record lectures or tutorials so I can listen to them again." ID 113*
>
> *"Sound recorder - I record all my lectures, so it allows me to concentrate and participate in class as I am then able to do my lecture notes when I get home. So in essence I am not in a frenzy to write down lecture notes whilst participating." ID 121*

Some students use it to record important information and keep track of it just like a memo.

> *"Memo/Sound recorder It's allows me to keep track of things when I don't have a diary or a place to write anything down." ID315*

While some students were using the sound recorder app for recording lectures for future reference, it is interesting to note the impact the sound recorder app had on some student's learning process as it was directly integrated into the learning process as revealed in the comments below.

> *"We have had to conduct a lot of interviews in our postgrad diploma, and the voice recorder has made a huge." ID 156*
>
> *"I'm studying speech therapy so recording speech assessments is important." ID 161*

Other ways students are using smartphones

The research sought to better understand and in turn reveal other ways that smartphones can be used for learning that might not have been listed in the previous

section. Some students revealed some interesting ways that they use their smartphones as shown in the comments below.

> *"I use Google Docs to write my essays on." ID 142*
>
> *"Calling friends to ask them to explain a concept to me." ID 120*
>
> *"Listening to music while studying." ID 199*
>
> *"I listen to classical music while studying which is on my phone." ID 343*
>
> *"Timing myself to see how long I take to complete a task, often by setting a time limit using an alarm helps me focus and get work done." ID 374*
>
> *"Instagram - I follow a lot of pages relevant to my degree." ID 384*

A smartphone's functionality can be improved through the many specific applications that are downloadable from the app store. Many educational apps are free to download while others, one would have to buy or pay a subscription. Due to this fact, it emerged through the responses that there are many other specific apps that students are using with particular focus to their studies or needs. Below are some comments revealing the extent to which a smartphone can impact on the student's learning.

> *"Apps that can read for me audibley." ID 147*
>
> *"Through specific apps like WordReference, Wikipedia." ID 160*
>
> *"Osmosis app - medical quizzes to test knowledge. Podcasts app, listening to journal articles." ID 292*
>
> *"Translator to learn English especially when I am reading or I want to say an idea." ID 318*
>
> *"I use the office applications which allows me to access my lecture slides and notes - quick and easy." ID 452*
>
> *"duolingo - french speaking app = i'm learning French." ID 457*
>
> *"I sometimes read scientific papers on my phone (Adobe - PDFs) when I'm not near a computer." ID 428*

Thematic Analysis on the use of a Smart phone on student's overall learning.

With the objective of understanding more the impact that a smartphone has on students' learning, we asked the question, if your phone is taken away from you, in what ways will that impact/affect your learning? We note that there are many ways that a

student can be negatively impacted by not making use of smartphones. The following themes emerged.

Communication

Constant communication has proven to be vital for students. As previously noted, a smartphone helps aid communication in many ways especially e-mail notifications from the university and lectures and communication with peers through social media e.g. WhatsApp. The following comments were made with regards to how the lack of a smartphone will impact their communication.

> *"Lack of Communication and vula access will hinder studies." ID 115*
>
> *"Communication between group members for assignments or tutorials will be difficult." ID 151*
>
> *"Impaired communication with peers. Unable to learn on the go." ID 175*
>
> *"Lack of communication and ability to ask questions, more difficult to find answers quickly and on the go." ID 235*

Access to Learning material

The following comments were made with regards to how not having a smartphone will impact their access to learning material.

> *"I won't be able to access my learning materials on the go and at my convenience." ID 129*
>
> *"I would not be able to easily access information whenever I want and wherever I am." 179*
>
> *"That would be a huge loss. I lost my phone earlier this year, with it I lost my notes, some files. It really compromised my progress." ID 228*
>
> *"Quick access to information and to get things done will be effected." ID 263*

Chat Groups

Smartphones appear to mainly be used for communication through social media chat groups. The following comments were made to show how smartphone phones impact on the ability to conveniently communicate through these chat groups.

> *"The only thing that would be affected is the class group chat that we have as we tend to make class decisions on it, so without my smart phone i won't have the opportunity to be part of the discussions." Res ID 157*

> *"It would be frustrating because I wouldn't have Whatsapp groups or a means to message people." Res ID 155*
>
> *"It would make it incredibly difficult to keep up with my peers on group chats about work and classes and it will be a major loss in my resources." ID*
>
> *"Mostly just in interactions/communications with my class, project groups, professors and supervisors. We use WhatsApp and Skype a lot on our phones." ID 309*

Time Management

Some students used their smartphones to help them manage their time using various tools and applications. The following comments were made.

> *"I can't set alarms. I use my phone to schedule my days and to keep track of due dates and without it I would probably miss lectures, due dates and exams." ID 216*
>
> *"No direct impact, it would just mean that I will take longer to respond to emails and will not be able to read journal articles on the bus or in queues etc." ID 260*

Campus and Class Announcements

The following comments reveal how in not having a smartphone, the ability to receive campus and class enouncements will be impacted.

> *"I would be unaware of sudden class/venue changes or sudden happenings. I would also be out of the social loop when it comes to class communication." ID 123*
>
> *"Usually when an announcement is made on Vula, I will get an email and that usually comes on my phone." 220*
>
> *"I will not be up to date with any announcements and communications, I cannot ask questions to my classmates should I need to. I will always need to log onto a computer in order to view emails and preview tutorials or look at the jammie timetables." ID 313*

Analysis of the recommendations

Students were asked to provide any recommendations that would further enhance their learning from smartphones. Generally, two themes emerged.

Mobile friendly websites and learning material

Some students that responded to the questionnaire recommended that more mobile-friendly websites and material be made available. The university's learning management

systems, Vula was heavily criticised for being mobile-unfriendly yet it is the most important online resource that students used. Below are some comments made regarding this.

> *"More mobile friendly sites to view articles etc." ID 119*
>
> *"More user friendly sites for learning." ID 128*
>
> *"allow videos on Vula to be more mobile friendly (e.g. to enlargen them)." ID 148*
>
> *"Mobile friendly educational apps." ID 178*
>
> *"Learning from a phone would be better if the apps were more mobile friendly. Sometimes there are mobile versions but does not operate on the phone to the best of its ability." ID 248*
>
> *"Change the vula app, and make it easier and more mobile friendly. So that I can actually download the documents. Vula should also be free on every network." ID 258*
>
> *Lighter (less CPU-intensive) applications, more compatibility with all Vula subsites (some of my courses have items unavailable on mobile, which limit my mobile learning access)." ID 276*
>
> *"The vula app is only properly viewed in landscape mode, however most people use portrait mode predominantly." ID 376*
>
> *"More mobile friendly websites, e.g Vula- it is almost impossible to watch a lecture video from Vula using my phone." ID 328*
>
> *"Mobile friendly websites, most times things don't want to load properly on my smartphone which is pretty decent Huawei P8 lite, so its frustrating to do work under those conditions." ID332*

Cheaper Mobile Data

Cheaper mobile data emerged as a dominant theme for enabling mobile learning. Students are of the view that mobile data prices are still high and they need them to be lowered to enable mobile learning. Some of the comments that were made include:

> *"Data become cheaper and for universities to give students free SD cards so they can have memory on their phone to store notes." ID 120*
>
> *"Data prices need to come down, and phones shouldn't be so expensive- maybe the university can make an agreement with various phone companies to offer discounts to students." ID 159*
>
> *"If we could have access to study material for free, because you find that WiFi is not connecting well and then you have to wait for it to be fixed. Also if you don't have access to WiFi. Data is very expensive." ID 212*

"Cheaper data would make learning possible when I'm not at home or at university and have access to wifi." ID 266

"More video content of low file size would be a welcome change. I sometimes download Khan Academy videos on my Youtube app to revise on some concepts." ID 172

"Outside University campus, reduced costs of learning via making the cost of data cheaper or free (for certain websites)." ID 494

Findings and discussion

In this section, we present an overview of the findings of this research study. The study sought to investigate the impacts and consequent satisfaction of smartphone use among university students. We found out that smartphone device ownership among university students was very high with over 98% of students surveyed owning a smartphone.

