INFORMATION NEEDS AND SEEKING BEHAVIOUR OF DOCTORAL STUDENTS USING SMARTPHONES AND TABLETS FOR LEARNING: A CASE OF THE UNIVERSITY OF CAPE COAST, GHANA

BY

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DECLARATION

I, **Kwaku Anhwere Barfi,** declare that **"**Information needs and seeking behaviour of doctoral students using smartphones and tablets for learning: a case of the University of Cape Coast, Ghana" is my work and that all sources that I have used or quoted have been indicated and acknowledged, using complete references.

9/11/2020

Signature Date

DEDICATION

The thesis is dedicated to my mother for teaching me the value of higher education, to my loving wife who has been a root of encouragement and sacrifice and to my children – may you be inspired to always work hard to make your dreams come true.

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ABSTRACT

This qualitative study investigated the information needs and information-seeking behaviour of doctoral students who use smartphones or tablets for learning. Fifteen doctoral students who are registered at the University of Cape Coast were interviewed. Ellis's (1989) model of information-seeking behaviour guided the study and supported the researcher in developing a model that could be used to acquire an understanding of how mobile technologies influence information needs and information-seeking behaviour. Two contexts influence the participants' information needs and information-seeking behaviour, namely, the academic context and their everyday life contexts. The interplay between the elements of the context in which participants find themselves and their mental structures appear to influence their information needs and information-seeking behaviour. Most of the participating students do not seem to have the required information literacy skills to seek information in an online environment. The contextual elements that appear to influence the participants' information needs and searching behaviour include situations in action, academic tasks and information resources. The ability to connect to the Internet and retrieve online sources of information proved to be important. The participants use the mobile devices to retrieve information from the Internet and in some instances from the university library's resources. Certain device-related characteristics, such as small screens, limited memory space and short battery lifespan, seem to affect the usefulness of mobile devices for information-seeking purposes. The cost of data and an inability to connect to the Internet, due to disruptions in network signals and a lack of Wi-Fi infrastructure, also curb the use of mobile devices. WhatsApp not only provides the participants with the means to share information and discuss their academic tasks, but it also makes collaboration and group work possible. Some of the students lack the required information literacy skills to make optimal use of the library's resources. Therefore, it would be prudent for the university to include information literacy skills training in the curricula for all levels of study. This requirement should also include doctoral students who have not previously completed an information literacy course.

KEYWORDS

Information, Information needs, Information resources, Information-seeking behaviour, Information-searching skills, Mobile applications, Mobile communication technologies, Doctoral students, WhatsApp.

NGAMAFUPHI

Lolu cwaningo lohlelo olugxile kwingxoxo beluphenya izidingo zolwazi kanye nezenzo zokucinga ulwazi lwabafundi abakwiziqu zesibili abasebenzisa ama-*smartphones* noma ama-*tablets* ukufunda. Abafundi abayishumi nanhlanu abasezingeni leziqu zesibili abazibhalise kwi-*University of Cape Coast* bebehlolwa ngokwezimvo. Imodeli ka-Ellis (1989) yezenzo ezihlose ukufumana ulwazi ihole ucwaningo futhi yaxhasa umcwaningi ekuthuthukisweni kwemodeli engasetshenziswa ukuthola ulwazi olumayelana nokuthi ngabe izinhlelo zobuchwepheshe be-inthanethi yefowunu zithinta kanjani izidingo zolwazi kanye nezenzo ezihlose ukuthola ulwazi. Izizinda ezimbili zinomthelela phezu kolwazi lwabadlalindima kanye nokuziphatha okuhlose ukuthola ulwazi, zona yilezi yisizinda sezemfundo kanye nezizinda ezimayelana nempilo yabo yansuku zonke. Ukuhlangana phakathi kwezinhlaka ezimayelana nesizinda abadlalindima abazithola ngaphakathi kwaso kanye nokuhleleka kwemiqondo yabo kubonakala kunomthelela phezu kwezidingo zabo zolwazi kanye nokuziphatha okuhlose ukuthola ulwazi. Iningi labafundi abadlala indima alibonakali lifuna amakhono olwazi lokufunda ukuze bacinge ulwazi kwisizinda kwu-inthanethi. Izinhlaka zesizinda ezibonakala zithinta izidingo zolwazi lwabadlalindima kanye nezenzo zokusesha zifaka izimo kwimisebenzi yezenzo zemfundo kanye nemithombo yolwazi. Ikhono lokuxhumanisa i-inthanethi kanye nokuvumbulula imithombo ye-inthanethi kukhombisa kusemqoka kakhulu. Abadlalindima basebenzisa izixhobo zomakhalekhukhwini ukulandelela ulwazi ku-Inthanethi, kanti kwezinye izimo, ukuthola ulwazi kwimithombo eyithala lezincwadi yasenyuvesi. Yize-kunjalo, izimpawu ezithile ezihlobene nezixhobo, ezingamasikirini amancane, isikhala esincane sokugcina ulwazi kanye nempilo emfushane yebhediri, kubonakala kuthinta izinga lokusebenziseka kwezixhobo ezingomakhalekhukhwini ngezinhloso zokucinga ulwazi. Izindleko zedatha kanye nokungakwazi ukuxhumana nge-Inthanethi ngenxa yokuphazamiseka kwamasiginali obuxhakaxhaka benediweki kanye nokwentuleka kwengqalasizinda ye *Wi-Fi* kanti futhi nokuvimbela ukusetshenziswa kwezixhobo ezingomakhalekhukhwini. Uhlelo lwe-*WhatsApp* aluhlinzeka kuphela

abadlalindima ngamasu okuphana ngolwazi kanye nokuxoxa ngemisebenzi yezemfundo, kanti futhi yenza ukuthi kube nokusebenzisana kanye nokuthi iqembu likwazi ukusebenza. Abanye babafundi baswela amakhono wokufunda adingekayo ukuze bakwazi ukusebenzisa ngokusezingeni eliphezulu kwemithombo yethala lezincwadi. Ngakho-ke, bekungaba kuhle kwinyuvesi ukuthi izinhlelo zokuqeqesha mayelana namakhono olwazi lokufunda kwikharikhulamu yawo wonke amazing ocwaningo. Lezi zinhlelo ezifunekayo kufanele futhi zisebenze kubafundi beziqu zesibili abangakaze esikahthini esedlule baphothule isifundo sokuthola ulwazi.

AMAGAMA ASEMQOKA

Ulwazi, izidingo zolwazi, imithombo yolwazi, izenzo ezihlose ukuthola ulwazi, amakhono okuthola ulwazi, izixhobo ezingomakhalekhukhwini, izinhlaka zethekinoloji zokuxhumana, abafundi bezique zesibili, i-*WhatsApp*

OPSOMMING

Hierdie kwalitatiewe studie het ondersoek ingestel na die inligtingsbehoeftes en inligtingsoekgedrag van doktorale studente wat slimfone of tablette vir hul studie gebruik. Onderhoude is gevoer met vyftien doktorale studente wat by die University of Cape Coast geregistreer is. Ellis (1989) se model van inligtingsoekgedrag het die studie gerig en het die navorser ondersteun in die ontwikkeling van ’n model wat gebruik kan word om ’n begrip te vorm van hoe mobiele tegnologieë inligtingsbehoeftes en inligtingsoekgedrag beïnvloed. Twee kontekste affekteer die deelnemers se inligtingsbehoeftes en inligtingsoekgedrag, naamlik die akademiese konteks en die konteks van hul daaglikse lewe. Dit wil voorkom of die wisselwerking tussen die elemente van die konteks waarin deelnemers hulself bevind, asook hul verstandelike strukture, hul inligtingsbehoeftes en inligtingsoekgedrag beïnvloed. Die meeste van die deelnemende studente beskik klaarblyklik nie oor die nodige inligtingsgeletterdheidsvaardighede om in ’n aanlyn omgewing vir inligting te soek nie. Die kontekstuele elemente wat skynbaar die deelnemers se inligtingsbehoeftes en -soekgedrag beïnvloed, sluit situasies in aksie- akademiese take en inligtingshulpbronne in. Daar is bevind dat die vermoë om tot die internet te koppel en aanlyn inligtingsbronne te verkry, belangrik is. Die deelnemers gebruik die mobiele apparate om inligting van die internet, en in sommige gevalle, van die universiteit se biblioteekhulpbronne te verkry. Sommige apparaatkenmerke soos klein skerms, beperkte geheuespasie en kort batterylewe blyk ‘n uitwerking op die bruikbaarheid van mobiele apparate vir inligtingsoekdoeleindes te hê. Die koste van data en ’n onvermoë om tot die internet te koppel vanweë onderbrekings in netwerksein en ’n gebrek aan Wi-Fi-infrastruktuur belemmer ook die gebruik van mobiele apparate. WhatsApp bied nie net aan die deelnemers ’n manier om inligting te deel en hul akademiese take te bespreek nie; dit maak ook samewerking en groepwerk moontlik. Sommige van die studente beskik nie oor die nodige inligtingsgeletterdheidvaardighede om die biblioteek se

hulpbronne optimaal te kan benut nie. Daarom sal dit wys wees as die universiteit opleiding in inligtingsgeletterdheidvaardighede in die kurrikula vir alle studievlakke insluit. Hierdie vereiste moet ook geld vir nagraadse studente wat nie vantevore ’n kursus in inligtingsgeletterdheid voltooi het nie.

SLEUTELWOORDE

inligting, inligtingsbehoeftes, inligtingshulpbronne, inligtingsoekgedrag, inligtingsoekvaardighede, mobiele toepassings, mobiele kommunikasietegnologieë, nagraadse studente, WhatsApp

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LIST OF ABBREVIATIONS AND ACRONYMS

The following abbreviations and acronyms are used in this thesis:

ACRL	Association of College and Research Libraries
AJOL	African Journals Online
ARL	Association of Research Libraries
CANS	College of Agricultural and Natural Sciences
CDMA	Code Division Multiple Access
CES	College of Education Students
CHLS	College of Humanities and Legal Studies
CoDE	College of Distance Education
CoHAS	College of Health and Allied Sciences
e-learning	Electronic learning
GPRS	General Packet Radio Services
GSM	Global System for Mobile Communications
ICT	Information and communications technology
ISBN	International standard book number
m-learning	Mobile learning
QR	Quick response
SMS	Short message service
SNSs	Social networking sites
UCC	University of Cape Coast
UCCIRB	University of Cape Coast Institutional Review Board
Unisa	University of South Africa
URL	Uniform Resource Locator
VoIP	Voice over Internet Protocol
YMSG	Yahoo! Messenger
2D	Two-dimensional

CHAPTER 1

GENERAL INTRODUCTION

1.1 INTRODUCTION

The use of mobile devices has changed societies in ways previously unthinkable. Mobile devices affect every part of people's daily lives, providing access to communication and information retrieval platforms (UNESCO 2013:7). As more technological mobile devices become available, so does their potential to support teaching and learning. Smartphones and tablets provide immediate and simultaneous connections to news, social media and databases. There is an abundance of smartphone and tablet applications available that has the potential to facilitate research and assist students with their information needs (Fritschi & Wolf 2012:6-10; Hylén 2012:6-8). As these technologies continue to evolve, students will need assistance in how to search for information effectively. Libraries and library instruction programmes are in a position to leverage mobile devices as a tool to help students in searching for information by using smartphones or tablets.

In their study, Porter, Hampshire, Abane, Munthali, Robson and Mashiri (2012:145-162) found that, despite country differences in mobile phone penetration, it cannot be denied that mobile phones are being used across Africa. For example, Frempong (2009:1-20) observed that mobile telephony in Ghana has become ingrained in the communications system. He also notes that the deployment of mobile phones has been dramatic, and the total number of mobile subscribers has already surpassed fixed-line subscriptions by 2011.

In 2010, Wong, Chin, Tan and Liu (2010:15-26) observed that students had started to use mobile devices for learning. Two years later, Lan and Huang (2012:179-193) found wide acceptance of mobile devices among learners for educational purposes. This could be why students reckon that the adoption of mobile devices has influenced their learning styles. This trend seems to be changing doctoral students' learning behaviour and norms.

When it comes to learning possibilities, Kim and Frick (2011:1-10) also believe that the use of these mobile devices has the potential to enhance learning. Al-Fahad (2009:1-9) and McConatha, Praul and Lynch (2008:15-21) report that research focusing on students' adoption of mobile learning (m-learning) indicates that students are becoming active learners and have a great deal of control over their learning activities.

The use of smartphones or tablets to search for information that would satisfy their information needs is a relatively new phenomenon in Africa. Little research has apparently been conducted in Africa on this topic (Mubako 2017; Edonkumoh 2015; Yousuf 2015). This study intends to address this gap by investigating the information needs and information-seeking behaviour of doctoral students using smartphones and tablets for learning. This was a case study done at the University of Cape Coast, Ghana. Since doctoral students were assumed to be knowledgeable and experienced users of mobile devices for learning, the researcher focused on this student group.

1.2 CONTEXTUAL BACKGROUND TO THE STUDY

The University of Cape Coast (UCC) had an initial student enrolment of 155 students in 1963 (Kwarteng, Dwarko & Boadi-Siaw 2012). The UCC now has a total student population of 74 548 (UCC Student Records & Management Information Sector 2019/2020). The breakdown is as follows: 19 389 regular students, 5 494 sandwich students (i.e. students who work part time and only attend classes during holidays) and 49 665 distance learning students. The University of Cape Coast is organised into six colleges, namely, the College of Agricultural and Natural Sciences (CANS), the College of Education Students (CES), the College of Distance Education (CoDE), the College of Humanities and Legal Studies (CHLS), the College of Health and Allied Sciences (CoHAS) and the School of Graduate Studies.

The university library endeavours to support doctoral students' research and learning needs. The vision of the library is to provide accurate, reliable and authentic information promptly (UCC Library Strategic Plan 2013-2017). Moreover, they also want to provide excellent information services and easily accessible material in print and electronic formats (UCC Library Strategic Plan 2013-2017).

The mandate of the UCC Library is to dispense information support services to facilitate teaching, learning and research activities (UCC Library Strategic Plan 2013-2017). These services are meant to introduce students to the information resources that are available in the library to support their academic activities or pursuits. For this purpose, a unit of the library trains students in information literacy skills.

The UCC Library provides access to its collection of printed material as well as to electronic resources. It also provides access to resources belonging to sister libraries through inter-library lending and document delivery (UCC Corporate Strategy 2012-2017). Although the UCC Library is a hybrid library, most of its collections are in paper format. The library also has a few resources in microform, which are provided with the appropriate reading equipment (UCC Library Strategic Plan 2013-2017).

In addition to the resources available in print and microform formats, the UCC Library has a wide range of electronic resources that is accessible to all students, including those students who use smartphones or tablets for learning (UCC Corporate Strategy 2012-2017). The UCC Sam Jonah Library subscribes to a wide range of electronic databases that makes full-text articles available to help users with learning, teaching and research (Kwafoa, Barfi & Agyapong 2019:7-9). The electronic resources include Emerald, EBSCOhost, JSTOR Archival Database, Highwire, HINARI, SAGE Journals, African Journals Online, Free Book Centre, SAGE Knowledge and Taylor & Francis. The UCC Sam Jonah Library also has access to free e-books and e-journals for all categories of students. As part of the library's effort to encourage doctoral students to access and use the electronic resources via their computers, smartphones or tablets, an annual e-learning seminar is being cooperatively organised by the School of Graduate Studies and the UCC Library. The e-learning seminar targets all first-year doctoral students and introduces them to the available electronic resources that could support them in their studies. The e-learning seminar quests to introduce doctoral students to various databases, search engines and how to utilise the Internet to find information by using their computers, smartphones or tablets.

The UCC Library is not well funded. The books collected in the library are insufficient and many of the information sources are old. The UCC Library therefore constantly seeks alternative ways to respond to changing information needs. The introduction of resources available on mobile devices seems to be one such alternative. In consideration of the discussion in the introduction and the background, there are a few areas of concern requiring investigation. These include:

- An exploration of the information needs of doctoral students registered at the UCC.
- Understanding the registered doctoral students' information-seeking behaviour.
- Establishing the role smartphones or tablets play in doctoral students' information-

seeking behaviour.

- Ascertaining how the library can effectively meet the information needs of doctoral students registered at the UCC.
- Developing a research framework that could be used by librarians and researchers to investigate doctoral students' information-seeking behaviour when they utilise mobile phones or tablets.

1.3 PROBLEM STATEMENT

The book collections in the UCC Library are inadequate and many of the information sources are no longer current. The researcher observed that, although students are certain they would find the required information, the same students are often confused or uncertain in conducting their information searches. The reasons for their uncertainty also interest the researcher. The researcher is concerned as to whether the students' uncertainties are related to their inability to use their mobile devices to search for information or their inability to evaluate the retrieved information for relevance. Their uncertainty could also be put to the unavailability and inaccessibility of the required information in the UCC Library. In addition to the reasons for the students' uncertainty, these students could be encountering challenges which could affect their information-seeking behaviour. Establishing those challenges also concerns the researcher.

Furthermore, some doctoral students talk about lecturers who repeat the same presentations and content in their lectures. To expand their knowledge base, students use their smartphones or tablets to check whether more current information has become available. Are they satisfied with the information they retrieve when using their smartphones and tablets? As a university librarian who is tasked with assisting students in retrieving and searching for information, the researcher is concerned with understanding the information needs and information-seeking behaviour of doctoral students registered at the UCC. Moreover, despite observations that doctoral students are continuously searching for information on their mobile devices, little is known about their information needs and information-seeking behaviour, in the mobile environment. The question now arises whether these students use their devices to access library resources and whether they can download information that is significant to their learning needs.

Over the periods, there has been research work on information needs of people from diverse background and professions. Some of the professions whose information needs have been investigated include software practitioners (Josyula 2016), librarians (Alazemi 2015), and engineers (Du Preez 2015). However, information needs of doctoral students have not been exclusively investigated, this has left the information needs of doctoral students scanty in literature. To fill this gap in literature, one of the focus of the current study is to examine the information needs of doctoral students. Additionally, existing literature has consistently combined information needs with seeking behaviour of students, however, this study seeks to exclusively examine the information needs and seeking behaviour of students.

Within the various study of information seeking, areas like science and technology researchers (Babayemi, Velile & Tinashe 2019), graduate students (Desta, Du Preez & Ngulube 2019), faculty members (Azadeh & Ghaseni 2016) and postgraduate students (Orlu 2016; Esew 2015) and international students (Esfahani & Chang 2012) have been investigated. However, the information seeking behaviour of doctoral students is yet to gain prominence in existing literature. This current study therefore seeks to empirically investigate the information needs and information-seeking behaviour of doctoral students using smartphones or tablets for learning. Understanding the use these students make of mobile devices to satisfy their information needs could support the UCC management in ensuring that the necessary infrastructure and services are available to support the students.