The current generation of university students has been using mobile phones for many years. This research in turn set out to find out how these students are using their smartphones as a learning tool that enhances their studies. It was hypothesized that the different smartphone functionalities each have distinct positive and negative impacts on their learning. Furthermore, these impacts, as well as any issues experienced, can be assumed to correlate strongly with the students' satisfaction of using the smartphone as a learning aid.

We found that the uses of smartphones for learning purposes can be grouped into three main functional areas. Firstly, as a supporting tool (e.g. calculator, browser, calendar), then to communicate with fellow students or instructors, and finally for video/multimedia capability.

The data collected showed that the positive impacts outweigh the negative impacts substantially. Although the different functional uses of the smartphone are significantly correlated with various positive and negative impacts, the different use cases only explain a tiny fraction (4% to 14%) of the variability in impacts, so other antecedents will be needed to explain smartphone impact on learning.

On the other hand, the proposed model of positive and negative impacts, as well as the lack of any serious issues experienced, offer a satisfactory (>60%) explanation of the variability in user satisfaction with using smartphones for learning purposes. Interestingly, female students are slightly less satisfied.

Finally, there is some statistical support for the notion that satisfaction leads to continued use in a learning context, rather than use impacting on satisfaction directly.

Open-ended questions of the survey produced an in-depth understanding of how students use their smartphones for learning. In response to the most used application

for learning, most students indicated that they use internet browsers from their phones followed by email and sound recorder. We found that students also use their smartphones as an aid to listening to music while studying while others use tools like a timer to manage their study time.

We found out that if students don't have their smartphones to use for learning, their ability to communicate, easily access learning materials, campus announcements and chat groups will be affected.

Among the recommendations that were given by students was the need for mobile friendly learning resources. Student's complained that the LMS the university uses was not mobile friendly. Although other third party apps that allow for the access to the UCT's LMS, Vula, an official and supported app will be beneficial.

Access to cheaper mobile data was also a recommendation made. Students mentioned that the expensive mobile data hindered them from getting 'online' from their mobile devices to access learning material. This confirmed our findings in literature which revealed that the cost of data in South Africa was viewed as very high. In South Africa, campaigns such as #DataMustFall arose to try and bring awareness to the fact. Policy makers should then consider zero rating educational websites to allow for free access from mobile devices.

Conclusions and Recommendations

In this chapter, we revisit our main research findings and provide the research's theoretical contributions and its limitations then propose recommendations for future research.

Contribution to theory

In this research study, the research developed a new framework for investigating the impact of smartphones on student's learning. This framework can be used by other researchers to further conduct research on this field or the framework can be altered for other research.

Recommendations

In terms of recommendations, students had for improved smartphone-enabled learning, students suggested that there is a need to have more mobile-friendly websites for smartphones. Online learning management systems (LMS) such as Vula proved to be lagging in terms of their compatibility with small screens. Stakeholders need to improve the compatibility of such.

Students also rely on free WiFi to make use of their smartphones. However, we found that some students feel WiFi on campus is inadequate. This might be due to some grey areas or in-between buildings or in residences. University IT would need to investigate and improve on the campus WiFi service in this regard.

Cheaper data was also highly recommended by students. This affirms findings in the literature that in South Africa, mobile data is considered to be very expensive. Policymakers need to thus investigate the data affordability by students and ways they could enable broader access to cheaper data or access to zero-rated learning materials.

Finally, It is hoped that university administrators and academic staff will note the pervasiveness of use and positive impact of the smartphone in student learning. Thus, attention should be given to providing learning materials and other resources in a mobile-friendly format, provision of free and ample bandwidth on- and off-campus, and ensuring that the learning management system has a mobile-friendly dedicated interface.

Limitations

The research study was limited to a sample from one university setting and might not be truly representative of the population. A larger sample from across different universities would help validate the findings. However some universities are quite comparable to the University of Cape Town, such as WITS university, University of Pretoria, Stellenbosch University and University of Johannesburg. At these universities, the IT infrastructure, academic resources and penetration of smartphones among students is quite similar. However some settings are different such as at the University of Limpopo where the online academic resources and IT infrastructure does not fare well compared with the University of Cape Town.

The researcher also had limited time in carrying out the research study. Initially the researcher intended to pull a sample from across various universities in south Africa but due to time and resources constraints, the researcher ended up drawing a sample from only the University of Cape Town.

Future Research

Further research at other universities can hopefully validate or extend our findings. In particular, the weak link between use and impact need to be explained further i.e. other drivers for achieving learning impact need to be uncovered. The generalizability of the presumed positive and negative impact classifications would also be useful. Luckily, most students in higher education settings use smartphones and they are a relatively easy and accessible population to sample for academic research.

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Appendix

Appendix 1: Table of Constructs

Construct	Questionnaire Items	Research Question	Hypothesis
Section 2 Smart Phone Use (Independent Variable)	Items 1-10	Sub Question 1	
Section 3 Positive Impacts (Independent Variable)	Items 1-7	Sub Question 2	H1
Section 4 Negative Impact (Independent Variable)	Items 1-6	Sub Question 3	H2
Section 5 Issues (Independent Variable)	Items 1-11	Sub Question 4	H5
Section 6 User satisfaction (Dependent Variable)	Items 1-6	Sub Question 5	

Appendix 2: Online Survey

Section 1: Demographics

1. What is your Gender?

Male ☐ Female ☐ Prefer not to answer ☐

2. Which of the following group do you belong?

Black/African ☐ Coloured ☐ Indian/Asian ☐ White ☐ Other ☐ Prefer not to answer ☐

3. Which level are you? Undergraduate☐ Postgraduate ☐

4. Which faculty are you in? Commerce☐ EBE☐ Health Sciences ☐
Humanities ☐ Law☐ Science ☐

5. Year of Study ☐

6. What type of phone do you use? Smartphone Phone☐ Feature Phone☐

7. What size is your phone's screen? < 4 inch ☐ 4 inch - 5 inch ☐ >5 inch ☐ Not sure ☐

Section 2: Use

Please rate your frequency of use of the following mobile applications or services in relation to your studies.

		Never	**Rarely (less than 10 %)**	**Occasionally (About 30%)**	**Sometimes (About 50%)**	**Frequently (About 70%)**	**Most of the Time (About 90%)**	**Always**
1	Face Book	1	2	3	4	5	6	7
2	Instant Messaging (e.g. WhatsApp)	1	2	3	4	5	6	7
3	Email	1	2	3	4	5	6	7
4	Internet Browser	1	2	3	4	5	6	7
5	File Storage	1	2	3	4	5	6	7
6	Camera	1	2	3	4	5	6	7
7	Calendar	1	2	3	4	5	6	7
8	Memo	1	2	3	4	5	6	7
9	YouTube / Podcasts	1	2	3	4	5	6	7
10	Maps/Location Services	1	2	3	4	5	6	7

11. Which of the above mentioned applications is most important to your learning?

_____
_____

12. Which other ways do you use your smartphone for learning?

_____
_____

Section 3: Positive Outcomes

Please indicate the extent to which you agree or disagree with the following statement:

		Strongly Disagree	**Disagree**	**Somewhat disagree**	**Neither agree or disagree**	**Somewhat agree**	**Agree**	**Strongly Agree**
1	Using a smartphone for learning is saving me time	1	2	3	4	5	6	7
2	I feel comfortable using my phone to study	1	2	3	4	5	6	7
3	Multimedia helps me to understand concepts better	1	2	3	4	5	6	7
4	Using my smartphone in learning activities increases my productivity	1	2	3	4	5	6	7
5	My phone enables me to learn from anywhere	1	2	3	4	5	6	7
6	I can freely ask a question over the phone than in person	1	2	3	4	5	6	7
7	I find people are helpful on chat groups.	1	2	3	4	5	6	7

Section 4: Negative Outcomes

Please indicate the extent to which you agree or disagree with the following statement:

		Strongly Disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly Agree
1	I find it distracting to use my phone in class	1	2	3	4	5	6	7
2	I cannot use my phone to study	1	2	3	4	5	6	7
3	I find it distracting to use my phone to study	1	2	3	4	5	6	7
4	I am able to store and retrieve information on my phone	1	2	3	4	5	6	7
5	I feel disconnected/ isolated from others while learning from my smartphone	1	2	3	4	5	6	7

Section 5: Issues

Please indicate the extent to which you agree or disagree with the following statement:

		Strongly Disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly Agree
1	Small screen makes it difficult to learn	1	2	3	4	5	6	7
2	The websites I need to use are not mobile friendly	1	2	3	4	5	6	7
3	Data is expensive and I cannot afford it	1	2	3	4	5	6	7
4	I depend on free WiFi to access learning material from my phone	1	2	3	4	5	6	7
5	WiFi on Campus is adequate	1	2	3	4	5	6	7
6	I can access Vula resources from my phone	1	2	3	4	5	6	7
7	Storage space for learning material on my phone is not an issue	1	2	3	4	5	6	7
8	I do not know how to use some of the features on my phone	1	2	3	4	5	6	7
9	For my own privacy, I do not interact with my	1	2	3	4	5	6	7

	classmate on phone chat groups/							

Section 4: Satisfaction

Please indicate the extent to which you agree or disagree with the following statement:

		Strongly Disagree	**Disagree**	**Somewhat disagree**	**Neither agree or disagree**	**Somewhat agree**	**Agree**	**Strongly Agree**
1	I am happy with using my phone for learning	1	2	3	4	5	6	7
2	Generally I can access learning material from my phone	1	2	3	4	5	6	7
3	My phone is very helpful in my studies	1	2	3	4	5	6	7
4	I would recommend mobile learning to others	1	2	3	4	5	6	7
5	I enjoy learning from my phone	1	2	3	4	5	6	7

11. If your phone is taken away from you, in what ways will that impact/ affect your learning?

_____
_____
_____

12. What recommendations do you have that can make learning from your phone more possible?

_____
_____
_____
_____
_____

Appendix 3: Consent Letter

Dear Student,

I am B-Abee, Toperesu, a student enrolled in the part-time Master of Commerce programme of the Department of Information Systems at the University of Cape Town. As part of the course curriculum I am required to submit a dissertation.

The purpose of my research is to determine the impact of your smartphone on your learning experience.

This research has been approved by the Commerce Faculty Ethics in Research Committee. Your participation in this research will be greatly appreciated.

Participation is entirely voluntary and all information will be treated as confidential and used solely for the purpose of this study. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time. It will take approximately 10 minutes to complete survey.

The link to the survey is
https://ucpcommerce.eu.qualtrics.com/jfe/form/SV_esWdhq65z0TS4ap

Kind Regards,

Researcher: B-Abee Toperesu (tprbab001@myuct.ac.za)
Supervisor: Prof Jean-Paul Van Belle jean-paul.vanbelle@uct.ac.za

Appendix 4: Ethics Approval Letter

Faculty of Commerce

Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
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E-mail: com-faculty@uct.ac.za
Internet: www.uct.ac.za
@Commerce_UCT **UCT Commerce Faculty Office**

14/09/2017

Mr B-Abee Toperesu
Department Information Systems
University of Cape Town

REF: REC2017/009/006

Dear B-Abee Toperesu

Project: The Impact of a Smart Phone on the Student's Learning Experience in Higher Education Institutions in South Africa.

It is a pleasure to inform you that the EiRC has **formally approved** the above-mentioned study.

Approval is granted for the period of 12 months. Should you require an extension or make any substantial changes to the research methodology which could affect the experiences of participants, you must submit a revised protocol to the Committee for approval.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Your sincerely

Litha Tyulu
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University of Cape Town
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Appendix 5: Factor Analysis