With the advent of mobile technology, researchers have not fully incorporated it into information needs and seeking behaviour. Researchers who have done so have not delved into the role that mobile technologies play in the information needs and seeking behaviour of doctoral students. For example, Babayemi, Velile and Tinashe (2019) focused on science and technology researchers, Guma, Businge, Nkamwesiga and Andogah (2017) used university students, Azadeh and Ghaseni (2016) dealt with faculty members, Alazemi (2015) focused on librarians, Du Preez (2015) used engineers and Fritschi and Wolf (2012) used teachers.

The problem to be investigated in this study is to learn why doctoral students use smartphones and tablets when they seek information that would support their information needs.

1.3.1 Purpose of the study

The purpose of this study is to empirically investigate the information needs and information-seeking behaviour of doctoral students using smartphones or tablets for learning.

1.3.2 Objectives of the study

The objective of this study is to explore the doctoral students' information needs and information-seeking behaviour when using smartphones and tablets. Some specific objectives include:

i. To acquire an understanding of the information needs of the doctoral students who are registered at the UCC.
ii. To acquire an understanding of the information needs and seeking behaviour of doctoral students who are registered at the UCC.
iii. To understand the experiences of doctoral students at UCC in the use mobile technologies in their information seeking process.
iv. To solicit suggestions from doctoral students on the improvement of library services at UCC for mobile technology users.
v. To develop a framework or model for research on the information-seeking behaviour of doctoral students in the mobile technology environment.

1.3.3 Research questions

With the purpose and objectives of the study in mind, the research question for the study can be formulated as follows:

> What role do smartphones or tablets play in the information-seeking behaviour of doctoral students who are registered at the University of Cape Coast?

In order to address the specific objectives and in order to answer the research question, the following sub-questions were formulated to guide the study:

1. What are the information needs of doctoral students using smartphones or tablets for learning at the University of Cape Coast (UCC)?
2. How do the doctoral students who are registered at the University of Cape Coast (UCC) search for information?
3. What role does smartphones or tablets play in the information-seeking behaviour of doctoral students who are registered at the University of Cape Coast (UCC)?

4. How can the information needs of doctoral students registered at the University of Cape Coast (UCC) be met effectively?
5. Which model model can support an investigation of the information seeking process of doctoral students in the mobile technology environment?

1.4 LITERATURE REVIEW

This literature review is focused on the information needs and information-seeking behaviour of doctoral students. The keywords that were used to conduct the literature review include 'information needs', 'information-seeking behaviour', 'smartphones' and 'tablets'. The databases and search engines that were searched for information are Emerald, JSTOR, Science Direct, African Journals Online (AJOL), Directory of Open Access Journals, Google Scholar and EBSCOhost. Most of the articles that were retrieved from these databases and search engines are also available in the journals listed in Scopus, WOS and LISTA.

The literature was reviewed to highlight certain keywords or themes, such as information, information needs, information-seeking behaviour, roles smartphones or tablets play in seeking information, resources available for students who use mobile devices in learning, and barriers that manifest when using smartphones or tablets for learning. Chapter 2, Chapter 3 and Chapter 4 of this study comprise a detailed literature review of these themes.

1.5 IMPORTANCE OF THE STUDY

It is interesting how mobile devices are affecting students' learning styles. It seems that smartphones and tablets play a significant role in doctoral students' information needs and information-seeking behaviour. It is fundamental for the library and university to understand this to ensure that their services are adapted to better support these students.

Despite the importance of using these devices for learning, little is known about the information needs and information-seeking behaviour of doctoral students at the UCC. Again, no single study has been conducted in the context of the use of smartphones or tablets in learning since the university was established in October 1962. It is expected that this study will reveal the information needs and information-seeking behaviour of doctoral students and some of the barriers that manifest when using smartphones or tablets for learning. This would enable the researcher to suggest recommendations.

This research outcome will help the university management and the library to identify critical factors or barriers that could affect the successful adoption of the use of smartphones or tablets for learning by doctoral students. Additionally, the research findings will help the university's authorities to identify strategies for supporting information needs and information-seeking behaviour of doctoral students using smartphones or tablets for learning.

Once these are identified, it is expected that the university's authorities will provide students with more free Wi-Fi access points on campus and provide places where students can recharge their cell phones or mobile devices. Moreover, it is planned for the findings to be adopted as part of information literacy training to support students and also as one of the services rendered by the library.

The study will help to ensure that the e-resources available at the UCC will support the use of mobile technologies in learning. Perhaps the findings of the study will facilitate improvement or adaptation of the information literacy programme at the UCC. Moreover, it is expected that there will be an improvement in the Wi-Fi infrastructure in the library to ensure that students have access to electronic resources without having to pay for it.

It is believed that the study will help to develop a model that could support doctoral students' information-seeking behaviour. The newly proposed model explains and describes how doctoral students seek information for academic development or lifelong learning. As such, the proposed model could be used to support researchers in acquiring a better understanding of the information needs and information-seeking behaviour when using mobile devices for learning.

1.6 METHODOLOGY

Various research methods exist, which can follow a quantitative, qualitative or mixed-methods approach. The research approach followed in this study is qualitative. Data in quantitative research require statistical analysis to enable researchers to confirm a phenomenon, whereas qualitative research data cannot be analysed statistically. Qualitative data support the researcher in understanding a phenomenon better. Leedy and Ormrod (2014) argue that qualitative research is a more original and emotive approach than quantitative research. They believe that the qualitative research approach empowers researchers to

understand and interpret the behaviour and experiences of individuals while conducting interviews for gathering data. In other words, because the study was focused on understanding a phenomenon, a qualitative approach seemed to be the best approach.

1.6.1 Ethical considerations

Ethics in research refers to the beliefs and codes of conduct of what is morally and legally right or wrong in conducting research (Babbie 2010:64). Ethical issues are necessary in academic research and help researchers to protect the dignity of their participants and develop trust among participants (Creswell 2009:87). In the view of De Vos, Strydom, Fouché and Delport (2011:114), ethical issues are sets of moral principles that are accepted as rules guiding behaviour and conduct between researchers and participants. Vanclay, Baines and Taylor (2013:244) stress the need for students to adhere to the ethical guidelines provided by academic institutions to guide them in their research work and to protect the reputation of an institution.

The researcher adhered to the ethical principles of the University of South Africa (Unisa). The researcher got ethical clearance from Unisa and permission from the University of Cape Coast Institutional Review Board (UCCIRB) to conduct the study. The researcher also acknowledged all scholarly works and information consulted from journal articles, books, dissertations, theses and data from the field.

Furthermore, all participants were requested to sign a consent form. The consent form and the reasoning for the use of the form is discussed under section 5.5.1. The consent form letter appears in Appendix I.

1.7 DELIMITATION OF THE STUDY

The study was limited to doctoral students at the UCC. The participating doctoral students were registered students in the College of Education Studies, the College of Distance Education, the College of Humanities and Legal Studies, the College of Agricultural and Natural Sciences, and the College of Health and Allied Sciences. The study was carried out during the 2019/2020 academic year. The participants in the study were limited to only doctoral students drawn from colleges of the UCC.

Another delimitation is the use of smartphones and tablets for studying purposes only. In other words, the study did not investigate the use the participants made of these devices to search for information for other aspects of their daily lives or to socialise with friends and family, although some of the participants spontaneously provided information on their everyday life information-seeking behaviour. The study examined the information needs and information-seeking behaviour of doctoral students using mobile devices for learning and differences among different nationalities and programmes were not examined. Again, the familiarity of the environment to the researcher and eased of data collected from the participants were the major rationale for selecting doctoral students from University of Cape Coast.

1.8 DEFINITION OF KEY CONCEPTS

It is useful to explain certain key concepts such as information needs, information-seeking behaviour, information resources, information-searching skills, smartphones, tablets and doctoral students, which were used in this study. Also, mobile communication technologies, mobile applications, collaboration, social networking sites, tasks and mobile alerting services are explained.

1.8.1 Collaboration

According to Schuler, Hutchins and Lashell (2012:11-15), collaboration refers to the state where students share information and formulate responses to questions quickly with the support of mobile devices. With the support of mobile cloud computing, users can share material on their field of study and even edit colleagues' assignments (Kiryakova 2017:279). According to Kiryakova (2017:279), collaboration motivates users to participate actively in doing different tasks, because their actions and results are visible to others. By this, users can use their mobile devices to share their ideas and research with colleagues, according to their preferences. In the context of this study, collaboration is the real-time information-sharing among doctoral students to complete a task by using mobile devices.

1.8.2 Information

The concept 'information' refers to data, texts, images, sound, voice codes, and computer programs that convey meaningful facts, ideas, conditions and knowledge that make meaning (Njoku 2004:297-300). Kehinde, Obi, Akande and Anyim (2016:3) explain that every library

user needs information in a variety of formats and on diverse levels or in different volumes. From the explanation of Kehinde et al. (2016), doctoral students in universities fall within the category of users who need information in a variety of formats and volumes.

Therefore, within the context of this study, information refers to data, texts, images, sound, voice codes and the meaningful facts that doctoral students use in their daily endeavours, being it academically, socially, politically or culturally.

1.8.3 Information needs

Information needs arise whenever individual finds themselves in a situation requiring knowledge to deal with the situation as they think is appropriate (Okonoko, Njideka & Mazah 2015:1). Furthermore, in the view of Miranda and Tarapanoff (2008:2), an information need is a state or process that begins when one realises that there is a gap between the information and the knowledge available to solve a problem. According to this definition, the individual must identify a need for information and be motivated to find a solution to the identified problem. This definition implies that the knowledge gap and the need or desire to fill such a gap prompts information needs. In this study, information needs are applied to how doctoral students fill their knowledge gaps in their academic-related subject of study or the desire to solve their everyday life situations with accurate information.

1.8.4 Information resources

Information resources are information stored in an electronic information system (Thanuskodi 2012:326). In turn, Appleton (2006:20) views information resources as products that help users to request information electronically with the aid of technology. From these definitions, it can be explained that information resources can be used to store information electronically and non-electronically to satisfy information needs. Within the context of this study, information resources refer to all available and non-restrictive resources from which information is gathered by doctoral students to fill the knowledge gap.

1.8.5 Information-searching skills

According to Kuhlthau (2008:71), an information-searching skill is defined as “the ability of users to locate, evaluate and utilise information wisely”. In the current study, information-searching skills are defined within the context of information-seeking behaviour. Therefore,

information-searching skills are the technical knowledge and skills needed by doctoral students to locate, retrieve and evaluate information through electronic means like online journals and e-books, or non-electronic means like the university's library.

1.8.6 Information-seeking behaviour

Information-seeking behaviour is defined by Okonoko, Njideka and Mazah (2015:2) as the ways and means an individual use to collect and locate information for personal use. Information-seeking behaviour is expressed in various forms, from reading printed material to research and experimentation (Bhatti 2009). Wilson (2000:49) also asserts that information-seeking behaviour is a goal-oriented process of purposive seeking for the required information using manual information systems. Wilson's definition also asserts that information seeking can be active or passive, such as an awareness of information.

According to these definitions, it could be deduced that information-seeking behaviour goes beyond locating and retrieving information for use. It also has to do with users' awareness of sources of information and their preferences for such sources, as well as the ability to gather information from these sources (Hiller 2002:8-12; Leckie, Pettigrew & Sylvain 1996:184-185). Therefore, within the context of this study, information-seeking behaviour entails locating, retrieving and evaluating information by a student from preferred sources and the skills to gather such information from the preferred source to satisfy an information need.

1.8.7 Mobile alerting services

Mobile alerting services are network alerts designed to disseminate emergency alerts to mobile devices using integrated library management systems or software (Saxena & Yadav 2013).

1.8.8 Mobile applications

Mobile applications are purposive software applications (apps) intended for use on small computing devices such as smartphones and tablets (Hinze, Vanderschantz, Timpany, Cunningham, Saravani & Wilkinson 2017). A mobile application is also a software that a user can download and access directly while using a mobile device like a tablet or smartphone.

Library applications are focused on the delivery of information resources to handheld devices, or the communication of information about the library and its services (Hinze et al. 2017).

These applications are used for several reasons, subject to the information user need. In this study, a mobile application refers to software running on smartphones or tablets, which contributes significantly to helping doctoral students satisfy their needs. They include library applications and mobile applications, such as WhatsApp, to enhance the possibilities for collaboration in learning among students.

1.8.9 Mobile communication technologies

Kim, Mims and Holmes (2006:79) define mobile communication technologies as "a technology that uses radio frequency spectrum to facilitate the transmission of multimedia services for use". Short, Lin, Merianos, Burke and Upperman (2014:199) argue that these functionalities provide instant and flexible access to the Internet for a wealth of information.

1.8.10 Doctoral students

Doctoral students in this study are those categories of students who have earned a master's degree and are studying at the UCC for a higher qualification, such as a doctoral degree.

1.8.11 Smartphones and tablets

This refers to a mobile communication device or a one-piece mobile computer that performs many of the functions of a computer (Oxford living dictionary 2017). These devices have a touchscreen, which can be controlled with a finger or stylus, supported using one or more physical content-sensitive buttons and are guided by the input of one or more accelerometers (Mohapatra, Mohapatra, Chittoria, Friji & Kumar 2015:3-8). Mohapatra et al. (2015) also note that tablets or smartphones come equipped with touch sensitive, hide able onscreen keyboards. Tablets are also available in a variety of sizes. This definition is accepted for this study.

1.8.12 Social networking sites

Social networking sites (SNSs) are Web 2.0 applications that enable the sharing of information, and which have been adapted for use on mobile devices among users (Akeriwe

2013:19). Sharma and Godiyal (2016:157) also define social networking sites as Internet-based tools that facilitate communication, content exchange and collaboration among users. Social networking sites are used as a means of communicating information among users to promote learning (O'Brien, Mellett & Ó hAodha 2014:134; Akeriwe 2013:19; Mahmood & Richardson 2011).

In this study, social networking sites are all sites that allow doctoral students to search catalogues, create image databases, and share videos and PowerPoint presentations. Examples of such discussion forums include WeChat, Tumblr, Telegram, Instagram, Pinterest, Google +, MySpace, Baidu Tieba, StumbleUpon, Delicious and LinkedIn.

1.8.13 Tasks

Tasks are things users do to achieve goals (Hackos & Redish 1998:56). These tasks be a series of actions undertaken by students in pursuit of a goal. Byström and Järvelin (1995:193) note that these tasks have a recognisable purpose, beginning and an end. Kim (2009:680) describes tasks differently. She describes a task as a function to be performed. Kim (2009:680) continues by explaining that the goal or end-result of the task is what the user wants to achieve.

In the context of this study, 'tasks' are interpreted in terms of the different activities (e.g., assignments, examinations, conference presentations, debates) that doctoral students need to carry out to complete the academic and social activity in which they are engaged. In this study, tasks also refer to users' reasons for searching for information using information systems. These tasks do not follow any systematic process but take place when the information gap evolves.

1.9 CHAPTER LAYOUT

The study is organised into eight different chapters as follows:

Chapter 1: General introduction

The first chapter introduces the study. It provides background information on the study and the problem statement. This chapter also discusses the purpose of the study, objectives of the study, the research questions and definition of key concepts used in the study.

Chapter 2: Information needs

The purpose of this chapter is to conceptualise information needs and acquire an understanding of what information needs entail. For this purpose, the concept of information needs is defined. Thereafter, the discussion focuses on how context and certain user-related characteristics affect information needs of doctoral students.

Chapter 3: Information-seeking behaviour

The purpose of this chapter is to conceptualise the information-seeking behaviour of doctoral students who use smartphones or tablets for learning. A discussion on the contextual elements that affect users' information seeking and the role of technology in information seeking is included. This chapter also covers the conceptual framework of the study, using Ellis's behavioural model of information seeking.

Chapter 4: The role of mobile technologies in information needs and information-seeking behaviour of students

This chapter addresses the potential role that mobile technologies, such as smartphones or tablets, play in students' learning. The primary concern is to establish whether mobile technologies can be used for learning. In addition, the characteristics of different mobile technologies and their applications are explored while also establishing their use when retrieving information for learning.

Chapter 5: Research methodology

The fifth chapter discusses all the strategies the researcher adopted in collecting data for the study. It outlines the research approach, research design, target population, sampling procedures and data collection procedures. This chapter also discusses the reliability and validity of the study and the data analysis procedure.

Chapter 6: Findings

This chapter presents the findings that were obtained through interviews with selected doctoral students at the UCC. Fifteen participants were selected for the study. To establish the role of mobile technologies in this regard, the report of the empirical data is subdivided into four themes: the information needs of doctoral students registered at the University of Cape Coast, the registered doctoral students' information-seeking behaviour, the role that smartphones or tablets play in doctoral students' information-seeking behaviour and, lastly, the students' suggestions on how the library can effectively meet their information needs. These themes are in line with four of the research objectives of the study.

Chapter 7: Discussion of the information needs and information-seeking behaviour of

doctoral students who use smartphones and tablets for learning

The purpose of this chapter is to discuss the empirical findings based on the research objectives in this study.

Chapter 8: Conclusions, limitations and recommendations

This chapter answers the research questions of this study, indicates the limitations of the study and makes recommendations for further studies.

1.10 CHAPTER SUMMARY

This chapter introduced the study, which involved a qualitative investigation of the information needs and information-seeking behaviour of doctoral students using smartphones and tablets for learning, at the UCC. The contextual background of the study, the problem statement and research questions were explained. It is observed that students are certain to find required information, yet they are sometimes confused in the process of conducting their information searches. Their uncertainty could be put to the unavailability and inaccessibility of the requited information in the UCC Library. Other aspects addressed in this chapter include the delimitation of the study, the research method followed and ethical considerations. Lastly, the important terms were defined. Chapter 2 conceptualises information needs.

CHAPTER 2

INFORMATION NEEDS

2.1 INTRODUCTION

The concept of information needs is core to all studies concerned with information behaviour. This is because information needs give rise to information activities such as information seeking and use (Meyer 2016). Researchers have adopted certain root factors and secondary trigger approaches to conceptualising information needs studies (Savolainen 2017:3). The root factors that affect information needs, which in turn influence users' identification and access to the information sources they need to support their information needs, include the context in which an information need arises, as well as certain user-related characteristics. Therefore, the purpose of this chapter is to identify and discuss those factors which prompt doctoral students' information needs.