Variable	Factor Loadings (Varimax normalized) (Data_Set Ver 5 (Autosaved)) Extraction: Principal components (Marked loadings are >,500000) Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	**Factor 14**
UseFacebook	0,101562	-0,150984	0,033210	-0,025953	0,743159	-0,079266	-0,075294	-0,112833	0,100969	0,104913	-0,033390	-0,015160	-0,183133	0,105584
UseIM	0,113119	0,248848	0,121097	0,020807	0,706038	0,074143	-0,096439	0,200420	-0,009607	-0,063415	-0,048577	-0,073668	0,201973	0,083810
UseEmail	0,188421	0,764996	-0,041072	-0,048603	0,184034	0,043440	-0,076281	-0,062079	0,051686	-0,095195	0,044536	-0,059475	0,116757	0,063252
UseBrowser	0,103485	0,785747	0,163459	0,005086	-0,007087	0,060717	-0,004221	0,072613	-0,007020	0,143674	0,049752	-0,110241	0,037270	-0,041450
UseStorage	0,154285	0,770730	-0,031389	0,019536	-0,007325	-0,074707	-0,028764	0,017303	-0,063354	0,121320	0,077036	0,130895	-0,094357	-0,021030
UseCamera	0,095731	0,404331	0,025210	0,184181	0,586104	0,221656	0,139682	0,061896	-0,104612	-0,115770	0,077131	0,067404	0,178947	-0,134602
UseCal	0,131974	0,561121	-0,202196	0,057768	0,169269	0,108753	0,003398	-0,041890	0,086114	0,100600	0,071272	0,176010	-0,103015	-0,294778
UseMemo	0,091319	0,226793	-0,191083	0,033879	0,257514	0,164910	0,295510	0,107777	-0,076110	0,384751	0,218443	0,079812	0,088683	-0,364387
UseYouTube	0,185638	0,200464	0,061959	0,115021	0,204808	0,015696	-0,130654	-0,063477	-0,029752	0,777158	0,021779	-0,064884	0,103465	0,019103
UseMaps	0,075060	0,119219	-0,036581	0,010336	0,739568	0,073691	0,046337	-0,058585	0,050064	0,288355	0,127082	0,070759	-0,013331	-0,172625
PosTime	0,619604	0,236839	0,022495	-0,022892	0,089789	0,198041	-0,038294	-0,034691	0,037738	-0,233416	0,373865	0,068638	-0,037919	-0,034346
PosComfort	0,777972	0,121566	0,049979	0,066445	0,030771	0,057801	0,003546	-0,126221	-0,045679	-0,015667	0,292237	-0,009041	0,017463	0,020789
PosUnderstand	0,303699	0,169208	0,039370	0,008104	-0,008837	0,090384	-0,065094	0,068996	0,090174	0,100042	0,738143	0,020395	0,058145	0,040060
PosProductivity	0,682495	0,086367	-0,068379	-0,087885	0,189217	-0,030397	0,038903	0,027392	0,002948	-0,021362	0,351477	0,033886	-0,050764	-0,167610
PosAnywhere	0,552893	0,040214	0,083093	0,037915	0,142000	0,115776	-0,035274	0,074280	-0,200515	-0,060858	0,479970	0,020627	0,073178	0,067276
PosAskQue	0,213465	0,035870	0,074837	0,058715	0,048664	0,767969	-0,017873	-0,101036	-0,176264	0,064005	0,014879	0,053810	-0,033188	0,101317
PosChatgroups	0,164474	0,048569	-0,021254	-0,027555	0,066345	0,807655	-0,020504	0,096514	0,200684	-0,024501	0,116118	-0,023770	-0,021435	-0,076029
NegDistructClass	-0,378457	-0,112989	-0,104255	0,124707	0,002042	0,056195	0,153149	0,029455	0,150602	0,016230	0,104557	0,129502	-0,035695	0,696154
NegPhone	-0,729941	-0,038400	-0,030299	-0,025189	0,138244	0,063546	0,163185	0,131913	-0,065556	0,006252	-0,125396	0,072419	-0,098872	0,239248
NegDestructStudy	-0,715713	-0,079147	-0,038908	-0,039444	0,027099	0,054279	0,078644	0,142779	-0,042828	0,034180	0,004841	0,111648	-0,090887	0,414487
NegStore	0,170686	0,118073	0,116689	0,135017	-0,030663	0,037359	-0,065753	0,064061	-0,116062	-0,133766	0,016648	0,778022	0,002616	0,131790
NegIsolated	-0,444977	0,016698	0,317563	-0,035273	-0,087930	-0,049388	0,291261	-0,022028	-0,185148	0,215839	0,074944	-0,148651	-0,228824	0,101657
IsuSmallScreen	-0,162185	0,001323	0,103003	0,057034	0,036373	-0,078008	0,121619	0,795493	-0,013496	-0,056268	0,058858	-0,016691	-0,265993	0,035986
IsuMobileFriendly	-0,132429	0,001719	-0,108516	0,133877	-0,028513	0,062328	0,009858	0,153968	0,055898	-0,103379	-0,066089	-0,073553	-0,835237	0,034368
IsuData	-0,060896	-0,026170	-0,053329	0,821182	-0,022697	0,050938	0,019521	0,004858	0,010082	0,072147	0,120369	0,004078	-0,188861	-0,122917
IsuWiFi	0,071561	0,041366	0,086871	0,786353	0,092946	-0,023740	0,051942	0,028810	0,119436	0,035015	-0,109089	-0,002873	0,059725	0,194552
IssueCampusWiFi	0,070591	0,017019	0,158171	0,114243	0,066169	0,021825	0,005624	0,014568	0,858857	-0,035819	0,027307	-0,002121	-0,050217	0,090745
IssueVuka	0,095460	-0,009687	0,789057	0,023117	0,085026	-0,017335	-0,089608	0,000903	0,220598	-0,005664	-0,008752	0,176230	0,072985	-0,026559
Issue Storage	0,063410	-0,110986	0,253775	-0,323180	0,068149	-0,010927	0,009350	-0,129520	0,243758	0,158591	0,035010	0,619475	0,158227	-0,078069
IssueFeatures	-0,056051	-0,078587	-0,137821	0,059891	-0,060967	0,004533	0,849734	0,066401	0,035673	-0,078813	-0,058085	-0,042450	0,032590	0,079700
IssuePrivacy	-0,060060	-0,030227	0,149509	0,031094	0,069120	-0,235978	0,494705	-0,544523	-0,080619	-0,031398	-0,068748	-0,036816	-0,279258	0,008354
SatLearning	0,826534	0,101285	0,081835	0,020001	0,065049	0,125463	-0,004426	-0,079374	0,004429	0,037151	0,068502	0,048719	0,022124	0,012300
SatAccess	0,455693	0,018914	0,550776	0,021530	0,037712	0,225790	-0,100452	0,137247	-0,054984	0,055869	0,151455	0,196663	0,100382	-0,059818
SatHelpful	0,740418	0,101860	0,073383	-0,018810	0,111644	0,140515	0,011853	0,132217	0,037597	0,085351	-0,011808	0,128934	0,049897	-0,073886
SatRecomend	0,816476	0,118275	-0,009227	-0,054949	0,081917	0,137627	0,038134	0,097081	0,056624	0,186728	-0,110552	0,117506	0,020049	0,041814
SatEnjoy	0,821730	0,099940	0,082579	0,008850	0,089558	0,108427	-0,000273	-0,060704	0,021285	0,203211	-0,061731	0,089374	0,022947	0,059745
Expl.Var	6,367506	2,679649	1,386812	1,551977	2,281369	1,624779	1,306941	1,208918	1,123606	1,199572	1,347628	1,264880	1,179455	1,176938
Prp.Totl	0,176875	0,074435	0,038523	0,043110	0,063371	0,045133	0,036304	0,033581	0,031211	0,033321	0,037434	0,035136	0,032763	0,032693

Appendix 6: Correlation Analysis Grouped

Variable	Correlations (Final Quantitative Data Set)Marked correlations are significant at p < ,05000N=402 (Casewise deletion of missing data)																	
	DemGender	DemEthnic	DemProg	DemYear	DemPhone	DemSize	UseTools	UseSocial	UseVideo	PosLocation	PosSupport	PosUnderstanding	NegClass	NegDistraction	IssScreenSize	IssContent	IssData	IssVula	Satisfaction
DemGender	1,000000	0,001872	-0,066203	-0,103600	-0,100948	-0,024056	-0,017086	0,059511	-0,097660	0,000392	0,069158	-0,004582	-0,046046	0,126877	0,080332	-0,004309	0,026530	-0,071749	-0,105866
DemEthnic	0,001872	1,000000	-0,013544	0,027376	0,014617	0,066048	0,027187	0,027457	0,132981	0,064599	0,102368	0,012766	-0,158253	-0,066796	-0,076815	-0,023090	-0,019322	-0,018245	0,131461
DemProg	-0,066203	-0,013544	1,000000	0,225798	-0,010720	0,035242	0,076627	-0,003346	-0,084975	0,073473	-0,011651	0,000352	-0,105195	-0,110231	-0,005594	0,079974	-0,112254	-0,193236	0,071896
DemYear	-0,103600	0,027376	0,225798	1,000000	-0,036134	-0,005213	-0,025527	-0,025098	-0,110503	0,079291	0,076682	0,030457	0,024646	-0,010530	0,048210	0,037157	0,054458	-0,042011	0,019715
DemPhone	-0,100948	0,014617	-0,010720	-0,036134	1,000000	-0,075962	0,025040	-0,055055	0,059339	-0,090910	-0,052035	-0,105098	-0,226699	-0,038668	-0,096000	-0,027387	0,059772	-0,056242	0,006017
DemSize	-0,024056	0,066048	0,035242	-0,005213	-0,075962	1,000000	-0,017839	-0,081310	0,046882	-0,048269	0,064623	0,039855	-0,044064	0,024937	-0,018045	-0,083979	-0,072424	0,077853	-0,011249
UseTools	-0,017086	0,027187	0,076627	-0,025527	0,025040	-0,017839	1,000000	0,337218	0,282857	0,345058	0,149645	0,271932	-0,203297	-0,235397	-0,029310	-0,051440	0,051445	0,012718	0,311698
UseSocial	0,059511	0,027457	-0,003346	-0,025098	-0,055055	-0,081310	0,337218	1,000000	0,335193	0,272876	0,192051	0,147315	-0,086088	-0,079097	0,007098	-0,088678	0,102467	0,104392	0,267342
UseVideo	-0,097660	0,132981	-0,084975	-0,110503	0,059339	0,046882	0,282857	0,335193	1,000000	0,193887	0,115769	0,155502	-0,141419	-0,175189	-0,103973	-0,150635	0,117053	0,094414	0,264062
PosLocatior	0,000392	0,064599	0,073473	0,079291	-0,090910	-0,048269	0,345058	0,272876	0,193887	1,000000	0,320479	0,484289	-0,322792	-0,640871	-0,116884	-0,153521	0,016578	0,119550	0,736332
PosSupport	0,069158	0,102368	-0,011651	0,076682	-0,052035	0,064623	0,149645	0,192051	0,115769	0,320479	1,000000	0,221507	-0,033320	-0,147340	-0,021459	-0,004916	0,050232	0,042600	0,327481
PosUnderst	-0,004582	0,012766	0,000352	0,030457	-0,105098	0,039855	0,271932	0,147315	0,155502	0,484289	0,221507	1,000000	-0,108567	-0,275044	-0,008640	-0,084234	0,033082	0,071685	0,353866
NegClass	-0,046046	-0,158253	-0,105195	0,024646	-0,226699	-0,044064	-0,203297	-0,086088	-0,141419	-0,322792	-0,033320	-0,108567	1,000000	0,471626	0,162254	0,128078	0,145478	-0,037411	-0,333607
NegDistract	0,126877	-0,066796	-0,110231	-0,010530	-0,038668	0,024937	-0,235397	-0,079097	-0,175189	-0,640871	-0,147340	-0,275044	0,471626	1,000000	0,234927	0,215480	0,011554	-0,091625	-0,641494
IssScreenSi	0,080332	-0,076815	-0,005594	0,048210	-0,096000	-0,018045	-0,029310	0,007098	-0,103973	-0,116884	-0,021459	-0,008640	0,162254	0,234927	1,000000	0,238350	0,093812	0,008753	-0,185406
IssContent	-0,004309	-0,023090	0,079974	0,037157	-0,027387	-0,083979	-0,051440	-0,088678	-0,150635	-0,153521	-0,004916	-0,084234	0,128078	0,215480	0,238350	1,000000	0,172290	-0,136810	-0,186196
IssData	0,026530	-0,019322	-0,112254	0,054458	0,059772	-0,072424	0,051445	0,102467	0,117053	0,016578	0,050232	0,033082	0,145478	0,011554	0,093812	0,172290	1,000000	0,035550	0,023439
IssVula	-0,071749	-0,018245	-0,193236	-0,042011	-0,056242	0,077853	0,012718	0,104392	0,094414	0,119550	0,042600	0,071685	-0,037411	-0,091625	0,008753	-0,136810	0,035550	1,000000	0,175273
Satisfaction	-0,105866	0,131461	0,071896	0,019715	0,006017	-0,011249	0,311698	0,267342	0,264062	0,736332	0,327481	0,353866	-0,333607	-0,641494	-0,185406	-0,186196	0,023439	0,175273	1,000000

Appendix 7: Correlation Matrix All

Correlations (Data_Set Ver 5 (Autosaved)) Marked correlations are significant at p < ,05000 N=398 (Casewise deletion of missing data)