2.2 BACKGROUND

The concept 'information behaviour' can be subdivided into various components and elements and this chapter will be looking into those components and element. Information needs are one such component which, due to the interaction between elements in the personal domain of users and the context in which users find themselves, give rise to information activities such as information seeking (Meyer 2016). 'Information needs' is an elusive construct with multiple meanings (Case & Given 2016:74-76; Ford 2015:34; Cole 2011:64; Naumer & Fisher 2010:2452; Campbell 1995:2). Case (2012:85) argues that information needs can be studied or discussed from different perspectives or approaches. This view is supported by Savolainen (2017:3) and Nicholas and Herman (2010:5-10) who have observed that, over the decades, there has been a change in the focus of information needs studies.

One of the focus areas or approaches from which the concept 'information needs' can be understood, is to acquire an understanding of how it is situated within the context of human needs that give rise to a need for information. For example, students rely on information to further or complete their studies. The academic environment in which they find themselves could therefore provide the context within which their academic information needs arise. However, multiple contextual elements within this environment could also affect information needs. This is in line with Savolainen's (2012:2) view that the elements of information needs

can be conceptualised differently, depending on the context in which it manifests. This chapter explores those contextual features that have the potential to affect students' information needs.

2.3 INFORMATION NEEDS

Information needs can be defined as "a state that arises within a person, suggesting some kind of unsatisfactory situation that requires filling" (Dervin 1983:156). Dervin's (1983b) definition suggests that information needs represent information gaps. Dervin (1983:156) further explains that people need to 'make sense' of the world. In such situations, questions arise in the person's head and these questions need to be answered (Dervin 1983:170). She refers to such questions as information needs.

In turn, Miranda and Tarapanoff (2008:2) define information needs as a process that begins when one realises that there is a gap between the information and the knowledge available to solve a problem and the actural solution of the problem. According to this definition, the individual has to identify a need for information and be motivated to find a solution to the identified problem. Similarly, Ingwersen and Järvelin (2005:20) and Case (2002:5) view an information need as a consciously recognised gap in the knowledge available to an actor.

Wilson (2006:663-664) explains information needs differently. According to him, an information need is not a primary need but arises from secondary or basic needs such as physiological, affective or cognitive needs that must be satisfied by looking for information. He further explains that these information needs are contextual and are based on the person himself/herself. Fatima and Ahmad (2008:141-143), Safahieh (2007:12) and Belkin and Vickery (1985:6) note that, because information needs exist in the minds of users, these needs are not directly observable. This subjective experience of information needs is then one of the reasons why Case and Given (2016:82) and Wilson (1997:552) acknowledge researchers' difficulty in defining the concept 'information need'.

The implication of information needs being subjective is that only the person experiencing the need can articulate the need and work on it. Therefore, an information needs researcher can only deduce people's needs from their behaviour and what they report (Wilson 1997:552).

In communication science, Atkin (1973:206) views information needs as a function of extrinsic uncertainties caused by differences in individual current levels of certainty. In his discussion of Atkin's definition, Case (2012:83) notes that there are differences in what users want to know and what they know.

In turn, Kuhlthau (1993:343) defines information needs as "the awareness of missing something, which requires the search for information that might contribute to understanding and meaning". According to Kuhlthau's definition, there must be a reason for the user to experience an information need.

The definitions of Bopape, Dikotla, Mahlatji, Ntsala and Makgahlela (2017:3), Case and Given (2016:371) and Feather and Sturges (1997:217) for information needs are similar to Kuhlthau's (1993) definition. They define information needs as "instances where an individual is not comfortable with the current state of their knowledge". Okonoko, Njideka and Mazah (2015:1), Case (2007:333) and Fatima and Ahmad (2008:141-142) describe such instances when the person senses a problematic situation or an information gap. They indicated that this happens when the internal knowledge and beliefs of a person fail to suggest a path towards the satisfaction of their goals. Students, for example, need accessible information to solve academic and everyday life problems. An information need is therefore a prerequisite for information seeking and individuals' sensorimotor structures motivate them to actively search for information.

Kuhlthau (2004:26) also observes that information needs can "be actual, but unexpressed need for information, or an ill-defined area of indecision which may be expressed in an ambiguous rambling statement". According to her, information needs can begin as a vague kind of dissatisfaction, which is characterised by an uncertainty and a perplexing reaction to a vague, new idea. This uncertainty increases and mounts until the lack of knowledge will threaten the information user.

Information needs also depend on a specific situation and time in which users find themselves. As Ossai-Onah (2013:5) notes, users find themselves in circumstances where they have to answer or solve questions. To enable them to answer questions effectively,

people would search for information.

According to Cole (2011:1216-1220), information needs could be unexpected, somehow unnecessary and the solution to the problem may not be needed immediately. However, Cole (2011) also argues that, on the contrary, an unexpected need could be an urgency and importance issue for users. In addition to being unexpected, information needs can be unexpressed and are often not recognised as information needs (Davies & Harrison 2007:79). However, Davies and Harrison (2007) consider expressed information needs as something that leads to action.

These definitions and explanations of information needs show that information needs are unsatisfactory situations, circumstances, occurrences and uncertainties, or gaps in peoples' lives which require a search for information. Hence, there is a need to search for information to ensure the restoration to normalcy. Rath (1996:10) notes that the required information that could satisfy users' information needs are often current information, exhaustive information and catching-up information.

However, Case (2012:85) found two research approaches in his literature review on information needs, namely, subjective and situational approaches. He believes that research conducted using subjective methods or approaches characterise information needs in the internal context (i.e., the inner person) of the user. Studies with a situational approach analyse the contexts of the information need. These two approaches to the context of information needs are not mutually exclusive but could co-occur. The following discussion explores the context and the various elements of context that give rise to information needs.

2.4 THE ROLE OF CONTEXT IN INFORMATION NEEDS

Context is a socially defined setting in which information use can be observed (Allen & Kim 2001:1). Lee (2011:96) also views context as a "collection of objects, factors, elements and attributes that are related to a target entity in important ways". According to Allen and Kim (2001:1), different situations occur within each context and individuals may be situated within each context in different ways. Cool (2001:8) sees context as a "framework of meaning". This view of context as being a framework of meaning is supported by Rieh (2004:744). According to her, context serves as a framework for bringing the world into focus while cleaning out certain stimuli. Interacting with information resources available to

users motivates them to construct their context. In turn, McCreadie and Rice (1999:58) describe context as the "larger picture in which the potential user operates". The larger picture is the context in which the user operates and also in which the information system operates.

Context is explained from a different point of view by Taylor (1991:219). According to him, context can be an information use environment that applies to daily life information practices. He argues that information environments are not restricted to only a group of users.

However, several of the definitions discussed in this review embrace context as a combination of setting, interactions, sets of things, frameworks of meaning and information use environments **(**Lee 2011:96; Allen & Kim 2001:1; Cool 2001:8). Furthermore, the concept 'context' includes many elements. Savolainen (2012:2) pertinently identifies three contextual elements that affect information needs. These are: a situation of action, tasks and dialogue. In addition to the three elements identified by Savolainen (2012:2), Bowler, Julien and Haddon (2018:6), Courtright (2007:287), Joo and Choi (2015:272-291), Moodley (2013:20), Bates (2009:2381), Cool (2001:10) and Taylor (1991:218) also identify information resources and the available technologies as elements of context.

2.4.1 Situation in action

Situation in action can be viewed as "a part of context" (Courtright 2007:276) or could be viewed as "equivalent to context" (Johnson 2003:736). McCreadie and Rice (1999:58) argue that situation in action is a type of circumstance from which a need for information arises. According to Savolainen (2012), these circumstances are bound to some solid requirements and conditions of action. According to Ellis and Haugan (1997:384-387) and Savolainen (2012), the situation of action affects information needs. They point out that the situation in which an information need arises dictates the user's information-seeking path.

Furthermore, Savolainen (2012) notes that information needs can undergo changes within or between situations. This view is supported by Cool (2001:8) who states that situations are not static but undergo interpretive processes and changes. Information needs requires an understanding of users' personal situations and it might change as time goes on.

Situations are characterised by temporal and spatial constituents (Savolainen 2012:5). According to Savolainen (2012:9), temporal and spatial situations set the requirements for the required information. Furthermore, Wilson (1981:8) notes that the temporal constituents may create a time delay before users recognise a need for information.

In turn, Julien and Michels (2004:547-548) mention that some information needs require information urgently, whereas other information needs do not. They explain this when they state that the situation occurs in a set of circumstances which then creates an awareness of an information need (Julien & Michels 2004:547-548). Julien and Michels (2004:552) also maintain that the urgency of the information needs determines the source that will be accessed and used by the user.

Apart from the situation in which information needs arise, Savolainen (2012:5) also found that information needs change as the situation in which they manifest changes. Doctoral student's information needs can occur when they are engaged in purposeful information to complete course assignments, to write final year research papers or term papers and prepare for class discussions.

2.4.2 Tasks

A task can be defined as a "set of physical, affective, and/or cognitive actions in pursuit of certain, but not unchangeable goals" (Byström & Hansen 2005:1051). In computer science, tasks are also viewed as "series of actions undertaken in pursuit of a goal" (Hackos & Redish 1998:69). According to Hackos and Redish (1998:69), a meaningful product can be the result of task completion. In turn, Byström (2007) defines tasks as "a purposeful set of linked concrete or cognitive activities performed by people; normally it has a meaningful purpose as well as an identifiable beginning and end". Kim (2009:680) describes a task differently. She describes a task as a function to be performed and continues by explaining that the goal or end-result of the task is what the user wants to achieve (Kim 2009:680).

Tasks can also be categorised as being subjective or objective (Case 2012:86; Hackman 1969:97-100). Objective tasks are understood to be external to the performer and are imposed on the user (Byström & Hansen 2005:241).

Therefore, as Case (2012) notes, objective tasks give rise to relatively fixed information needs, and users are expected to make sound decisions in some task-related situations.

Subjective tasks, on the other hand, are seen as an internal activity and Hackman (1969:97-100) views the information needs of subjective tasks as being subordinate to the task performers' objective information needs. Hjørland (1997:315) and Goguen (1997:4) concur with Hackman's view. According to them, information for one person may not be information for another person in subjective tasks. This is corroborated by Bates (2006:1033), who maintains that information needs prompted by subjective tasks are more dynamic in structure and human needs are influenced by this dynamism.

According to Kim (2009:683), tasks can also be viewed as interpretive or exploratory and the required information for such tasks cannot be predetermined. Users need to complete an interpretive or exploratory task to determine the information required (Kim 2009:683-684). This is because interpretive and exploratory tasks can only be configured by thinking and searching for solutions, rather than locating the information that is needed. According to him, the search may produce more answers than what can be supported with evidence. The evidence may confirm or be in contrast with the user's information needs.

Apart from tasks being interpretive or objective, Vakkari (1999:825-826) and Byström and Järvelin (1995:194) clarify that a task could also be simple or complex. This view is supported by Byström's (1999:581-582) observations of tasks. According to her, simple tasks are information-processing tasks whereas complex tasks are decision-making tasks. As such, simple tasks are quick to perform, and complex tasks require the user to be creative.

In her findings, Du Preez (2008:320-321) study linked the importance of task-related information to the availability and accessibility of the information. According to Byström and Hansen (2005:1051), this prompts users to use several sources to fulfill their information needs. Therefore, Vickery and Vickery (1987) argue that the availability and accessibility of information resources can give rise to information needs. As such, the availability and accessibility of information sources and resources like e-books, full-text databases, printed books and online journals could determine which sources are sought and used by the doctoral students to satisfy theirk information needs.

According to Hertzum and Pejtersen (2000:762), the decisions users need to make are mostly directed by knowing the meaning of the context of the task when they obtain information about the product that they would use. Information needs of individual students differ, depending on their respective tasks (Hertzum & Pejtersen 2000:762-763). When applied to doctoral students, Safahieh (2007:21) found that students need information to complete their project assignments, write articles and for other tasks that form part of their course requirements. Additional tasks that can generate information needs for doctoral students include research, class presentations, writing dissertations, thesis, presenting papers and examinations.

Task descriptions are useful in studies where the focus is on individual differences (Byström & Hansen 2005:1051-1052). The results of studies using tasks as a point of departure to study information needs can lead to the improvement of services from users' perspectives (Byström & Hansen 2005:1052-1053). In the current study, 'tasks' refer to users' reasons for searching for information and for using a particular information system. The effect the task domain has on information needs depends on certain factors, such as the information required and task performance. It also depends on the different types of information acquired, the information resources that were used and the search strategies that were applied.

2.4.3 Information resources

Information resources are stored in an electronic information system (Thanuskodi 2012:326). Information resources are media-bearing materials which exist in various formats (Adewumi 2011). Information resources are embedded in the context of users' information needs and could even double up as a retrieval tool, e.g., a book index (Bowler, Julien & Haddon 2018:6). Users could therefore use these information resources to access information which could support their information needs (Lievrouw 2001:11-13). Some of the information resources that are important to doctoral students, which were identified by Joo and Choi (2015:272-275) and Appleton (2006:20), include electronic journal articles, online databases, online dissertations and theses, digital archives and electronic books. These information resources offer doctoral students' different opportunities in searching for information to satisfy their information needs.

2.4.4 Information technologies

Information technologies are viewed as the extensible technological foundation and the interfaces used by extensions that interoperate with it (Tiwana, 2015). According to Fagbe, Amanze, Oladipo, Oyenuga and Adetunji (2015:11), information technologies shape the information search services that are offered to users. The Internet is a critical platform that can be used to search for information.

The Internet can be defined as a "global network of computers communicating via an agreed-upon protocol" (Chauhan & Panda 2015:1-3). According to West (2015:2), Moodley (2013:94-96) and Niskala (2008:86), poor Internet access means a lack of opportunity to search for information. For example, Kwaah (2019:92), Okello-Obura and Magara (2008:48) and Luambano and Nawe (2004:13-16) observed that low-speed Internet connections affect students' use of technology. However, Moly (2014:42-45) argues that, if information users do have access to Internet, their use is also affected by the availability of resources like bandwidth and by network connection problems.

Although there are other factors on which information needs depend, limited information resources and information technology access are two influential factors.

Apart from the situational approaches to information needs that Case (2012:85) identifies, he further explains the subjective aspect of information needs. The following discussion in section 2.5 focuses on the subjective approach to information needs.

2.5 SUBJECTIVE APPROACH TO INFORMATION NEEDS

A need is said to be "a subjective experience that occurs only in the mind of a person in need" (Wilson 1997:552). Borlund and Dreier (2014:494) refer to the "internal context" of users, whereas Meyer (2016) refers to the users' "inner person". As Case (2012:78) explains, subjective information needs are needs that are characterised as thoughts, which act as motivation to prompt action. Therefore, when users receive and use the obtained information, their needs can be fulfilled.

According to Borlund and Dreier (2014:494), information needs studies that have a subjective approach are characterised by their focus on those elements in the inner person that

give rise to information needs.

According to Meyer (2016), the interaction between the different elements in the inner person, as well as the interaction between elements in the inner person and elements in the context, gives rise to information needs. From Meyer's (2016) point of view, the inner person refers to the person's knowledge, skills, experience, motivation, personal preferences, feelings of uncertainty, trust, etc. The following discussion is an attempt to explain some of the elements in students' inner persons that have an effect on their information needs.

2.5.1 Cognitive structures

Cognitive structures pertain to the mental processes of perception, memory, judgement and reasoning of humans (Bhuvaneshwari 2004:46). The term 'cognitive' can therefore be interpreted as thought processes that include high-level functions such as information processing and memory, and executive functions such as planning, problem solving and self-monitoring. According to Du Preez (2015:71**)**, how information users' process information can differ and this is dependent on their current state of knowledge.

Certain cognitive structures seem to affect users. The three cognitive structures identified by Allen (1991:7) include conceptual knowledge, task knowledge and knowledge of the resources that are used. This kind of knowledge can be acquired through education and work experience (Du Preez 2015:26). Borlund and Dreier (2014:494), Allen (1997:207-211) and Dervin (1983:157) contend that the basic idea of the cognitive structure is that different users will experience different information needs in identical cases. This happens because individuals have different understandings of their situations, which are based on their experiences and other pressing factors unique to them.

Individuals' cognitive structures enable them to understand received messages (Meyer 2016). Meyer (2016) further elaborates by stating that the understanding occurs when the received message is harmonised with existing knowledge, concepts and skills. When this occurs, users can judge the received message, based on prior knowledge. This is supported by Case and Given (2016:89). According to them, the receiver's interpretation of the world as 'making sense' leads to a more detailed picture of how and not when to receive messages.

2.5.2 Affective structures

In psychology, affective structures entail the feelings or user experiences that may or may not relate to a particular object or event (Berkowitz 2000:11-12). These events or attributes may also be personal preferences. It could also be trust, anxiety, lack of confidence, frustration and confusion (Kuhlthau 1991:366). These affective structures can affect information needs in the sense that it will affect source selection or a need for more resources to confirm something.

Meyer (2016) states that the affective structure comprises attributes such as emotions and feelings. According to her, these affective structures can affect a person's attitude to accomplish a task. In turn, Wilson (1997:551-560) notes that the affective structure has something to do with users' belief systems that move (motivate) them to perform a particular task.

However, information needs can also be triggered by affective needs for an accomplishment (Wilson 1981:7). Kuhlthau (1991:362) points out that users' affective structures are triggered by emotions and feelings that are related to the human mind.

Some conditions give rise to information needs. The conditions revealed by Case (2012:85-87) include the reduction of uncertainty and making sense. This is also emphasised by Kuhlthau (2004:4-5). According to her, the affective need is targeted on reducing feelings of uncertainty and therefore affective elements, such as trust, affect a user's search for information. This helps users select and use a specific information resource.

2.5.3 Sensorimotor structures

Sensorimotor structures are the personal intentional, planned, goal-oriented, or striving component of motivation (Baumeister, Bratslavsky, Muraven & Tice 1998:1253). According to Nahl (2001:1), the sensorimotor structures of the inner person act as motivators (triggers) for users to react and do something about their information needs. The experience of a need is only disclosed by inferring from the actions of the person in need or through motives (Baumeister et al. 1998:1263). Similarly, Case (2012:81-83) states that information needs give rise to information activities but if the retrieved information makes the user realise that they need more and different information, the information retrieval activity prompts

information needs.

2.6 REFLECTION ON INFORMATION NEEDS

The discussions on information needs have provided various contextual elements which prompt users' information needs. All users strive hard to use the resources available to fulfill their information needs. The information needs of users within their context are conceptualised in Figure 2.1.

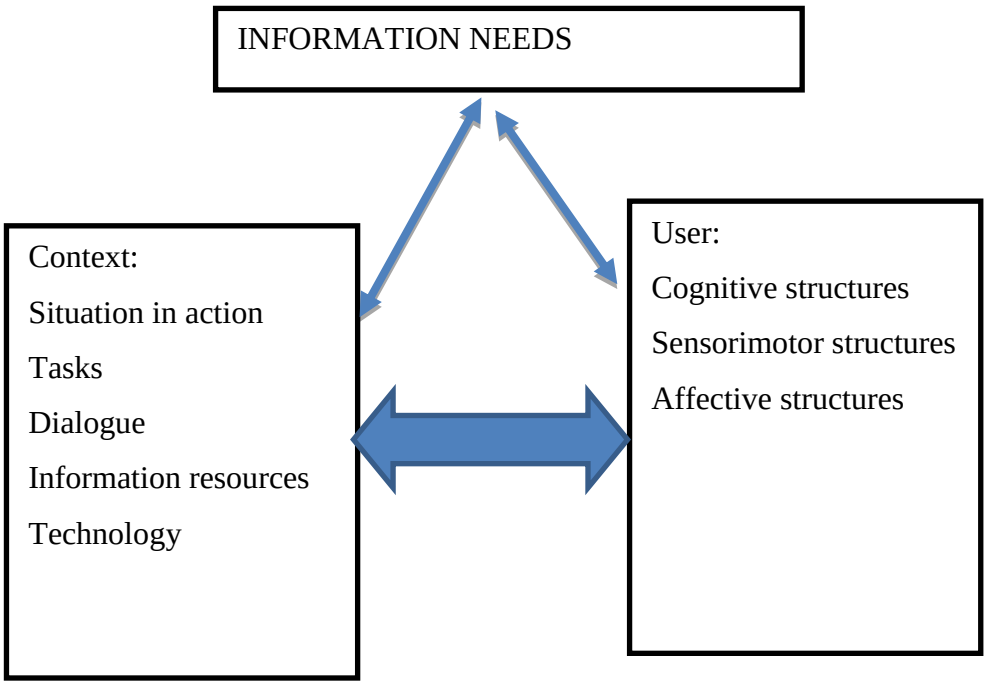

Figure 2.1: Graphic representation of users' information needs

Figure 2.1 illustrates that information needs are affected by some contextual elements, as indicated in the diagram, namely situation in action, tasks and dialogue. These contextual elements also define the knowledge gap of the information user. However, information resources that are available for users to satisfy their information needs are also situated in context. This also applies to the available information communication technologies that can be used to search for and access information. From the diagram, there is a bidirectional relationship between the contextual elements, and the cognitive and affective structures of information users. Some of the cognitive structures are knowledge gaps, basic information-

searching skills, and experience. In turn, some of the affective structures also affect information needs. These are: an awareness of an information need, feelings of uncertainty and anxiety.

2.7 CHAPTER SUMMARY

This chapter focused on information needs and endeavoured to understand those factors that give rise to an information need, which in turn prompts an information activity. From the discussion, it was understood that information needs arise when a user identifies a lack of knowledge or a shortfall in his/her understanding to satisfy a goal. The literature reviewed showed that information needs can be discussed from a contextual or a subjective view of thought. Two major contexts in which information need arise were identified, namely, the situation of action, and task performance. Studies that have a subjective approach to information needs consider the individual's cognitive, affective and sensorimotor structures. Not all aspects with doctoral students' information needs were studied. An in-depth study of doctoral students' information needs may yield more detailed findings. The next chapter addresses information seeking, which is an information activity that is prompted by an information need.

CHAPTER 3

INFORMATION-SEEKING BEHAVIOUR

3.1 INTRODUCTION

This chapter aims to conceptualise the behaviour of doctoral students towards information-seeking and learning using smartphones or tablets. A discussion on the contextual elements that affect users' information seeking and the role of technology in searching for information continues hereafter. Again, the contextual and specific elements that influence the actions of students seeking information are explained in detail. Furthermore, the chapter also includes a discussion on the Ellis (1989) model which guides this study.

3.2 BACKGROUND

Information seeking is the "conscious effort a user makes to acquire information in response to a need or gap in knowledge" (Case 2012:5). In searching for information, different kinds of behaviour are shown as students have different reasons or motives for seeking information. Information seekers also have different abilities and they use different information resources when they search for information.

According to Talja, Keso and Pietäinen (1999:751-753), there has been a growing recognition of the user's research context "as a frame of reference in information behaviour" (Du Preez, 2015:28). This is because information behaviour emerges from circumstances but does not happen coincidentally (Attfield, Adams & Blanford 2006:165-166). According to Attfield et al. (2006:165-166), the information-seeking behaviour context provides an explanatory framework for meaningful interpretation. They also observe that such a context places an evolving personal situation and offers a basis for generalisation by suggesting prior circumstances that might have be predictive. According to the study of Vakkari, Savolainen and Dervin (1997:451-452), "context provides the necessary field for understanding users' information behaviour" (Attfield et al. 2006:166).

Consequently, learning more about users need for information is important and the available information resources influence their information-seeking behaviour. Students rely on information to further or complete their studies. Additionally, they seem to be embracing mobile information technologies to enhance their learning. To provide an information service

to these students, an understanding of their information-seeking behaviour is required.

3.3 INFORMATION SEEKING

There are various definitions in the literature for information seeking. One of the oldest definitions is the one by Krikelas (1983:6). According to him, the quest for information seeking refers to any human activity to discover a message or information that fills a perceived information needs. This means that the person seeking information is experiencing a knowledge gap. Wilson's (1999:251) definition of information seeking is similar to Krikelas's definition. He describes information searching or seeking as an outcome of a need perceived by an information user who requests direct or indirect sources to fulfill that need, resulting in success or failure to find pertinent information. In a similar vein, Ajiboye and Tella (2007:42), Case (2002:5) and Wilson (2000:49) view information seeking as a conscious effort that users make to acquire information in response to an information need or a gap in their knowledge.

The definitions by Esew (2015:5), Okonoko, Njideka and Mazah (2015:2) and Ajiboye and Tella (2007:40-42) describe information-seeking behaviour in terms of the ways and means an individual use to collect and locate information for personal use. According to them, users gather and search for information to update and develop their knowledge and ideas. Therefore, users attempt to seek current information from library resources, including electronic sources, to meet their goals.

Information seeking is described differently by Fatima and Ahmad (2008:141), Pettigrew, Fidel and Bruce (2001:44) and Majid and Kassim (2000:2). According to them, information seeking can be seen as a series of acts taken by individuals to communicate their information needs, and consequently to search, evaluate and select the information that would satisfy their information needs. Similarly, the study of Burke (2007:679) maintains that the quest for seeking information encompasses the medium employed by individuals in finding specific information and pursue solutions to information problems. Therefore, users are then interested in the topic and decide to search for more information themselves on the topic as learners.

The purposeful acquisition of information from selected information carriers can also be

defined as information seeking (Esew 2015:3; Wilson 2000:49). According to this definition, the individual purposively seeks information from available resources to fill a perceived need for information. In their definition for information seeking, Ingwersen and Järvelin (2005:386) argue that users may consult manual information sources or computer-based systems when they seek for information to satisfy an information need. Manual information sources and computer-based systems are examples of the formal and informal information sources (Wilson 2000:49). Rieh and Hilligos (2008:49) expanded the list of information sources. The list of sources includes the use of online search engines, advisory bodies, visiting the "library and watching television to search for information" (Desta et al. 2017:363). Bhatti (2009:2) also added academic studies, "experimentation and entertainment as information sources" users can use when seeking for information.

A study conducted by Agyapong (2005:70-74) revealed that students are motivated by diverse reasons to search for information while resorting to the information resources provided in the library of the University of Ghana. Agyapong (2005) also found that, in their immediate environment, graduate students use resources accessible to them and that when they look for information, they use different channels of information. The library is also used frequently as an information resource in seeking information to acquire knowledge.

In turn, Zerbinos (1990:922) argues that information seeking takes place when a person has knowledge stored in her/his long-term memory, which then precipitates an interest in related information. This happens when there is a motivation or interest in acquiring that knowledge. She further indicates that it can also take place when users recognise a knowledge gap or an information need that motivates them to acquire new information. To acquire information, the user has to select information from a particular source, system, channel or service to satisfy that need. This view of a knowledge or information gap that prompts information seeking is supported by Case and Given (2016:372) and Marchionini (1995:5-6). According to them, information-seeking behaviour occurs when a problem is identified but cannot be substantiated by an internal knowledge and belief suggest a path towards the attainment of their solution.

According to Kuhlthau (2004:3), information seeking is considered to be a process. The findings of her longitudinal studies indicate that people are searching for information to

broaden their perception of the environment because the search for information in life is a principal action. Considering the quest for information as a learning process, Marchionini (1995:5-6) describes it as a mechanism in which users utilise to purposefully change their state of knowledge. In addition, he describes that the mechanism is fundamentally interactive as knowledge seekers direct attention, embrace and respond to stimuli, focus on progress and assess the usefulness of the information.

In a similar vein, the study of Singh and Satija (2006:29) maintains that the behaviour towards information seeking is a "human process that requires adaptive and reflective" (Attfield et al. 2006:5) actions of an information user searching for information. According to this, users' information-seeking behaviour results from the recognition of some perceived needs for information and is focused on satisfying the need.

Information-seeking behaviour, according to Case (2002:5), is a normal daily activity which becomes prominent when one has to make a major life choice or complete a task within a defined time. In such situations, people continue to search for information from different sources until their needs are fulfilled or their goals accomplished. Case (2002:5) and Wilson (1999:249) describe such information seeking as a "common aspect of human life". According to Wilson (1999:249), users usually employ all information activities in respect of information seeking.

Lastly, Esew (2015:3), Palsdottir (2003:228), Case (2002:5), Wilson (2000:49) and Williamson (1997:337-338) note that information seeking could be active or passive. Regarding the passive aspect of information seeking, studies such as Bates (2009:49), Allen et al. (2011:776) posit that it occurs when users come across some information but do not intend to use the information acquired. According to Wilson (2000:49), it "includes face-to-face communication with others, as well as the passive reception of information". However, passive information-seeking occurs when a user uses media technologies such as watching a television programme or listening to the radio without actually seeking information (Wilson 1997:562). In turn, Erdelez (1997:412-414) notes that users may not necessarily act on the information that was passively received. Such information seeking is not motivated by a specific goal but by coincidence. Passive methods of searching for information include awareness, serendipity and information encountering. A successful knowledge-seeking

operation is knowledge searching.

3.3.1 Awareness

Users' awareness of information can determine the information-seeking path that will be taken (Leckie, Pettigrew & Sylvain 1996:184-185). According to Bates (2009:2381), "people obtain data by absorbing information in their everyday lives simply by being conscious of it". The awareness of students on a particular information determines the type of sources they will choose. For example, if students are not aware of the value of an electronic source, they will not use the electronic source. In turn, Bertulis and Cheeseborough (2008:187) conclude that it is as important for users to be aware of information that is relevant and possibly important for their information needs, as it is to simply have access to the information.

3.3.2 Serendipity

Serendipity is defined by Merriam Webster (2020) as "the phenomenon of finding valuable or agreeable things not sought for". However, when considering the concept from the view point of information-seeking behaviour, Foster and Ford (2003:321) view serendipity as something paradoxical. This is because serendipity is considered to be elusive and unpredictable. As Foster and Ford (2003:321-322) explain, this occurs when users actively search for information they need and they accidentally find the information they were not looking for but which is relevant to their information needs. As such, serendipity is considered as both purposive and non-purposive information seeking.

In their findings, Rice, McCreadie and Change (2001:182) linked browsing and serendipitous information retrieval. According to them, serendipitous information retrieval is one of the ways that a user employs when browsing through library journals to search for information. Rice et al. (2001:179) also note that serendipitous information retrieval can be done by using search browsing, general browsing and serendipity browsing techniques.

3.3.3 Information searching

Information searching is the information-seeking activity in which users may engage when they identify their need for information (Wilson 1999:249). In turn, Hepworth (2007:51-52) describes information searching as a specific cognitive action. Information searching involves the processes where users formulate a search strategy, go to the library systems and conduct

an information search (Kuhlthau 2006; Callery 1996:2).

These definitions and explanations of information seeking have shown that information seeking is the attempts of users to fill the gap in their knowledge and as a reaction to their information needs. However, it is strictly a human process that requires adaptive and reflective actions of the information seeker. Furthermore, section 3.4 will focus on context and how context influences information seeking.

3.4 THE ROLE OF CONTEXT IN INFORMATION SEEKING

The concept 'context' was clarified in Chapter 2, section 2.4. In that discussion, it was shown that researchers use different terms to refer to context and also identify various elements of context that have the potential to influence users' information needs. In a similar vein, elements in the users' context also affect their information-seeking behaviour.

In their discussion of context, Järvelin and Ingwersen (2004:379) note that a wide range of information technologies is involved in everyday life information practices and can be used in various contexts to seek, use and share information. Marchionini (1995:34-36) remarks that the habit of using information technologies in a given context shapes users' expectation of the information that is available for use. He further explains that contexts help users to rely on the available technology regarding storage capabilities and hypertext links that connect one resource to another. Lievrouw (2001:12) also believes that the use of information technologies plays a dual role. According to her, information technologies serve as a shaper of information practices and are used to support "separate social spaces" (i.e., contexts) where each social space includes certain contextual elements such as information resources, communication relations and enabling technologies. Each context embraces certain elements that shape information seeking. The elements that Courtright (2007:287-288) identifies include "rules, resources and culture, social factors in context, problem situations and information technologies". In turn, Wilson (1981:8) identifies work contexts and the work contexts' climate, the socio-cultural context and the physical context as contextual elements affecting information-seeking behaviour. In a study focusing on students' information-seeking behaviour, Desta, Du Preez and Ngulube (2019:364) identify the university as a context where the university library and the tasks students need to complete during their studies act as contextual elements affecting the students' information needs and information-

seeking behaviour.

3.4.1 University libraries

The current study was conducted within an academic context. In his study, Desta et al. (2019:364) identifies universities as information-seeking contexts. In addition to being a context in which information is needed, sought and used, Desta et al. (2019:364) also note that universities have libraries which provide access to the information sources students need to use to complete their academic tasks.

In a similar vein, Esfahani and Chang (2012:6) argue that academic or university libraries provide access to different kinds or types of information sources. The information sources they identify include online databases, printed books and online journals. An information search in the University of South Africa (UNISA) library catalogue together with the University of Cape Coast (UCC) library proved that these two academic libraries also provide access to e-books. The physical availability and accessibility of the information sources in the library affect students' information-seeking behaviour. This has led to changes in the manner in which students access information and how libraries deliver information in the digital environment (David 2002:13).

3.4.2 Sociocultural context

Culture is a social phenomenon (Jarvis 2006:55). This could relate to individual or external influences that shape users' behaviour and opinions. In terms of cultural relations, Williams and Johnson (2011:42) stress the importance of considering personality characteristics, intercultural attitudes and life experiences. The importance of understanding the sociocultural context of users is stressed by Williamson (2005:230) and Bradley (2000:425). According to them, this sociocultural context could affect a user's information seeking.

Savolainen (2016:4) notes that social norms, normative expectations and cultural values are human constructs which affect users' information seeking. He explains that this is because some of the elements in the sociocultural context act as barriers to information. Barriers can be defined as "obstacles hindering, delaying or preventing access to information" (Swigon 2011:475). According to this definition, barriers can not only completely halt users' information seeking, but can also make the information-seeking process take longer and

make the search unnecessarily extensive.

Savolainen (2016:6) and Harris, Stickney, Grasley, Hutchinson, Greaves and Boyd (2001:130-134) note that human constructs such as social norms, normative expectations and cultural values are also present in institutional contexts. According to them, institutional barriers come into existence when organisations consciously and unconsciously prevent users from obtaining the information they need. This is supported by Houston and Westbrook (2013), who view authoritarian control as a form of institutional barrier that could affect information seeking.

In turn, Swigon (2011:483), Joseph (2010:37-39) and Liew and Ng (2006:66) are of the view that a lack of information resources, such as printed books and access to databases, can also be viewed as institutional barriers that affect users' information seeking. Their view is supported by Shenton (2008:281-283) and Pettigrew, Durrance and Unruh (2002:898), who also found that a lack of sources and outdated library sources affect users' information seeking.

Students come from different cultural backgrounds. The students' cultural differences can influence their judgement and the choices they make when seeking information (Weber & Morris 2010). Therefore, Amsberry (2008:356) stresses the need for academic institutions to consider students' sociocultural contexts along with other possible challenges or barriers that prevent effective spread of important materials to this user group. Another reason for considering sociocultural differences is provided by Guild (1994:16-18), who maintains that information users approach learning differently with a motivation influenced by their cultural experiences.

3.4.3 Tasks

In section 2.4.2 it was shown that tasks are a series of actions or functions undertaken by users to achieve their unchangeable goals. Tasks is another contextual element that affects "users' information needs, which in turn shapes their information-seeking behaviour" (Desta et al. 2017:373) and supported by other studies (Kim 2009:680-681; Courtright 2007:283; Byström & Järvelin 1995:193-194). Based on two software engineers' definition of tasks, namely Hackos and Redish (1998:56), Vakkari (2003:416) defines task as an "activity to be

performed to accomplish a goal". Vakkari's (2003:417) definition of tasks is similar to the definition adopted by Bruce, Fidel, Ingwersen and Vakkari (2002:241). These authors define tasks as a set of actions an individual needs to complete, which are recognisable from beginning to end.

In turn, one study argues that a fundamental criteria that influences users on choice of information source, discovered and evaluated is information task (Solomon, 2002:240). Solomon (2002:240) further explains that this evaluation of information that is obtained about the task helps users to acquire new ideas relating to the task requiring completion. Students are expected to look or seek for information to "accomplish a task that could lead to an information need" (Du Preez, 2015:39), which in turn shapes their information-seeking behaviour. Students could be given these tasks for their academic or personal development. According to Bygate, Skehan and Swain (2001:11), writing an assignment as a course requirement or the completion of school projects are tasks for which students require information to deal with.