Variable	DemGender	DemEthnic	DemProg	DemYear	DemPhone	DemSize	UseFacebook	UseIM	UseEmail	UseBrowser	UseStorage	UseCamera	UseCal	UseMemo	UseYouTube	UseMaps	PosTime	PosComfort	PosUnderstand	PosProductivity	PosAnywhere	PosAskQue	PosChatgroups	NegDistractClass	NegPhone	NegDestructStudy	NegStore	NegIsolated	IsuSmallScreen	IsuMobileFriendly	IsuData	IsuWiFi	IssueCampusWiFi	IssueVula	Issue Storage	IssueFeatures	IssuePrivacy	SatLearning	SatAccess	SatHelpful	SatRecommend	SatEnjoy
DemGender	1,000000	-0,004881	-0,069478	-0,101470	-0,102837	-0,027785	0,001617	0,059030	0,042949	0,071531	-0,037390	0,169727	-0,093466	0,011164	-0,099173	-0,050881	0,053786	-0,005039	-0,011595	-0,095588	0,051477	0,089932	0,030078	-0,041276	0,143777	0,116917	0,023538	0,015600	0,087600	0,005742	-0,012610	0,054330	-0,058482	-0,073927	-0,220306	0,151726	0,025453	-0,092885	-0,069762	-0,056946	-0,128479	-0,151308
DemEthnic	-0,004881	1,000000	-0,011572	0,029199	0,013920	0,071116	-0,033264	0,018079	-0,037160	0,022531	0,014802	0,073600	0,067751	0,121225	0,129839	0,011663	-0,001804	0,076449	0,009330	0,056932	0,064325	0,132125	0,044689	-0,154152	-0,018919	-0,096879	0,056587	0,023314	-0,075355	-0,019233	0,017121	-0,049932	-0,102765	-0,017934	-0,055849	-0,023533	0,053546	0,105745	0,098467	0,042130	0,123620	0,159715
DemProg	-0,069478	-0,011572	1,000000	0,223574	-0,010282	0,029833	0,068452	-0,150886	0,087595	-0,015047	0,034786	-0,073471	0,115167	0,156796	-0,078067	0,144023	0,080924	0,053996	-0,006747	0,107808	-0,015225	-0,062622	0,040850	-0,109931	-0,082338	-0,119078	-0,083035	0,020003	-0,002957	0,083069	-0,040673	-0,148105	0,091103	-0,196306	-0,058336	0,101433	0,058956	0,074081	-0,057964	-0,023016	0,130325	0,054674
DemYear	-0,101470	0,029199	0,223574	1,000000	-0,036502	-0,010580	0,054293	-0,126924	-0,028439	-0,025144	-0,072762	0,006980	0,053757	0,034920	-0,108763	-0,000017	0,082533	0,052858	0,025088	0,086224	0,056269	0,039755	0,088220	0,023442	-0,018503	-0,015752	0,053206	-0,037292	0,047685	0,031100	0,087096	0,016928	-0,016989	-0,042697	0,035725	0,147830	-0,017171	0,023903	-0,009276	0,015239	0,046554	-0,011461
DemPhone	-0,102837	0,013920	-0,010282	-0,036502	1,000000	-0,077669	-0,017314	-0,087653	0,048492	0,009737	0,008562	-0,074122	0,015109	-0,007097	0,059294	0,006811	-0,080005	-0,078302	-0,106114	-0,084638	-0,052130	-0,083401	-0,002450	-0,226665	-0,017078	-0,054372	-0,114054	0,041215	-0,095754	-0,027151	0,048318	0,052793	-0,003355	-0,056379	-0,081345	-0,022675	-0,051930	0,005111	-0,068852	0,005456	-0,010261	0,015508
DemSize	-0,027785	0,071116	0,029833	-0,010580	-0,077669	1,000000	-0,049210	-0,015008	-0,044444	0,025619	0,025015	-0,083276	-0,035526	-0,045222	0,063262	-0,061230	-0,058104	-0,006233	0,042181	-0,003754	-0,067512	0,109175	-0,018726	-0,052236	-0,007830	0,048807	0,106055	0,052741	-0,011938	-0,086816	-0,091813	-0,017257	-0,024297	0,073532	0,120571	-0,073416	-0,005579	0,006821	0,036039	-0,050990	-0,033159	-0,004079
UseFacebook	0,001617	-0,033264	0,068452	0,054293	-0,017314	-0,049210	1,000000	0,339744	0,053331	-0,037823	-0,015739	0,203804	0,043270	0,083201	0,167245	0,436063	0,028577	0,066105	0,000657	0,164013	0,074748	0,041048	0,042957	0,014254	0,012751	-0,064829	-0,025136	-0,047704	-0,019339	0,001917	0,020274	0,082818	0,106024	0,113286	0,104707	-0,015355	0,046740	0,096492	0,048547	0,058613	0,118208	0,139441
UseIM	0,059030	0,018079	-0,150886	-0,126924	-0,087653	-0,015008	0,339744	1,000000	0,340859	0,226245	0,145399	0,493938	0,157316	0,224046	0,211728	0,422091	0,176759	0,139156	0,116480	0,178347	0,150150	0,124595	0,119418	-0,054072	-0,032588	-0,064318	0,054261	-0,104628	0,063953	-0,092573	-0,008473	0,086024	0,097113	0,102746	0,056526	-0,127155	-0,131923	0,175855	0,197615	0,201421	0,189209	0,182804
UseEmail	0,042949	-0,037160	0,087595	-0,028439	0,048492	-0,044444	0,053331	0,340859	1,000000	0,500977	0,482289	0,348188	0,394045	0,263083	0,179270	0,205481	0,327575	0,248660	0,227615	0,218594	0,184668	0,088672	0,141459	-0,151848	-0,177941	-0,217080	0,113768	-0,124762	-0,084213	-0,093757	-0,076770	0,048097	0,050913	0,007973	-0,053535	-0,125934	-0,078806	0,251427	0,117807	0,219454	0,226468	0,234306
UseBrowser	0,071531	0,022531	-0,015047	-0,025144	0,009737	0,025619	-0,037823	0,226245	0,500977	1,000000	0,537122	0,321097	0,356526	0,201017	0,288285	0,157133	0,224427	0,183122	0,242997	0,160649	0,131748	0,113213	0,113194	-0,172740	-0,129861	-0,172196	0,060366	-0,044733	0,030494	-0,052935	0,039102	0,018162	0,011387	0,062493	-0,037737	-0,061387	-0,068545	0,180141	0,165488	0,185922	0,190271	0,159688
UseStorage	-0,037390	0,014802	0,034786	-0,072762	0,008562	0,025015	-0,015739	0,145399	0,482289	0,537122	1,000000	0,290291	0,396149	0,225410	0,240350	0,153106	0,260608	0,221856	0,194059	0,224132	0,181661	0,061738	0,052960	-0,165820	-0,147618	-0,164444	0,147478	-0,062280	0,011006	-0,015896	0,035171	0,044712	-0,021031	-0,002225	0,002571	-0,069449	-0,051954	0,197049	0,096081	0,187097	0,196060	0,192284
UseCamera	0,169727	0,073600	-0,073471	0,006980	-0,074122	-0,083276	0,203804	0,493938	0,348188	0,321097	0,290291	1,000000	0,378046	0,305017	0,204899	0,464618	0,276287	0,205304	0,170274	0,232156	0,238000	0,196933	0,216752	-0,092048	-0,033097	-0,109864	0,096222	-0,094815	0,020392	-0,090906	0,100027	0,140058	0,007164	0,048624	0,009699	0,008058	-0,046797	0,204521	0,163693	0,235172	0,204732	0,207867
UseCal	-0,093466	0,067751	0,115167	0,053757	0,015109	-0,035526	0,043270	0,157316	0,394045	0,356526	0,396149	0,378046	1,000000	0,316268	0,164471	0,295391	0,259129	0,188383	0,185271	0,245636	0,137735	0,099303	0,132106	-0,134027	-0,140704	-0,181261	0,029326	-0,098832	-0,049575	-0,005504	0,068402	0,040969	-0,002386	-0,012461	-0,005806	-0,088275	-0,066009	0,200637	0,096068	0,240117	0,253275	0,242028