The link between the task that requires completion and the use of information channels and sources is noted by Landry and Fay (2006:1896-1900), Kim (2002), Vakkari (1999:819-821) and Byström and Järvelin (1995:191-193). The nature of the task therefore determines and shapes the information-seeking behaviour of the user.

Students have different types of tasks in which they engage. These include doing an assignment, preparing for group or class discussion, writing project work, preparing for an end-of-semester examination, sitting for an examination, course work and preparing conference or seminar papers (Desta 2016:29). Moreover, Desta et al. (2019:364) argue that all of these tasks require a particular information to deal with.

3.4.4 The role of technology in information seeking

Technology plays an important role in information seeking (Meyer 2016). Considering Rieh's (2004:749) observations, technology has changed the information-seeking and retrieval behaviour of users. As Rieh (2004:749) notes, users have become reliant on technology-based information retrieval systems when they search for information. Lievrouw (2001:18) specifically identifies Web search engines as important information-seeking tools.

Apart from providing access to information, information communication technologies seem to enhance information use (Burford & Park 2014:623-625; Williamson 2005:130; Ingwersen 2005:130; Wilson 1981:662). Burford and Park (2014:623-625), Williamson (2005:130) and Ingwersen (2005:130) further observe that mobile technologies and digital information tools provide access to information. These mobile technologies also serve as a foundation for information sharing and knowledge acquisition. From Saxena and Yadav's (2013:3-7) point of view, mobile technologies serve as a primary interface for users to access and share information.

In turn, Bruce (2014:9-11) argues that users can efficiently use mobile technologies and related devices in all aspects of their daily lives to search for information, navigate the Web and access their email. According to Burford and Park (2014:623-625) and Williamson (2005:130), users are no longer restricted to a location or environment (including a university library) when seeking information by using technological devices. Meyer (2016) comments that technological devices enhance the user's ability to construct and individualise online information and construct an interface to suit their information requirements.

In the past, students' information seeking was restricted by their university libraries' collections. But now, thanks to the available information technologies, students can search in much larger collections that include quality information. Nkomo (2009:19-20), Lehnert (2001:37) and Dalgleish and Hall (2000:104) remark that opportunities to use the Internet to search for information have made technology the best information resource for learning. Besides, the use of technology has also improved students' information retrieval skills (Omidian & Seifi Maleki 2013:164-165; Omidian 2011; Alobiedat & Saraierh 2010; Buzzetto-More 2008).

Nowadays, doctoral students can use the Internet to search for information while using their mobile devices. Major, Hassler and Hennessy (2017:6-8) and Qayyum and Smith (2015:15-17) argue that students appear to be comfortable in using these technological resources for learning. However, they also noted that students seemed to struggle when using certain tools that were available on their technological devices to find relevant and credible information for their academic related activities. This observation is supported by the findings of Cull

(2011) and Kennedy, Judd, Churchward, Gray and Krause's (2008:116-119) studies. They found that many students did not seem to have mastered the required skills to search for information when using technological devices and therefore required information-searching skills training. This was also corroborated by Parthaje, Unnikrishnan, Thapar, Kumar, Panikulam, Geroge, Pai, Kulkarni, Holla, Darshan, Kumar, Mehta and Jay (2016:74-77), who reported that some students lacked the necessary information-seeking skills when using their mobile devices. They further indicated that students had much to learn to ensure they were able to use their mobile technologies to effectively and efficiently search the Internet for information relevant to their academic work.

In addition to the changes brought about by information communication technologies, mobile technologies have now brought a different set of challenges or barriers to their users. The following discussion explains some of these challenges or barriers that could affect students' information seeking when using mobile devices.

3.4.4.1 Costs

The costs involved in using technology to search for information affect users' information seeking (Babayemi, Velile & Tinashe 2019:10; Dunaway, Searles, Sui & Paul 2018:116). This could be put to the fact that searching for information by using technology is costlier in a mobile technology environment than when searching for information while utilising Wi-Fi technologies (Donner & Walton 2013:353-355; Wilson & Bolliger 2013). Therefore, using a mobile device when doing research for schoolwork, learning new things on mobile devices, and discussing and participating in project assignments costs more (Dunaway, Searles, Sui & Paul 2018:110-115; Farley, Murphy, Johnson, Carter, Lane, Midgley, Hafeez-Baig, Dekeyser & Koronios 2015:7-10; Donner & Walton 2013).

Similarly, Nestian, Tită and Turnean (2020) and Kamvar and Baluja (2006:702-705) argue that searching for information using a mobile device sometimes takes longer and it also produces fewer results, as compared to the results users retrieve when they use other means. Therefore, a lack of financial resources affects the information seeking of users who use mobile devices, in that they need to buy data to gain access to mobile digital services. According to West (2015:3), it is costly for mobile users to access data and the more they use their mobile devices for learning, the more expensive it is to search for information by using

these devices.

3.4.4.2 Functionality

Online information users make decisions about the platform they need to use when searching for information. The type of mobile device influences their ability to save, store and share documents (Napoli & Obar 2014:325-328; Donner & Walton 2013:353). This is supported by Cummings, Merrill and Borrelli (2010:30-34). According to them, mobile device functionality and the options available, such as the creation of a PDF document and the downloading of a Microsoft Office file downloading, together with the functionality of the device to store and view content, affect users' information seeking.

In a similar vein, Edonkumoh (2015:12) and Boruff and Storie (2014:23-26) observe that users require some level of understanding to use the digital gadgets that are embedded in mobile devices. As Edonkumoh (2015:12) explains, users who do not understand how to use digital gadgets could become frustrated and therefore will not use their devices for information seeking. He further indicates that the software applications fixed in these mobile devices require a constant power supply to make it functional. Consequently, mobile devices with poor power supply affect the continuous usage of such a device for effective information seeking.

3.4.4.3 Screen size

One of the barriers of using a mobile device for information seeking pertains to the small screen size of tablets and smartphones (Alwraikat 2017:124-128; Lee & Song 2015:155-158; El-Hussein & Cronje 2010:12-16). As observed by Hashemi, Azizinezhad, Najafi and Nesari (2011:2477-2480), small-screen devices limit the size of the information being displayed. From Bruce's (2014:18) point of view, mobile devices with small screen sizes affect how easy images are viewed on the devices' screens.

In turn, Wilson and Bolliger (2013:220-223) and Chae and Kim (2004:167-171) conclude that the use of mobile phones for information seeking sometimes gives poor quality graphics (including inadequate resolutions) because of the size of the mobile device. In a similar vein, Napoli and Obar (2014:325-330) and Chae and Kim (2004:168-173) reckon that it is challenging to access high volumes of information using mobile screens. Images and text may either be too small or cause eye strain and require constant scrolling, which could affect

information seeking. For example, Al-Ghamdi, Yunus, Da'ar, El-Metwally, Khalifa, Aldossari and Househ (2016:10), as well as Kim, Sundar and Park (2011:1208-1210), indicate that information users tend to search for less detail content using small-screen mobile device.

Differences in the screen sizes of mobile devices will naturally shape users' information seeking in significant ways (Kim, Sundar & Park 2011:1208-1210; Jones, Buchanan & Thimbleby 2003:479-495). Moreover, such effects may become insignificant or minimal as smartphones and tablets continue to be produced in an array of sizes.

3.4.4.4 Physical barriers

The main physical barrier to the use of technology when seeking information is the infrastructure of the information and communication technology (ICT) infrastructure (Ingutia-Oyieke & Dick 2010:69). Ingutia-Oyieke and Dick (2010:69) identified frequent power outages on campuses as an important ICT infrastructure problem. Mobile users need to have access to a power source because a mobile device's battery does not have a long lifespan. According to Napoli and Obar (2014:325-330) and Chae and Kim (2004:168-173), mobile devices' batteries affect users' information seeking. According to them, the shortened battery life of mobile devices is problematic when users need to continuously use their devices for long periods to search for information. This could affect the rate at which users could search for information by using their mobile devices. Running out of battery power in the middle of an information search can be disruptive, especially if a spare battery or access to a power source is not readily available.

In turn, Moly (2014:42-45) and Ahmed (2013) identified a different barrier, namely the slow download speed of these devices and problems users' experiences in gaining access to online sources. This is because mobile devices can connect to Wi-Fi or private data service providers (Husnjak, Forenbacher, Perakvić & Periša 2016). Wi-Fi networks allow for wireless connectivity to the Internet and are developed with the connectivity needs of mobile devices in mind (Computer Information System Company 2012). As such, Wi-Fi comes as a natural solution for offloading or receiving online sources, due to the built-in capabilities of devices such as smartphones and tablets (Aijaz, Uddin, Holland & Aghvami 2015:3). Therefore, a smartphone and a tablet can link to both a mobile service provider's network and

to Wi-Fi. This is a kind of situation where the mobile device would automatically connect to the Wi-Fi if it has been set up to do so when a Wi-Fi connection is available. When a Wi-Fi connection is not available, the mobile device uses mobile data. However, the offloading traffic on Wi-Fi can also challenge mobile users (Aijaz, Uddin, Holland & Aghvami 2015:9). Therefore, if the university library's Wi-Fi infrastructure is inadequate, students will not be able to connect to the Wi-Fi infrastructure which, in turn, affects their information seeking. This view is supported by Desta et al. (2019:364) and Zhang and Adipat's (2005:295-300) findings**.** Ganaie and Rather (2014:66-69) and Al-Moumen, Morris and Maynard (2012:445-450) also found that slow download speed, weak internet signals and the fact that libraries do not always provide membership usernames and passwords could affect doctoral students' information seeking.

These explanations have shown that technology affects users' information seeking. Rather than requiring an explicit calculation each time devices are used to seek for information, perceptions of costs, functionality, screen size, physical barriers and certain attributes towards the optimum usage of mobile devices affect users' information seeking. Users' personal attributes also affect their information-seeking behaviour.

3.5 PERSONAL CHARACTERISTICS

It was illustrated in section 2.5 that some factors in the inner person shape the knowledge needs of the individual consumer. The same elements that shape information needs also shape the individual's information-seeking behaviour.

Humans need information for various purposes (Menou 1995:470-475). Information is important to change students' current state of knowledge. When students realise that they need information for their studies, they know that in all probability the information will not come to them on its own; therefore, they have to go about searching for it. Raber (2003) comments that students might also search for information to reinforce prejudice as much as to learn the truth.

Desta (2016:16-20) argues that several personality variables such as personal preferences, emotions, knowledge and information skills contributes in shaping information behaviour of graduate students. The combination of these variables determines a person's personality, and,

in turn, personality could affect a user's information behaviour.

Personality is defined as the unique patterns of feelings, thoughts and behaviour, which is formed by a stable combination of personality traits (Phares 1991:4-6). According to Phares (1991:4-6), individuals' personalities predict how they will behave at different times and in different situations, and in the same way users' personalities may develop over time. He further argues that users' personality traits are not static, but can change to some extent and with differing significance during the learning process. Similarly, in psychobiology, Cloninger (1999) views personality as "the combination of characteristics that form an individual's distinctive character". As Ozowa and Aba (2017:4) noted, the individual personality traits include users' emotions, actions, perceptions, thoughts, motivations and experiences.

Heinström (2003:2-3) states that people who have a certain personality trait can be inclined to react in a manner that is characteristic of that personality type in any given situation concerning information seeking. Heinström (2003:2-3) further observed that personality traits are likely to affect users' attitudes and behaviour in the information-seeking context. The attitude and behaviour responses of each individual are the best indicators to understand the user's personality.

Meyer (2016) determined certain elements of a person's mental structure (that is the inner person) that shape users' information-seeking behaviour. The following discussion explains different mental structures and the elements in these structures that affect students' information-seeking behaviour.

3.5.1 Cognitive structures

In section 2.5.1 it was shown that, due to the differences in individuals' cognitive structures, individual users will experience different information needs in identical situations. Because the need for information trigger information seeking activities, different users will engage in information-seeking behaviour, which is different from their peers in identical or similar situations. This happens because users have different understandings of their situations, which are based on their experience, knowledge and skills.

Users' ability to analyse and their ability to recognise when information is lacking are attributes of their cognitive structures (Meyer 2016). In turn, Wilson (1984:200) maintains that individuals' cognitive structures relate to the availability of information to determine their choice of information and how the chosen information affects their frame of reference. According to Wilson (1984:200), users make informed decisions, based on their knowledge of a particular issue. This view is in line with Schutz's (1946:468) view that users make decisions based on found knowledge or opinion. Some of the users' cognitive structures include knowledge, information-searching skills, personal experience and expertise.

3.5.1.1 Knowledge

It is noted that "knowledge is a personal aspect that could affect users' information-seeking behaviour" (Du Preez, 2015:280) and supports the position by Weiler (2005:48-51). According to Bates (2009:2381), people's interaction with their environment (the context in which they find themselves), leaves an impression on them and such impressions change their "knowledge store". Lee, Paik and Joo (2012:1) maintain that users' knowledge could influence their choice of a source of information for learning. The anecdotal evidence which apparently influence the behaviour of students looking for information encompasses their understanding of the subject and competence in information literacy.

Furthermore, Bates (2009:2381) claims that interaction with information can change a user's "knowledge store". This suggests that users can gather information in the environment to change an already conceived understanding or idea. According to Allen (1991:7), through education, training and work experience, users acquire knowledge in a particular subject and of resources to extract information in a particular field. This provides support for Taylor (1991:223) who posits that information behaviour is influenced by training and education.

Azadeh and Ghasemi (2016:27-27), Kim (2009:683-685) and Allen and Kim (2001:7-10) contend that the knowledge of the information seeker is also a factor in satisfying their need to seek for information. As Kim (2009) explains, the individual user's knowledge level determines the type of information they want to acquire.

3.5.1.2 Information literacy skills

Users' ability to search for information is affected by their information literacy abilities.

Information literacy skills as defined by Kuhlthau (2008:71) is the ease with which users can find, appraise and apply information appropriately. In turn, Jorosi and Isaac (2008:123-125) defines information literacy skills as "the ability to identify what information is needed, understand how the information is organised, identify the best sources of information for a given need, locate those sources, evaluate the sources critically and share that information".

In a similar vein, the Association of College and Research Libraries [ACRL] (2000:1) defines information literacy skills as the ability to "recognise when information is needed and have the ability to locate, evaluate and use effectively the needed information". According to this definition, the individual can clearly define an information need and use various search strategies to retrieve information that would satisfy the individual's information need. The ACRL's (2001) definition of information skills is similar to Montgomery's (1997:8-10) definition. He views information-searching skills as an umbrella concept that includes online information-searching and information retrieval skills.

In the view of Taylor and Procter (2005:1), information-searching skills are those skills reflecting users' ability to scan information efficiently and use technological tools to extract relevant learning materials. The skill used to retrieve or search for information varies among users (Esfahani & Chang 2012:3; Malliari, Korobili & Zapounidou 2011:83-84; Porter 2005:335).

Students rely on information to further their studies. Information needs spark specific activities that result in the quest to seek for with support from modern technological devices such as mobile phones. According to Spink and Cole (2006:2) and Somi and De Jager (2005:259), the availability of mobile devices for learning requires users to have information-searching skills when they search for information. In turn, the study of Sibanda (2004:387) maintains that the skills to search for information is a general requirement expected of all users to find and evaluate the information needed for their academic work.

3.5.1.3 Personal experience

Users' personal information-seeking experiences evolve and are affected by the successes of their previous information-searching attempts (Byström & Järvelin 1995:195-200). Therefore, based on their previous positive experiences of using certain information channels

and sources, users will be inclined to keep on using the same sources and channels. Carlson and Zmud (1999:157-162) are of a similar view. They also found that users' good experiences with information channels and sources usually lead to repeated usage of those channels and sources.

3.5.2 Affective structures

As described in section 2.5.2, affective frameworks including feelings, trust feelings are correlated with the urge to seek for information. A related literature review by Meyer (2016) found that affective structures could affect a user's attitude towards accomplishing an information-seeking task. Similarly, Savolainen (2014:2) noted that the affective structures that have this effect include personal beliefs, preferences and a predisposition towards certain objects and persons. The affective structures that were considered for this study include personal preferences, emotions and motivations.

3.5.2.1 Personal preferences

Users' personal choices for specific categories of sources of information might influence the behavioural search for information (Desta et al. 2019:366) and supported by other studies (Desta 2016:19; Lee, Paik & Joo 2012:1; Woo 2005:125-127). This view is supported by Kim and Sin (2007:656-660**)**. According to them, users' personal preferences for certain information sources like online books, online databases and journals affect their information seeking. Hiller (2002:8-12) also reports on how certain students' preferences affect their information seeking. She found that students prefer to use online information resources when they search for information, rather than using traditional methods. Moreover, students prefer sources of information with unique options, ease of control and convenience, which could eventually affect their information-seeking habits.

On the other hand, some students prefer seeking information by using electronic or digital resources (Thanuskodi 2012:3-6; Xuemei 2010:443-444; Kim & Sin 2007:655-660). Students prefer sources of information that they perceive to be reliable and that provide relevant information in supporting their learning needs.

3.5.3 Sensorimotor structures

In Chapter 2 section 2.5.3, it was shown that the sensorimotor structures of the inner person

act as motivators (triggers) which prompt users to react by seeking relevant information. The sensorimotor structures considered in the current study include emotions and motivation.

3.5.3.1 Emotions

Emotion is defined as the "brief episode of coordinated brain, autonomic and behavioural changes that facilitate responses from both external and internal events of significance for the organism" (Savolainen 2014:2). Savolainen's (2014:2) definition suggests that emotions are directed at objects, events or circumstances. According to Forgas (1992:230), emotion signifies a state (including fear, anger or happiness) that is short-lived and has a definite cause and clear intent. According to Landry (2014:23), such a state includes the joy one experiences, for example, when given a gift.

According to Savolainen (2014), emotions can motivate users to use certain information sources. Emotions can also be categorised as being a positive emotional valence (Savolainen 2015:12; Zeelenberg, Nelissen, Breugelmans & Pieters 2008:19). According to Savolainen (2015:12), beginning and extending a knowledge search is correlated with positive emotional valence (for e.g., joy). Successful search processes evokes positive emotions. In turn, feelings of uncertainty also potentially influence the behaviour to seek for information. The study of Kuhlthau (1993:346-347), uncertainty is a cognitive state that causes affective symptoms such as a lack of confidence and anxiety.

On the other hand, negative emotions hinder learning which, in turn, affect users' information seeking (Butler & Cartier 2005; Onwuegbuzie & Jiao, 2004:43-50; Mellon 1988:137-139). Emotions like fear can predict the information-seeking behaviour of users' (Ozowa & Aba 2017:18; Savolainen 2015:12; Lopatovska & Arapakis 2011:576; Lisa 2007:168-169). For example, fear among students can affect their information searches and performance. Also, fear can affect students' ability to search for information to complete an assignment.

Furthermore, Orlu, Ilo and Tochukwu (2017:7), Bronstein and Tzivian (2013) and Nahl (2005) argue that other negative emotions, such as frustration and irritation, also affect information seeking. This could be put to the fact that frustration leads to indecisiveness and vague thoughts or confusion regarding a problem or topic.

Emotions affect users' behaviour as it affects the strategies used in the search, the search performance, the search process, as well as the user's interest in the search process and the information that is acquired (Lopatovska 2009). Matteson, Farooq and Mease's (2013:204-205) findings endorse this view. They found that the emotional status of users can contribute towards several outcomes such as search process problems, information adjustment and personal information-searching problems.

3.5.3.2 Motivation

Motivation indicates forces acting either on or within a person to initiate and direct behaviour (Petri & Govern 2004:16). In psychology, motivation is defined as "the process that initiates, guides and maintains goal-oriented behaviour" (Cherry 2013). According to these definitions, users' motivation may prompt and guide their decisions to seek, select, access and use the selected information. In a similar vein, Gollwitzer, Delius and Oettingen (2000:198) view motivation as the type of goals people set and how they go about achieving them. Therefore, motivation explains how and when goal-directed behaviour of people gets started, energised and sustained.

Motivation influences the way information is searched and evaluated (Limberg 1998). The more users are interested in a certain subject or topic, the more information they want to obtain to satisfy their needs. As Heinström (2003:1-2) observed, users' decisions to search for information are dependent on their motivation, which may have a cognitive origin or may be emotionally based on the need to reinforce previous values.

Two mental structures act as motivators: self-efficacy and learning styles (Wilson 1999:257; Ford, Wood & Walsh 1993:6-9). The following discussion focuses on these motivators.

a. self-efficacy

In psychology, self-efficacy is simply "the confidence that one has in one's abilities" (Pajares 2000:1). However, Wilson (1997:563) views self-efficacy as an activating mechanism for users. Self-efficacy limits users' thinking and level of motivation to search for information (Case 2012:153). Users are also unlikely to search for information if they do not perceive a knowledge gap or a need for information to deal with the problem with which they are confronted. Case (2012:153) further suggests that, due to self-efficacy, an individual may be

aware that the use of a particular information source may produce useful information, but the individual will doubt his/her capacity to access that information source.

b. learning styles

Users' learning styles seem to affect their information behaviour. According to Court (1997:126), learning style is can be described as the interconnected of "personal knowledge and mental processing activities" (Du Preez, 2015:71). The study of Zapalska and Brozik (2006:328), a learning style is the preference of an individual to perceive and process information in a particular way. Users' learning styles can be affected by several factors, namely their instructional preferences, learning modalities and learning strategies (Shuib 2013:29). Peterson (2009:518-523), a psychologist, argues that the use of learning strategies and modalities in learning can be motivated by the type of learning task and the environment.

3.6 REFLECTION ON INFORMATION SEEKING

The review of related literature on the concept of information seeking that the search for information is motivated by a need for information. Additionally, information seeking is affected by the interaction between certain contextual elements such as tasks, university libraries and sociocultural factors, and users' mental structures, namely their cognitive, affective and sensorimotor structures. Technology is a contextual element that enables information seeking. Figure 3.1 graphically illustrates the various factors that affect information-seeking behaviour.

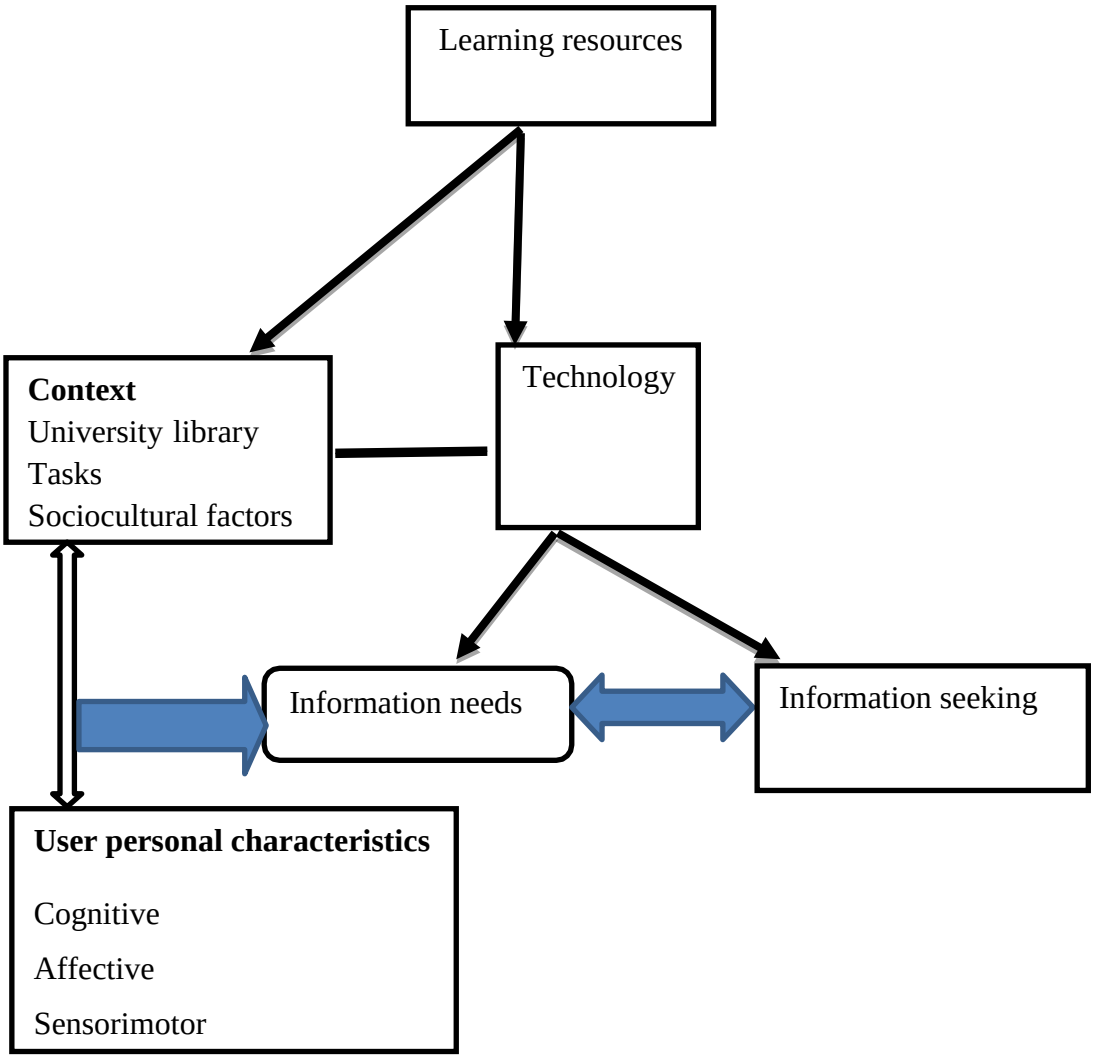

Figure 3.1: Graphic representation of users' information-seeking behaviour

The following discussion will focus on the information-seeking behaviour model developed by Ellis (1989). From Figure 3.1 it could be observed that information seeking has a bidirectional relationship with information needs. This is depicted by the double-pointed arrow. This means that as much as an information need leads to information-seeking behaviour, the information-seeking process could similarly prompt an information need. Due to the interrelationship between information needs and information-seeking behaviour, both are affected by technology, which is also a contextual factor. Additionally, the learning resources and library resources are linked to the contextual element. In Figure 3.1, the interaction of individual characteristics and related context is evident, which then give rise to information needs. Some of these contextual elements are tasks, sociocultural factors and the university library. Moreover, there are two categories of users' personal characteristics which

is cognitive characteristics and affective characteristics.

The following discussion will focus on the information seeking behaviour model developed by Ellis (1989).

3.7 ELLIS MODEL

Various researchers have investigated the information needs and information-seeking behaviour of students from different perspectives, using models to guide their studies. A few of the models that were developed and which are of relevance to this study include information seeking model by Krikelas (1983) and Ellis (1993; 1989), "work chart structure hypothesis" (Bystrom and Jarvelin (1995), Kuhlthau's (1993) information search process model, Leckie, Pettigrew and Sylvain's (1996) model of the information-seeking behaviour of professionals, the information behaviour model by Wilson (1999) and Schematic model by Savolainen (2006).

The Ellis model is an "empirical model designed to analyse the knowledge-seeking actions of academic social scientists in the hope that the model could be used as information retrieval system and development" (Ellis 2005:138). Furthermore, Ellis model is based on different assumptions of users' information-seeking processes (Robson & Robinson 2012:174-178; Makri, Blandford & Cox 2008:2248). As Ellis (1989:171-173) explains, the model is focused on explaining users' interactions with information sources. To do so, Ellis (1989) identified different features (i.e., the assumptions that Robson and Robinson (2012) and Makri et al. (2008) referred to in the information-seeking process, which individuals may adopt to discover information that would satisfy their information needs. Ellis (1989) behavioural model was developed based on eight (8) primary features as indicated below:

- Starting: the first feature of the model encompasses the initial information search. According to Wilson (2000:52; 1997:259) and Ellis and Haugan (1997:395), the starting activities occur when users locate issues in their working field. By doing this, users will perceive a gap between the information that is needed, and their knowledge and it is this information gap that prompts them to seek relevant information. The starting feature of an information search involves the identification of references that could initiate the information search (Meho & Tibbo 2003:570).
- Chaining: This feature involves "following chains of citations or other forms of

referential connection between materials" (Kalbach 2006:3; 2005:138). According to Ellis (1989:179), users recognise what they want and get involved in following a chain of cited sources.

- Browsing: This involves "semi-structured searching in an area of potential interest" (Desta, 2016). According to Alazemi (2015:93), users' browsing involves using pointers such as content pages, title lists, topic headings and summaries to narrow their search. Chu (2010) describes browsing as seeking and selecting information by skimming and scanning. According to Bawden (2011:4), browsing can also be viewed as active and passive information seeking. He further elaborates that active browsing occurs when users purposively search for information. However, passive browsing occurs when users come across some information but do not use the information acquired. According to him, users do general scanning with no end in mind.
- Differentiating: This feature involves using the known discrepancies between sources of information as a filtering tool for examining gathered information (Ellis et al. 1993:179). Ellis (1989:179) further indicates that users filter their searches by constantly following or tracking specific sources of information to differentiate or distinguish between the data provided and other ideas. In such situations, users review the results by viewing information such as the content and dataset size (Shneiderman, Byrd & Croft 1997:18-20). However, Alazemi (2015:97) noted that users might prefer some types of information over other types and therefore may or may not be able to achieve their search goals successfully. According to him, this could also depend on the user's ability to search for information.
- Monitoring: This feature has to do with maintaining technological development awareness by following a particular source (Ellis & Haugan, 1997:369). According to Kundu (2017:399-400), information seekers go through core sources of information which include personal contacts and publications. In a similar vein, Meho and Tibbo (2003:571) note that monitoring is achieved by going through sets of journals, abstracts and computer enhanced databases.
- Extracting: This is the orderly "identification of relevant material in an information source" (Nwobasi, Uwa & Ossai-Onah 2013:11) and this support the position of Ellis (1989:179). According to Ellis (1989:179), users then go through the available resources to select the material that are of interest to them. Similarly, Alazemi (2015:99) noted that users scan and interpret the results obtained to establish whether

it would suit their needs. He further observed that, when users find the required information, they download the information.

- Verifying: This feature involves the checking of the obtained information for accuracy. The study of Sayed (1999:13) notes that knowledge verification and usage are higher-order cognitive abilities. Further, Macpherson (2003:333) subsequently disclosed that in scholarly work, students often use intellectual capabilities to validate the knowledge collected.
- Ending: This feature consists of activities characteristic of information seeking at the end of a topic or project (Ellis & Haugan 1997:365). According to Ellis and Haugan (1997:365), this involves the putting together of material for publication. Additionally, according to Alazemi (2015:99), users make sure that the information obtained is accurate and then end the search process.

Figure 3.2 graphically illustrates the information-seeking behaviour model developed by Ellis (1989)

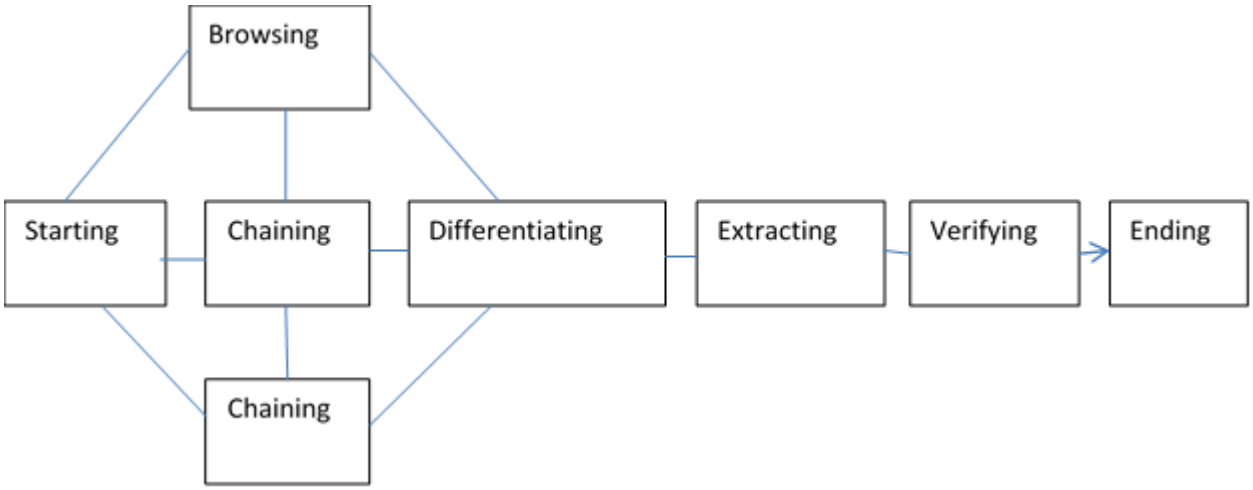

Figure 3.2: Ellis's (1989) information-seeking behaviour model
Source: Case (2012:144)

According to Ellis (1989:185-190), the different information-seeking activities do not follow a set pattern where each feature follows after another. Instead, the features adopted by the information seeker "depend on the circumstances or context of the individual's information-seeking activities" (Wilson, 1999).

The purpose or objective of Ellis's (1989) model is in line with early information behaviour research and was concerned with collecting data to improve an information system or service (Case & Given 2016:188). Furthermore, the identified three fundamental, interrelated characteristics of other models are present in this model, namely a process model, a summary model and a general model (Ingwersen & Järvelin 2005:64). Therefore, the different characteristics of the model would support researchers in acquiring an understanding of users' information-seeking processes as well as acquiring an understanding of those factors affecting the information-seeking process. Seeing that the purpose of the current study was to improve library services for doctoral students using mobile devices to search for information and an appreciation of users' information-seeking processes and resultant behaviour, the study of Ellis (1989) "behavioural model of information seeking" (Wilson, 1999) was used to guide the study.

3.7.1 Research conducted using the Ellis model

In a social science research that empirically relate to the quest for information behaviour, Ellis's (1989) model was tested (Orlu 2016:10). The model was also used by information scientists and knowledge managers (Choo, Detlor & Turnbull 2000), Chemists (Ellis et al. 1993:358-362), engineers (Ellis & Haugan, 1997:390-394) and Physicists (Ellis et al. 1993:358-362). Ellis (2005:139) noted that, despite the different disciplinary backgrounds of the different groups of researchers studied, there were considerable similarities in responses of the various groups.

A study conducted by Esew (2015:47) adopted Ellis's model to investigate the "online information-seeking behaviour of doctoral students in Ahmadu Bello University in Zaria" (Nwobasi et al. 2013). According to Esew (2015), Ellis's (1989) information-seeking behaviour model helped in properly appreciating the way and manner users search for information and satisfy their online information needs.

Furthermore, the study of two scholars, Meho and Tibbo (2003:570-571) re-examined Ellis (1989) model and out of the eight features, they considered six which include starting, browsing, chaining, differentiating, extracting and monitoring. The study validated the 1989 Ellis information seeking model but introduced four additional features to the current model

of Ellis. These features include access, network, verify, and manage information. Thus, the function to verify also emerges in these latest suggested optional information seeking features. It is clear that the checking function also emerges in these latest suggested optional information-seeking features. They further assert that not all the new features are information seeking activities but play significant role in retrieving information.

Bronstein (2007:15) adopted Ellis's behavioural model for research on the information-seeking behaviour of scholars of Jewish studies. Although all the information features in Ellis's model were used, the participants' information behaviour was not used randomly as Ellis had suggested. The study concluded that there was a strong relationship between the information strategies used and the features of the research in information seeking. A study conducted by Turnbull (2005:397) confirmed that Ellis behavioural model has contributed in shaping information seeking development on the web using technology.

3.7.2 Criticisms of the Ellis model of information-seeking behaviour

Although Ellis's (1989) model offers general insight into information-seeking behaviour, it has also been criticised by some researchers. One such criticism is that "there is no reported information about the specific tasks" (Kehinde et al. 2016:11) in which the studies were performed with physical data collection (Ingwersen & Järvelin 2005:82). Ingwersen and Järvelin (2005) also raised the concern that the characteristics of the Ellis model do not provide any direct design specifications for interactive systems, but only give types of activities that users might want to accomplish through such systems. Seeing that the purpose of the current study is not to design an information system, this limitation will not have an impact on the usefulness of the model for this study.

Additionally, Järvelin and Wilson (2003) point out that, although Ellis's model describes information-seeking behaviour, it does not explicitly relate to external causative factors. Apart from the external causative factors, Case (2002) contends that Ellis's behavioural model does not consider many factors and variables generally involved in information seeking. For example, some of the factors that are not considered by the model is type and kind of needed information or 'help' that might satisfy the user, the availability of sources of information, and their characteristics. In his findings, Bhuvaneshwari (2004:96) comments that, although Ellis's behavioural model itself is static, it does not provide for a feedback loop

between the various participants' groups. To deal with this issue, the researcher adapted this model.