UseMemo	0,011164	0,121225	0,156796	0,034920	-0,007097	-0,045222	0,083201	0,224046	0,263083	0,201017	0,225410	0,305017	0,316268	1,000000	0,281356	0,354351	0,154439	0,185999	0,170614	0,229283	0,214923	0,148908	0,165434	-0,154701	-0,077442	-0,147778	0,015614	-0,005824	0,010266	-0,068723	0,055185	0,013266	-0,048076	-0,088119	0,004590	0,049196	0,007534	0,170624	0,082080	0,192106	0,197900	0,172000
UseYouTube	-0,099173	0,129839	-0,078067	-0,108763	0,059294	0,063262	0,167245	0,211728	0,179270	0,288285	0,240350	0,204899	0,164471	0,281356	1,000000	0,377607	0,089517	0,204605	0,157200	0,171013	0,146321	0,140560	0,064670	-0,136319	-0,166212	-0,160901	0,000570	-0,055276	-0,107583	-0,151756	0,076470	0,115962	0,014625	0,097862	0,069484	-0,137088	-0,026153	0,193733	0,149859	0,216224	0,253150	0,274498
UseMaps	-0,050881	0,011663	0,144023	-0,000017	0,006811	-0,061230	0,436063	0,422091	0,205481	0,157133	0,153106	0,464618	0,295391	0,354351	0,377607	1,000000	0,158934	0,128619	0,151880	0,220656	0,178706	0,098891	0,154137	-0,104011	-0,010446	-0,111388	0,024262	-0,069670	-0,038874	-0,074876	0,014581	0,059094	0,077481	0,053926	0,081291	-0,043380	0,045748	0,158042	0,125924	0,223240	0,183169	0,194512
PosTime	0,053786	-0,001804	0,080924	0,082533	-0,080005	-0,058104	0,028577	0,176759	0,327575	0,224427	0,260608	0,276287	0,259129	0,154439	0,089517	0,158934	1,000000	0,658011	0,408013	0,594714	0,496812	0,245738	0,345483	-0,240614	-0,460024	-0,434984	0,198588	-0,294347	-0,085046	-0,083722	-0,018281	0,023374	0,069764	0,133531	0,076879	-0,115428	-0,015189	0,548062	0,340361	0,508397	0,509605	0,468591
PosComfort	-0,005039	0,076449	0,053996	0,052858	-0,078302	-0,006233	0,066105	0,139156	0,248660	0,183122	0,221856	0,205304	0,188383	0,185999	0,204605	0,128619	0,658011	1,000000	0,392215	0,568298	0,536148	0,234797	0,201848	-0,259440	-0,612338	-0,569968	0,162524	-0,278341	-0,164605	-0,151661	0,031383	0,061237	0,052004	0,101478	0,074287	-0,094227	-0,038160	0,698347	0,396182	0,529379	0,568550	0,632253
PosUnderstand	-0,011595	0,009330	-0,006747	0,025088	-0,106114	0,042181	0,000657	0,116480	0,227615	0,242997	0,194059	0,170274	0,185271	0,170614	0,157200	0,151880	0,408013	0,392215	1,000000	0,410391	0,381298	0,188344	0,191634	-0,106348	-0,284697	-0,223753	0,112937	-0,160842	-0,006145	-0,081741	0,047323	0,009904	0,068351	0,071836	0,074221	-0,073696	-0,158123	0,338100	0,334454	0,284587	0,296550	0,300666
PosProductivity	-0,095588	0,056932	0,107808	0,086224	-0,084638	-0,003754	0,164013	0,178347	0,218594	0,160649	0,224132	0,232156	0,245636	0,229283	0,171013	0,220656	0,594714	0,568298	0,410391	1,000000	0,504686	0,184503	0,175591	-0,355922	-0,503043	-0,526088	0,112240	-0,267252	-0,063568	-0,119357	-0,060491	0,003573	0,036390	0,054599	0,116993	-0,009987	-0,094105	-0,129556	0,497607	0,425273	0,463627	0,512052	0,526829	0,526871
PosAnywhere	0,051477	0,064325	-0,015225	0,056269	-0,052130	-0,067512	0,074748	0,150150	0,184668	0,131748	0,181661	0,238000	0,137735	0,214923	0,146321	0,178706	0,496812	0,536148	0,381298	0,504686	1,000000	0,230373	0,219120	-0,167985	-0,380104	-0,330031	0,175711	-0,249730	-0,058289	-0,131584	-0,006325	0,020647	0,003645	0,120415	-0,009987	-0,094105	-0,129556	0,497607	0,425273	0,463627	0,402681	0,436494
PosAskQue	0,089932	0,132125	-0,062622	0,039755	-0,083401	0,109175	0,041048	0,124595	0,088672	0,113213	0,061738	0,196933	0,099303	0,148908	0,140560	0,098891	0,245738	0,234797	0,188344	0,184503	0,230373	1,000000	0,423973	-0,035148	-0,126865	-0,121926	0,149973	-0,126205	-0,048906	-0,019741	0,021840	0,078101	-0,016281	0,031427	0,031231	-0,028328	-0,096396	0,280451	0,262572	0,198553	0,246623	0,251638
PosChatgroups	0,030078	0,044689	0,040850	0,088220	-0,002450	-0,018726	0,042957	0,119418	0,141459	0,113194	0,052960	0,216752	0,132106	0,165434	0,064670	0,154137	0,345483	0,201848	0,191634	0,175591	0,219120	0,423973	1,000000	-0,028220	-0,114339	-0,111365	0,061688	-0,132819	0,015684	0,008493	0,061260	-0,011250	0,120457	0,037957	0,029911	-0,036454	-0,236620	0,228325	0,223683	0,275382	0,240917	0,220826
NegDistractClass	-0,041276	-0,154152	-0,109931	0,023442	-0,226665	-0,052236	0,014254	-0,054072	-0,151848	-0,172740	-0,165820	-0,092048	-0,134027	-0,154701	-0,136319	-0,104011	-0,240614	-0,259440	-0,106348	-0,355922	-0,167985	-0,035148	-0,028220	1,000000	0,367685	0,508312	0,015523	0,205437	0,162513	0,126110	0,107552	0,138679	0,095478	-0,038672	-0,015996	0,165154	0,071086	-0,312766	-0,191053	-0,279342	-0,285762	-0,278914
NegPhone	0,143777	-0,018919	-0,082338	-0,018503	-0,017078	-0,007830	0,012751	-0,032588	-0,177941	-0,129861	-0,147618	-0,033097	-0,140704	-0,077442	-0,166212	-0,010446	-0,460024	-0,612338	-0,284697	-0,503043	-0,380104	-0,126865	-0,114339	0,367685	1,000000	0,721138	-0,090386	0,339255	0,195836	0,201177	0,006244	0,032924	-0,065893	-0,081666	-0,090509	0,178643	0,081882	-0,588237	-0,346225	-0,463620	-0,470974	-0,547471
NegDestructStudy	0,116917	-0,096879	-0,119078	-0,015752	-0,054372	0,048807	-0,064829	-0,064318	-0,217080	-0,172196	-0,164444	-0,109864	-0,181261	-0,147778	-0,160901	-0,111388	-0,434984	-0,569968	-0,223753	-0,526088	-0,330031	-0,121926	-0,111365	0,508312	0,721138	1,000000	-0,067435	0,330142	0,234966	0,182993	0,016240	-0,000716	-0,043618	-0,088391	-0,041082	0,108043	0,059047	-0,549210	-0,323884	-0,463456	-0,506470	-0,535321
NegStore	0,023538	0,056587	-0,083035	0,053206	-0,114054	0,106055	-0,025136	0,054261	0,113768	0,060366	0,147478	0,096222	0,029326	0,015614	0,000570	0,024262	0,198588	0,162524	0,112937	0,112240	0,175711	0,149973	0,061688	0,015523	-0,090386	-0,067435	1,000000	-0,093738	0,025724	-0,071288	0,027024	0,073905	0,075815	0,177397	0,236601	-0,059810	-0,083106	0,171948	0,272496	0,167787	0,167806	0,151689
NegIsolated	0,015600	0,023314	0,020003	-0,037292	0,041215	0,052741	-0,047704	-0,104628	-0,124762	-0,044733	-0,062280	-0,094815	-0,098832	-0,005824	-0,055276	-0,069670	-0,294347	-0,278341	-0,160842	-0,267252	-0,249730	-0,126205	-0,132819	0,205437	0,339255	0,330142	-0,093738	1,000000	0,116720	0,130342	0,047840	0,000361	-0,074248	-0,014814	-0,072003	0,150692	0,134012	-0,325841	-0,162772	-0,358805	-0,330036	-0,257453