Robson and Robinson (2013) observe that Ellis's model does not include the roles and activities of information providers. They also raised concerns that the model does not consider the individual's information needs or the context, such as the work environment, in which those needs arise. Orlu (2016:5) claims that the search process models do not represent real or natural life situations. According to him, the model fails to examine emotions in information-seeking behaviour in the context of library and information management. Because the purpose of the current study is not to examine the work environment and emotions in information seeking, this limitation will not have an impact on the usefulness of the model for this study.

Despite the several criticisms about the use of Ellis' model of information-seeking behaviour and the fact that this model does not consider all the contextual and user related factors that influence information-seeking behaviour which are addressed in other general models such as Wilson's 1981 model or Meyer's 2016 model, the researcher still deemed this a useful model for the current study. Although there are many factors that influence the information-seeking behaviour of doctoral students and which also have the potential to act as barriers to information, the model does support an investigation of the information-seeking processes that students embark on when seeking information that would satisfy their information needs. Because of the contextual and user related factors that influence the students' information needs and seeking behaviour of the students, the model needs to be adapted to also show the role elements from the students' context and their cognitive and mental structures have in their information seeking processes. Because of this, section 3.8 proposes a model that was adapted for this study.

3.8 PROPOSED MODEL

The Ellis model of 1989 is both a behavioural model, as well as an information search process model, which helps to understand the information-seeking behaviour of users concerning information systems (Ingwersen & Järvelin 2005). The Ellis model also focuses on features in the information-seeking process and not on the reasons why the information user behaves or acts in a certain manner. In his 1989 model, Ellis identified the following

information-seeking features or processes: starting, chaining, differentiating, extracting, verifying and ending. However, the model grounds these information-seeking processes (features) on individual behaviour while searching for information. What this means is that the different features or behaviours may not follow one after another, but each feature is adopted by information seekers, depending on their circumstances. The reason is that details of the interaction depend on the information-seeking features of the user concerned at a time and it is determined by their information needs.

As shown in section 3.7.2, the 1989 Ellis model does not provide for user-context related elements with the potential ability to influence the quest for information process. The current study requires a model that enables the integration of the information-seeking features with the contextual and user-related characteristics that affect the information-seeking process. Figure 3.1 graphically illustrates the various factors that could affect the doctoral students' information seeking behaviour. The proposed model is based on this figure. However, in order to accommodate the Ellis model, the information seeking component needs to be adapted in order to show the different steps in the information seeking process that are core to Ellis' model.

3.9 CHAPTER SUMMARY

This chapter focused on information seeking as an information activity to suggest a guiding information seeking framework for the empirical component of the current study. The discussion in this chapter endeavoured to show that information seeking is seen as a set of actions users embark in searching, evaluate and select information that satisfy their particular need (Kehinde et al. 2016:4). The information-seeking activities of users are affected by the specific user and context-related factors that determine the need for information. The contextual factors include the academic environment, the tasks requiring completion, but also the sociocultural context, such as the availability of technology and resources. The user-related factors pertain to the user's inner experiences, such as information skills, personal preferences, knowledge, trust and emotions. Moreover, information seeking is affected by the interaction between certain contextual elements such as tasks, university libraries and sociocultural factors, and users' mental structures. A literature reviewed focusing on a different group of information users could also have yielded different results.

Because one of the objectives investigated how students' use mobile devices for learning, the effect that mobile devices have on students' information-seeking behaviour and their learning is discussed in Chapter 4.

CHAPTER 4

THE ROLE OF MOBILE TECHNOLOGIES IN INFORMATION NEEDS AND INFORMATION-SEEKING BEHAVIOUR OF STUDENTS

4.1 INTRODUCTION

The purpose of this chapter is to establish whether information users use mobile technologies or mobile applications to access information that is available in the library to support learning. The primary concern is to establish which mobile technologies are capable to provide access to library resources and as such support learning.

4.2 BACKGROUND

Today's information users seem to be technology-driven (Shonhe & Jain 2017:430). The emerging technologies and the current trend of using mobile applications to get access to information have taken a turn in libraries as well. Educational institutions, including academic libraries, are making use of mobile library applications (library apps) as an alternative service to support students (Madhusudhan & Dar 2017:109-111; Kumbhar & Pawar 2014:1-2). Similarly, Carvalho and Ferreira (2015:4629) and Foti (2014:61) indicate that mobile devices such as tablets are used more for accessing data to learn, than for making calls. The current use of mobile technologies as a learning tool is as important as using technology to make calls. However, to establish whether mobile technologies are capable to support students learning, this chapter explains the concepts mobile learning, mobile technologies, and mobile applications. In addition, the characteristics of different mobile technologies and their applications are explored, while also establishing their use when retrieving information for learning.

4.3 MOBILE LEARNING

Mobile learning takes place in an e-learning environment (Osman, El-Hussein & Cronje 2010:12-15; Traxler 2007). As noted by Göksu and Atici (2013:687) and Stevens and Kitchenham (2011:1-4), mobile learning involves the use of mobile devices that enable learning. The mobile devices that are being used for mobile learning purposes must have the ability to connect to other devices to provide educational information and exchange ideas between students and instructors. This is why Cochrane (2010:133-138) describes mobile learning as the use of wireless-enabled mobile digital devices or wireless mobile devices in and between pedagogically designed learning contexts. The definition provided by Miller

(2012:54-56) and Geist (2011:758-762) supports this view. They define mobile learning as the use of portable electronic devices to access electronic information.

These definitions show that mobile learning can occur anywhere and anytime (Shunye 2014:1302; Short, Lin, Merianos, Burke & Upperman 2014:199; Shih, Chu, Hwang & Kinshuk 2011:373-374). In general, mobile devices can support learning activities in impromptu settings (Hosni 2016:18).

According to Guma, Businge, Nkamwesiga and Andogah (2017:70-73), mobile devices are used for Web browsing, information sharing, information storage, recording or uploading documents and task scheduling for learning. Mobile devices can also be used to play multimedia content that is intended for learning and which allows for interactive learning (Santos & Bocheco 2014:7).

Gaberson, Oerman and Shellenbarger (2014:180) and Ryu and Pardons (2012:705-710) reveal that mobile devices can also be used for self-directed learning. Moreover, learning materials are not limited to textbooks but could include learning materials that are available in different formats, for example, Podcasts, Vodcasts, and Flickr (Cardon & Okoro 2010:434-435). Therefore, students' engagement with learning content is promoted when they use mobile devices (Elkins, Hwang, Kim, Manolovitz, Mueller & Owens 2020:5; Gaberson et al. 2014:180). Similarly, Stanton and Ophoff (2013:503) and Al-Hmouz and Freeman (2010:455) observe that users have the choice to select learning content, based on their interests and the functionality of their mobile devices. This means that mobile learning provides a unique learning experience for users.

According to Attewell, Savill-Smith and Douch (2009), mobile devices make learning more convenient and inclusive for the individual's needs and circumstances. As observed by Naismith, Lonsdale, Vavoula and Sharples (2004:8), the nature of mobile devices makes it possible to discuss academic issues with colleagues. Similar findings were reported by Wang, Shen, Novak and Pan (2009:684-690), who revealed that information seekers used their smartphones or tablets for discussing the course content with classmates, to ask classmates questions, and to ask lecturers questions. This helps students to better understand the content and subject matter on a particular topic. For example, the students in Natarajan's (2006:249-

253) study believed that taking part in online discussions while using their devices enhanced their learning because they got quick responses. Natarajan (2006:250-253) further noted that students used these mobile devices to answer questions asked by their instructors, answer questions from classmates, and to exchange ideas with their classmates.

According to Boakye (2016:49), students can use their smartphones or tablets to seek educational information to stay up to date with current developments in education. Studies by So, Kim and Looi (2008:114-116) and Visser and West (2005:123) reveal that the use of mobile devices for learning makes it possible for those who perceive the cost of education as an obstacle to using technology to access education. This is especially important for those students residing in deprived areas or under-developed countries where the educational infrastructure is poorly developed or does not exist.

4.4 MOBILE TECHNOLOGIES

In computer science, B'Far (2005:634) states that the concept 'mobile technologies' is used to collectively refer to the different mobile communication technologies that have been produced in different subject fields. Kim, Mims and Holmes (2006:79) define mobile technology as a "technology that uses radio frequency spectrum to facilitate the transmission of multimedia services for use". Whereas B'Far's (2005) definition considers the different subject fields that contributed to the development of mobile technologies, Kim, Mims and Holmes's (2006:79) definition mainly considers the means employed to transmit multimedia services. Baran's (2014:26-28) definition supports this view. According to her, the concept 'mobile technology' can also be defined as a "term used to describe the ability to use technology to wirelessly connect to and use centrally located information and application software". This definition highlights mobile technologies' application of wireless communication networks. The wireless technologies that are used include Wi-Fi, Bluetooth, Global System for Mobile Communications (GSM) and General Packet Radio Services (GPRS) technologies (Vandi & Djebbari 2011:15-17).

Mobile technologies can be viewed as internet enablers that store, identify and carry information for users with the aid of mobile devices (Vandi & Djebbari 2011:16). Therefore, some researchers such as Kim, Mims and Holmes (2006:79) and O'Malley, Vavoula, Glew, Taylor, Sharples and Lefrere (2005:7) describe 'mobile technologies' in terms of the different

types of mobile devices that are available. According to them, the concept 'mobile technology' refers to a variety of devices (e.g., smartphones, tablets, PDAs, iPods, cell phones and laptops) that allow users to access data and information from any location. Their description is supported by the observations of Elkins et al. (2020:5) and Patil, Karhe and Aher (2012:374). They observed that mobile devices do not limit users to specific times or locations when seeking information.

In this study, mobile technologies refer to mobile devices that allow users to access data and information from any location with the help of internet enablers.

4.4.1 Advantages of mobile technologies

Mobile technologies have certain features that are beneficial to users. The features identified by Khaddage and Lattemann (2013:120-125) include portability, simplicity and availability of the device. According to Short, Linn, Merianos, Burke and Upperman (2014:199), these mobile technology features allow for fast and reliable access to the Internet for a wealth of information.

Given these features, the potential for mobile technologies to enhance learning is tremendous. Kwon and Lee (2010:1884-1888) and Lippincott (2010:210) observe that the introduction of mobile technologies in the educational environment has made learning personalised and self-directed. This view is supported by Chang (2013:481-486) who observed that users used mobile devices to view, search and obtain library services, without being constrained by location. This happens when users use their mobile devices to access learning management platforms for study material. Users can also use their mobile devices to access library databases to search for information that would support them in completing academic tasks such as an assignment or when doing research.

This is similar to the contextual element that shapes users' information-seeking behaviour, which was discussed in section 3.4.3. It was shown that students have different types of tasks in which they engage. These tasks include doing assignments, preparing for group or class discussions, writing projects, preparing for an end-of-semester examination, sitting for an examination and preparing for a conference. To complete such tasks, students can use mobile technologies to access learning management platforms. Students purposefully search for

information from their library databases using their mobile devices. Moreover, mobile devices make it easy for students to move around while still being able to read study-related material on their devices.

4.4.2 Disadvantages of mobile technologies

Although mobile technologies have the potential to promote learning, some mobile technology-related characteristics could hinder the use of mobile technologies. The disadvantages could be grouped according to the device itself, the network and user-related issues.

4.4.2.1 Device-related issues

Mobile devices are usually furnished with portable screens which are not conducive for learning (Cheng, Lam, Li, Au, Ma & Ho 2018:91; El-Hussein & Cronje 2010:12-18). According to Suki and Suki (2011:51-53), images and text on the screen may cause eye strain when the device is used for learning. This explains why Wilson and Bolliger (2013:220-224) and Suki and Suki (2011:51-53) are of the view that the small screen size of a mobile device makes it difficult to use mobile devices for learning. A further challenge of using mobile devices for learning pertains to the layout of webpages that are not mobile-friendly and, as a result, users are forced to keep scrolling back and forth across the page to view the content (Nowlan 2013:142-150). Harrison, Flood and Duce (2013:8-13) support this view when they maintain that sometimes there are difficulties on the webpages, which can make it difficult to load documents for learning.

In addition to the screen size and whether webpages are adaptable to be read on a mobile device, there is the issue of different types of mobile devices that hinder its use for learning (Alrasheedi & Capretz 2015:43-46; Shuddong & Higgings 2006). The device will determine what information can be accessed and used on the device. For example, an e-book reader does not provide access to social networking sites, but only to books that have been loaded on the e-book reader.

According to Sharples (2013:5-9), Bao (2012:66-68) and Suki and Suki (2011:44-50) the limited memory of some of the mobile devices makes it difficult to save additional content such as the information that students require for learning. Short battery life is another barrier

that can lead to insufficient time for completion of learning activities and even loss of information due to unexpected battery failure (Bao 2012:66-68; Suki & Suki 2011:44-50).

4.4.2.2 Network-related issues

Despite the growing network capacity, problems such as network signal failure are identified as barriers for using mobile devices for learning (Voelkel & Bennett, 2014:50-56; Bao 2012:66-68; Menkhoff & Bengtsson, 2012:230-238; Tao, Zhang, Liu & Zhao 2012:42-45).

4.4.2.3 User-related issues

Additional obstacles related to the use of smartphones or tablets for learning include students sending or receiving messages to and from colleagues during lecture periods (Mehdipour & Zerehkafi 2013:93-97). Wang, Wu and Wang (2009:100-110) support this view when they indicate that some users tend to use mobile devices for recreational activities such as messaging friends and accessing social network services, rather than to use them for academic purposes.

4.5 MOBILE APPLICATIONS

In her definition of mobile technologies, Baran (2014:26-28) indicates that mobile technologies "use centrally located information and application software". Application software (Apps) is defined as applications designed to run on mobile devices such as smartphones and tablets (Phongtraychack & Dolgaya 2018:1; Baktha 2017:15). Current available mobile applications include mobile cloud computing, podcasting (podcasts), instant messaging, social networking sites (SNSs) and quick response (QR) codes.

4.5.1 Mobile cloud computing

An analysis of Baran's (2014:26-28) definition for mobile technologies in section 4.4 suggests that the information and software used by mobile technologies are centrally located. Mobile cloud computing is defined as "distributed mobile apps that migrate storage and data processing from mobile devices to rich resources and centralised data centres in computer clouds" (Aepona 2010). According to this definition, mobile cloud applications move computing power and data storage away from the mobile device into the cloud, bringing the applications and mobile computing to more mobile subscribers. This will occur when users connect their mobile devices to a mobile data service using an App or a Web browser.

Therefore, as Sharma and Bohra (2015:288) and Qi and Gani (2012:1) note, the various mobile-based applications allow users to access large amounts of data in the cloud. Examples of such cloud-based mobile applications that can be used for learning include Google Drive, Dropbox, Microsoft's One Drive, Mendeley and RefWorks' research collaboration platforms.

Apart from access to and the storage of information, Kiryakova (2017:278) indicates that mobile computing platforms offer users the opportunity to share information intended for learning and to collaborate. According to him, users can share and comment on other participants' activities. Therefore, the ability to share information supports collaboration (Hargis & Wilcox 2008:5). This is confirmed by Schuler, Hutchins and Lashell (2012:11-15) and Hanewald and Ng (2011:7), who observed that mobile devices enhanced possibilities for collaboration in learning among students anywhere.

In the view of Ndumbaro (2016), collaborative learning can motivate users to collaboratively solve information-related issues that are too demanding for individuals to achieve. This is because collaborative learning allows students to share information and formulate responses to questions (Rikala & Kankaanranta 2012:148-152; Schuler, Hutchins & Lashell 2012:11-15). Therefore, with the support of mobile cloud computing, users can share material on their field of study and even edit colleagues' assignments (Kiryakova 2017:279). According to Kiryakova (2017:279), collaboration motivates users to participate actively in doing different tasks, because their actions and results are visible to others. In this way users can use their mobile devices to share their ideas and research with colleagues, according to their preferences.

4.5.2 Podcasts

Podcasts are applications that support information dissemination (Nwosu, Monnery, Reid & Chapman 2017:212-215). A podcast is "an audio or visual content that is automatically delivered over a network via free subscription" (Rajic 2013:90). A podcast can also be defined as an audio file posted to a website and made available for download (Cornick 2018:381; Balleste, Rosenberg & Smith-Butler 2006:8-10; DeVoe 2006:78-79). According to this definition, a podcast is not just a content package but also serves as a method to deliver content.

According to Rajic (2013:91), the podcast process starts with the creation of content through the use of audio-capturing and editing tools. As Sutton-Brady, Scott, Taylor, Carabetta and Clark (2009:220) explain, podcasts can be downloaded to users' mobile devices and can be transferred to digital audio players which enable mobile learning. It is important to note that a podcast needs to be downloaded in its entirety before it can be viewed and an active internet connection is needed for the downloading process (Lazzari 2009:27). However, as Cebeci and Tekdal (2006:49) note, once a podcast is downloaded, there is no need for an internet connection to view it later. Connectivity issues are then eliminated.

Various researchers, including Rajic (2013:92), Utulu (2012:10-14), Evans (2008:492-495), Cebeci and Tekdal (2006:49), Vafa and Chico (2013:230-235) and Clark and Walsh (2004:1079) identify some potential benefits of podcasts for learning. According to Rajic (2013:92), Dzandu and Boateng (2013:22-37) and Taleb and Sohrabi (2012:1102-1106), podcasts are used to provide summaries or syntheses of course material to students. Rajic (2013) and Laing, Wootton and Irons (2006:514-516) further mention that podcasts are used to provide introductory material of lectures or to record lectures. According to them, this allows students to listen to lectures, either because they were unable to attend those lectures or to reinforce their learning. This service, by using mobile devices, endeavours to assist users in getting access to various sources of information for learning.

As observed by Harinarayana and Raju (2010:74-78), podcasts can be used to enhance library service delivery. According to them, academic libraries can use podcasts to share information with users who have subscribed to it. Libraries could also use podcasts to present library skills training or information literacy training. For example, Kim and Abbas (2010:212-216) report on the use of podcasts to conduct library tours and tutorials to train users in the use of library resources that are related to their research activities or subject areas.

4.5.3 Instant messages

An instant message is defined as the technology through which users can send and receive notes or messages on the same system (Cornick 2018:381; Castelluccio 1999:34). Correspondingly, Grinter and Palen (2002:21) view instant messaging as a framework that "support[s] synchronous internet-based text chat with point-to-point contact on the same framework". According to Castelluccio (1999:34), this happens when users set up a list of

associates on the same system and they receive a pop-up message on their screens when one of the partners has written a message and sent it. As noted by Ocran (2017:2), these applications allow for effective communication on mobile devices.