IsuSmallScreen	0,087600	-0,075355	-0,002957	0,047685	-0,095754	-0,011938	-0,019339	0,063953	-0,084213	0,030494	0,011006	0,020392	-0,049575	0,010266	-0,107583	-0,038874	-0,085046	-0,164605	-0,006145	-0,063568	-0,058289	-0,048906	0,015684	0,162513	0,195836	0,234966	0,025724	0,116720	1,000000	0,235663	0,098105	0,059455	0,032223	0,010384	-0,133487	0,071797	-0,106159	-0,189139	-0,024974	-0,083592	-0,132009	-0,211124
IsuMobileFriendly	0,005742	-0,019233	0,083069	0,031100	-0,027151	-0,086816	0,001917	-0,092573	-0,093757	-0,052935	-0,015896	-0,090906	-0,005504	-0,068723	-0,151756	-0,074876	-0,083722	-0,151661	-0,081741	-0,119357	-0,131584	-0,019741	0,008493	0,126110	0,201177	0,182993	-0,071288	0,130342	0,235663	1,000000	0,213237	0,086506	0,057580	-0,136729	-0,227622	0,113323	0,072494	-0,151655	-0,167608	-0,147806	-0,139504	-0,181682
IsuData	-0,012610	0,017121	-0,040673	0,087096	0,048318	-0,091813	0,020274	-0,008473	-0,076770	0,039102	0,035171	0,100027	0,068402	0,055185	0,076470	0,014581	-0,018281	0,031383	0,047323	-0,060491	-0,006325	0,021840	0,061260	0,107552	0,006244	0,016240	0,027024	0,047840	0,098105	0,213237	1,000000	0,400720	0,064293	-0,076184	-0,211874	0,075140	0,054473	-0,018368	0,000359	-0,022937	-0,058789	-0,022061
IsuWiFi	0,054330	-0,049932	-0,148105	0,016928	0,052793	-0,017257	0,082818	0,086024	0,048097	0,018162	0,044712	0,140058	0,040969	0,013266	0,115962	0,059094	0,023374	0,061237	0,009904	0,003573	0,020647	0,078101	-0,011250	0,138679	0,032924	-0,000716	0,073905	0,000361	0,059455	0,086506	0,400720	1,000000	0,162888	0,134778	-0,130235	0,064849	0,005837	0,082313	0,020808	0,044188	0,052039	0,086708
IssueCampusWiFi	-0,058482	-0,102765	0,091103	-0,016989	-0,003355	-0,024297	0,106024	0,097113	0,050913	0,011387	-0,021031	0,007164	-0,002386	-0,048076	0,014625	-0,038160	-0,158123	-0,071505	-0,129556	-0,096396	-0,236620	0,071086	0,081882	0,059047	-0,083106	0,134012	-0,106159	0,072494	0,054473	0,005837	-0,009436	-0,009701	-0,018756	0,229169	1,000000	-0,049691	-0,148515	-0,088145	-0,127665	-0,058964	0,094831
IssueVula	-0,073927	-0,017934	-0,196306	-0,042697	-0,056379	0,073532	0,113286	0,102746	0,007973	0,062493	-0,002225	0,048624	-0,012461	-0,088119	0,097862	0,053926	0,133531	0,101478	0,071836	0,054599	0,120415	0,031427	0,037957	-0,038672	-0,081666	-0,088391	0,177397	-0,014814	0,010384	-0,136729	-0,076184	0,134778	0,218477	1,000000	0,307440	-0,156714	-0,009701	0,124059	0,383573	0,172464	0,132516	0,177237
Issue Storage	-0,220306	-0,055849	-0,058336	0,035725	-0,081345	0,120571	0,104707	0,056526	-0,053535	-0,037737	0,002571	0,009699	-0,005806	0,004590	0,069484	0,081291	0,076879	0,074287	0,074221	0,116993	-0,009987	0,031231	0,029911	-0,015996	-0,090509	-0,041082	0,236601	-0,072003	-0,133487	-0,227622	-0,211874	-0,130235	0,100632	0,307440	1,000000	-0,072623	-0,018756	0,141854	0,247131	0,147775	0,133624	0,138352
IssueFeatures	0,151726	-0,023533	0,101433	0,147830	-0,022675	-0,073416	-0,015355	-0,127155	-0,125934	-0,061387	-0,069449	0,008058	-0,088275	0,049196	-0,137088	-0,043380	-0,115428	-0,094227	-0,073696	-0,060791	-0,094105	-0,028328	-0,036454	0,165154	0,178643	0,108043	-0,059810	0,150692	0,071797	0,113323	0,075140	0,064849	-0,029307	-0,156714	-0,072623	1,000000	0,229169	-0,116289	-0,170414	-0,121941	-0,064203	-0,122640
IssuePrivacy	0,025453	0,053546	0,058956	-0,017171	-0,051930	-0,005579	0,046740	-0,131923	-0,078806	-0,068545	-0,051954	-0,046797	-0,066009	0,007534	-0,026153	0,045748	-0,115189	-0,038160	-0,158123	-0,071505	-0,129556	-0,096396	-0,236620	0,071086	0,081882	0,059047	-0,083106	0,134012	-0,106159	0,072494	0,054473	0,005837	-0,009436	-0,009701	-0,018756	0,229169	1,000000	-0,049691	-0,148515	-0,088145	-0,127665	-0,058964
SatLearning	-0,092885	0,105745	0,074081	0,023903	0,005111	0,006821	0,096492	0,175855	0,251427	0,180141	0,197049	0,204521	0,200637	0,170624	0,193733	0,158042	0,548062	0,698347	0,338100	0,556934	0,497607	0,280451	0,228325	-0,312766	-0,588237	-0,549210	0,171948	-0,325841	-0,189139	-0,151655	-0,018368	0,082313	0,095812	0,124059	0,141854	-0,116289	-0,049691	1,000000	0,473869	0,629929	0,657416	0,693017
SatAccess	-0,069762	0,098467	-0,057964	-0,009276	-0,068852	0,036039	0,048547	0,197615	0,117807	0,165488	0,096081	0,163693	0,096068	0,082080	0,149859	0,125924	0,340361	0,396182	0,334454	0,267193	0,425273	0,262572	0,223683	-0,191053	-0,346225	-0,323884	0,272496	-0,162772	-0,024974	-0,167608	0,000359	0,020808	0,098261	0,383573	0,247131	-0,170414	-0,148515	0,473869	1,000000	0,473144	0,423881	0,442794
SatHelpful	-0,056946	0,042130	-0,023016	0,015239	0,005456	-0,050990	0,058613	0,201421	0,219454	0,185922	0,187097	0,235172	0,240117	0,192106	0,216224	0,223240	0,508397	0,529379	0,284587	0,512052	0,463627	0,198553	0,275382	-0,279342	-0,463620	-0,463456	0,167787	-0,358805	-0,083592	-0,147806	-0,022937	0,044188	0,072734	0,172464	0,147775	-0,121941	-0,088145	0,629929	0,473144	1,000000	0,643291	0,617224
SatRecommend	-0,128479	0,123620	0,130325	0,046554	-0,010261	-0,033159	0,118208	0,189209	0,226468	0,190271	0,196060	0,204732	0,253275	0,197900	0,253150	0,183169	0,509605	0,568567	0,296550	0,526829	0,402681	0,246623	0,240917	-0,285762	-0,470974	-0,506470	0,188954	-0,330036	-0,132009	-0,139504	-0,058789	0,052039	0,085575	0,132516	0,133624	-0,064203	-0,127665	0,657416	0,423881	0,643291	1,000000	0,767556
SatEnjoy	-0,151308	0,159715	0,054674	-0,011461	0,015508	-0,004079	0,139441	0,182804	0,234306	0,159688	0,192284	0,207867	0,242028	0,172000	0,274498	0,194512	0,468591	0,632253	0,300666	0,526871	0,436494	0,251638	0,220826	-0,278914	-0,547471	-0,535321	0,197044	-0,257453	-0,211124	-0,181682	-0,022061	0,086708	0,094831	0,177237	0,138352	-0,122640	-0,058964	0,693017	0,442794	0,617224	0,767556	1,000000