Moreover, instant message platforms offer audio and video chatting features as well (De Bakker, Sloep & Jochems 2007:144). The list of popular instant messaging platforms they identified includes MSN (now Windows Live Messenger), AOL Instant Messenger, Yahoo! Messenger (YMSG), Skype, Google Talk and ICQ. When considering the recent messaging services that have become available to users, WhatsApp and Google hangouts can be added to the list.

Digital or e-reference services are examples of services for which instant messaging can be used. Chandwani (2018:2) defines a digital reference service as "the provision of reference services in a computer-based medium involving collaboration between library users and librarians". According to her, these services can use various media such as email, web forms, chat, video, web customer call centre software, and voice over Internet protocol (VoIP). Their ability to provide an e-reference service is supportive of learning (Matteson, Salamon & Brewster 2011).

Ifijeh and Isiakpona (2013:13-15) and Harinaarayana and Raju (2010:72-78) are of the view that instant messaging platforms can be used to enhance libraries' traditional reference services because it allows for immediate responses to library users' enquiries. This is only possible if the academic librarian or reference librarian is using the same instant messaging platform as their library users. Sahu and Bhoi (2015:122), Lippincott (2010:205-210), Kroski (2008:45-46) and Gibbons (2007) suggest that libraries can use an instant message platform to provide services that allow users to ask questions and receive responses from librarians during stipulated contact periods. This is different from the traditional reference service requiring face-to-face interaction between the reference librarian and the user. Although not all reference questions can be handled through mobile instant message platforms, its expansion could be beneficial to students who use mobile devices to search for information (Tao 2009:34-38).

According to Sahu and Bhoi (2015:122), examples of such platform services include Text a

Librarian, LibraryH31p, MyInfoquest and Shoutbomb. These instant messaging platforms were developed for libraries so that they could offer virtual reference services without being tied to a website. Students can also download these 'Apps' on their mobile devices. This is the platform on which the service is offered.

4.5.4 Social networking sites

Social networking sites (SNSs) are Web 2.0 applications that enable the sharing of information and which have been adapted for use on mobile devices among users (Akeriwe 2013:19). Sharma and Godiyal (2016:157) define social networking sites as internet-based tools that facilitate communication, content exchange and collaboration among users. Social networking sites are used as a means of communicating information among users to promote learning (O'Brien et al. 2014:134; Akeriwe 2013:19; Mahmood & Richardson 2011).

According to Akeriwe (2013:19), academic libraries are using social networking sites such as MySpace to share information with users. He observed that this kind of service allows users to search catalogues, create image databases, and to share videos and PowerPoint presentations. This view is supported by Mahmood and Richardson (2011) and Harinarayana and Raju (2010:72-78). According to them, academic libraries can do this by streaming videos through discussion forums. Examples of discussion forums include WeChat, LINE, Tumblr, Telegram, Taringa, Instagram, Pinterest, Google +, MySpace, Baidu Tieba, Delicious and LinkedIn (Subhash & Khaparde 2019:19-20).

4.5.5 Quick response code

The quick response (QR) code is a software that allows a user to search two-dimensional (2D) patterned squares in order to access data (Shin, Jung & Chang 2012:1417-1420; Jupiter 2011). As observed by Rikala and Kankaanranta (2012:142), quick response codes contain information such as text, uniform resource locator (URL) links or other data that can direct users to sources of additional information about a given topic. In a similar vein, Lee, Lee and Kwon (2011:485-488) mention that users who have a camera phone, embedded with a quick response code reader application and an internet connection, can scan the quick response code to display text and open a webpage with content for learning.

In the view of Sampson (2012) and Yusof, Goolamally, Latif and Fadzil (2012:312-515), the

use of quick response codes encourages students to share learning content among themselves. Apart from sharing information, Pérez-Sanagustín, Parra, Verdugo, García-Galleguillos and Nussbaum (2016:73-76) believe learning can be facilitated inside and outside the classroom through the use of quick response codes. Additionally, Al-Khalifa (2008:342-345) indicates that students could use mobile devices with quick response codes to send questions and comments and make suggestions to their instructors during lecture periods. This is confirmed by Rikala and Kankaanranta (2012:142), who maintain that lecturers could also give directions and information to students on how to complete their assignments by using quick response codes.

Quick response codes can be used to perform additional library service tasks. Hicks and Sinkinson (2011:61-64) state that such tasks include using the quick response codes to find and renew library books, linking to online tutorials at workstations in otherwise disconnected spaces, connecting to the librarian's phone number and providing assistance at the exact place of need.

4.6 WEBSITES ADAPTED TO BE READABLE ON MOBILE DEVICES

Libraries offer a variety of mobile device-based services as an alternative service to promote and support the learning needs of their users. This view is supported by the studies conducted by Kingsley (2020:63-66), Harrison, Burress, Velasquez and Schreiner (2018:250-252), Chaputula (2016:70-72), Salisbury, Laincz and Smith (2015:91-95), Bomhold (2014:336-340), Jackson (2013:174-177), Nowlan (2013:142-150) and Little (2011:267). They report that libraries are adopting technologies that enable users to view the library's websites and resources on their mobile devices. The benefits identified by Elkins et al. (2020:5), Malik and Mahmood (2013:420-428) and Ballard and Blaine (2013:251-258) include the bridging of obstacles presented by time and space.

4.6.1 Services that allow access to resources on mobile devices

Academic libraries are introducing ways for their users to access information from any location and at any time through the use of mobile devices (Murray 2010:238; Vila, Galvez & Campos 2010:327). Mbambo-Thata (2010:470) observes that one such way is the introduction of AirPAC for the Millennium System, an integrated library management system. She further mentions that the implementation of AirPAC in the University of South Africa (Unisa) Library allows library users residing in various places across the world to use

their mobile devices to access library services. This service also helps librarians to support users who need assistance, to check out library material while off-site and to update inventory items while they are around the library.

To bridge the time-space gap, libraries such as at the Mount Kenya University, invested in library automation and the installation of library management systems to allow users to get access to the library system from their mobile devices (George, Maina & Wanangeye 2016:19). According to George et al. (2016), the Mount Kenya University Library system affords users access to books, journal articles, conference papers, research papers, theses and dissertations, university publications and its Virtual Varsity modules. The service offers an account to all users, which they can customise to confirm library books borrowed and renew borrowed resources without physically going to the library premises.

Hoivik (2013:468-471) reports that the National Library of Norway provides services such as image delivery, digital library exhibitions known as "in-the-pocket", traditional free text searches, location-based searches, barcode scanning to enable international standard book number (ISBN) searches and voice/spoken searches. These services are provided to users who use mobile-based technologies for learning.

Also, Marshall (2011:12-15) reveal that Vanderbilt University provides ALA TechSource products that enable access to library e-resources through mobile devices.

These mobile device services support students in getting the information they require for their studies. By implementing certain mobile-based technologies such as AirPAC, academic libraries support users' learning.

4.7 REFLECTION ON THE ROLE OF MOBILE TECHNOLOGIES IN STUDENTS' LEARNING

Mobile technologies in modern times have a significant influence on users' information needs and information-seeking behaviour. Mobile technologies and learning resources provide an enabling environment for e-learning, information searching and real-time information sharing. It also provides the opportunities for libraries to incorporate information resource applications (library applications), which then contribute to smooth information-seeking

processes, which in turn satisfy users' information needs. Figure 4.1 presents a theoretical model for mobile technologies within the context of information needs and information-seeking behaviour of students.

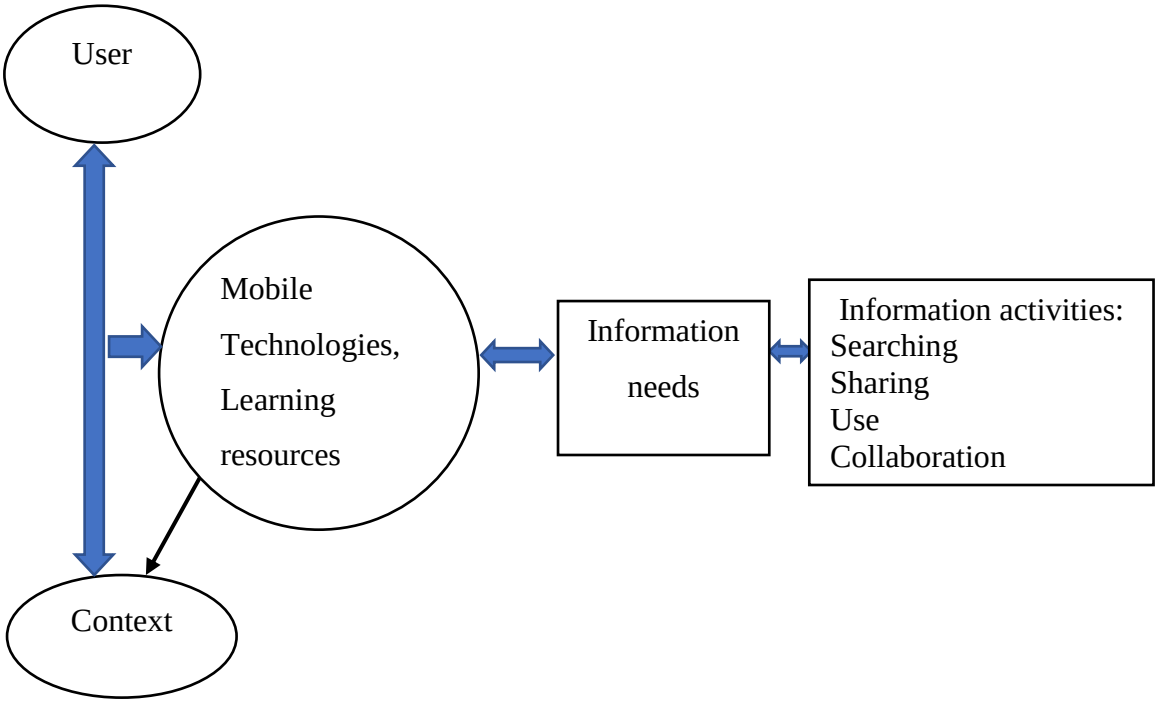

Figure 4.1: Graphic representation of the role of mobile technologies in information needs and information-seeking behaviour of students

Figure 4.1 indicates that mobile technologies encompass or comprise the hardware, i.e., the physical mobile devices (smartphones and tablets), mobile applications (library apps), e-learning platforms and social networking sites or media (WhatsApp). Students work in groups and they not only socially support one another but also collaborate. The one-directional arrow between mobile technologies, learning resources and context indicates that these technologies are elements of context. The successful use of mobile technologies for learning is dependent on contextual factors that could be device-related, user-related, or network-related. The interaction between the context and the user prompts information needs, which in turn give rise to information activities such as searching, using, sharing, collaborating, etc.

4.8 CHAPTER SUMMARY

The purpose of this chapter was to explain concepts such as mobile technologies and mobile

devices to acquire an understanding of what they are used for and what the advantages and disadvantages of using these technologies are for mobile learning and for finding information. Mobile technology has been identified as an environment in which information and communication technology are used everywhere by the various applications discussed. However, the literature also suggests that mobile technologies and applications can enhance and support learning. Therefore, mobile learning can be seen as a method of transforming the educational experience. Specific mobile applications like library apps and other information science applications were not extensively examined in the literature reviewed. The inclusion of these applications could have brought different insights. Notwithstanding this, mobile learning can be used as a method of transforming the educational experience. This chapter concludes the literature review for the study. With the empirical component of the study in mind, Chapter 5 focuses on the research methodology that was followed.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 INTRODUCTION

Chapter 4 highlighted the role of mobile technologies in information needs and information-seeking behaviour. A suitable research methodology had to be chosen to examine the "information needs and information-seeking actions of doctoral students" (Desta, 2016) using smartphones or tablets for learning. This is the purpose of this chapter. The chapter also discusses the research paradigm, research design and the strategies adopted in collecting data. The chapter furthermore pays attention to the sampling strategy, data collection method and data analysis procedures, as well as how the reliability and validity of the study were ensured.

5.2 BACKGROUND

Research methods or processes guide empirical research. According to Moodley (2013:29), research processes are the techniques that academic scholars use to analyse data. In the view of Sutton (2009:4381), "the research process involves three different levels of analysis, which are philosophy and theory, methods and techniques and data collection" (Sutton, 2009:4381). In essence, the study methodology that is "adopted, which may be quantitative, qualitative, or a synthesis of quantitative and qualitative approaches" (Du Preez, 2015:168), directs these three levels of analysis. The objective of the research directs the researcher to choose the appropriate method.

This study is fundamentally an information needs and related information-seeking behaviour which emerged from the context of information science. According to Wilson (2016), to make the best decision in selecting an appropriate approach for a study, it is important to follow empirical literature which adopted research paradigm that befits a particular study. This chapter explores the selection of an appropriate research approach befitting this current study.

5.3 RESEARCH PARADIGM

The research paradigm is referred to as a frame of reference used to organise and make sense of the world (Babbie 2010:33). Babbie's (2010:33) definition suggests that "a paradigm is concerned with individual's observation of the world". Similarly, Rubin and Babbie

(2010:15) and Creswell (2007:19) focus on research paradigm and describe it as a "framework for observation and understanding issues around us".

Further, the 'research paradigm' is explained by Du Plooy-Cilliers et al. (2014:19) as a cluster of assumptions that have the potential to influence the context of the study, the conduct of the research and how results should be interpreted. In a similar vein, Denzin and Lincoln (2000) uphold paradigm as a basic belief that addresses the ultimate or first principle in the study. According to them, these basic beliefs are accepted without questioning. The concepts of a research paradigm is to direct a study and allow researchers to illustrate the techniques they use in their studies (Rubin & Rubin 2012).

For a specific research paradigm, there are different research approaches which, in turn, determine the research design. The interpretive approach is a research approach that requires a qualitative research design. This study adopted the interpretive approach, which is, according to Govender (2012:20), a collective meaning-making process. The interpretivist believes that information can be interpreted well in the context of a comprehension of a given situation (Willis 2007:97-98). According to Walliman (2006:15), the interpretivist accepts the fact that in a social behaviour, personal meanings play critical role.

In the view of Thanh and Thanh (2015:26), using the interpretivist approach in a study allows participants to express their views and concerns. Thanh and Thanh (2015:26-27) further explain that the interpretivist approach enables researchers to get more information from the participants in a study. The interpretivist approach helps to solicit responses from participants' behaviour and actions to get in-depth information and it ensures that the participants are not dominated.

The use of the interpretivist method remains the robust, inferred from the forgoing description, coupled with the essence of this current review. This is because information needs and information-seeking behaviour are social constructs or phenomena (Vakkari 2008). Therefore, examining the role of mobile technologies in this phenomenon, from a doctoral student's perspective, required a comprehensive interpretation of the thoughts of the research participants (doctoral students). Additionally, interpretivism was chosen due to its ability to offer a set of opportunities to the researcher to fully understand the context within which

mobile technologies are used to seek relevant information that is supportive of the participating doctoral students' information needs.

Although interpretivism is a useful paradigm in "information behaviour studies and is appropriate to acquire an understanding of phenomena" (Du Perez, 2015:181). Bhattacherjee (2012:105) contends that the interpretivist paradigm has its barriers. According to him, one of the barriers is that it requires the training of researchers to be fit to interpret social issues without using their own assumptions. Another challenge is that the investigation tends to use more time and it demands the use of more resources than positivist studies do when collecting and analysing data (Bhattacherjee 2012:105). According to him, all the participants selected for the study may not have the same knowledge about the phenomenon under study, which may result in false conclusions.

Despite these concerns, an interpretivist study enables researchers to collect data in natural settings (Cohen & Manion 1994:36). This is an important advantage as the researcher needed to learn from the participating doctoral students at the UCC on their approach in using electronic or smartphones/tablets for learning and the effectiveness in the search for information that would meet their information needs.

5.3.1 Research approach

The approach to research can be defined as a strategy involving the "intersection of theory, research designs, and specific methods" (Creswell 2014). Creswell (2014) further indicates that the researcher adopts an approach to research by considering the research problem and questions involved in the study, the available resources and the target participants.

Additionally, the research approach is seen as an analytical procedure adopted in a study and it involves several decisions regarding sampling, data collection and analysis (Leedy & Ormrod 2001). The three main research approaches for conducting a study are quantitative, qualitative and mixed-methods research approaches (Creswell 2009; Yates 2004). In the view of Creswell (2009), the quantitative approach involves numerical data where the data collected can be quantified and statistically evaluated to support or refute alternative claims of information. The approach of using mixed methods requires the use of both numerical and narrative data (Yates 2004). Conversely, qualitative study method is not numerical and is

based on systematic protocols and involves a subjective assessment of postures, opinions and conduct (Kothari 2004:5).

Not all approaches may be suitable for every study (Creswell, 2009). Therefore, the choice of the approach for a particular study will depend on the nature of the research problem and the specific objectives. Based on the research problem and the specific objectives, this study requires the use of qualitative.

5.3.2 Qualitative research

"Empirical research in which findings are not in the form of numbers" is known as qualitative research (Punch 1998:4). Cibangu (2013:195) views qualitative research as a study in which the study of what is being tested and the analysis collected is not statistical, and at least one researcher is involved (n = 1)". This view is supported by Nel (2015:75) and Strauss and Corbin (1990:11). According to them, qualitative data are not expressed in numbers or ordinal values. Qualitative research aims at understanding participants' thoughts and feelings from their points of view (Sutton & Austin 2015:226-228). This insight and understanding of human behaviour may be the basis from which to "study real-life situations as they unfold naturally" (Patton 1990:39-40).

Additionally, Ngulube (2018:12) observes that qualitative research provides a means of gaining a deeper understanding of human behaviour and the factors that influence that behaviour. Fidel (1993:222) claims that qualitative analysis offers precise outcomes for human behaviour exploration and is successful in researching such phenomena. The gathering, analysis and presentation of narrative knowledge is concerned with qualitative methods (Teddie & Tashakkori 2009:6).

In using qualitative research, researchers obtain in-depth information because this approach allows understanding the 'why', 'what' and 'how' of a phenomenon (Du Plooy-Cilliers, Davis & Bezuidenhout 2014:20-22). This is in line with Govender's (2012:21) view that qualitative research requires an in-depth study of participants' lives in their natural settings, without using any standardised analysis.

5.3.2.1 Advantages of qualitative research

Qualitative research has certain qualities that are beneficial for researchers. One of the benefits of qualitative research includes the ability to explore real organisational goals and links that focus on understanding issues rather than generalising (Patton 1990:39-40). Likewise, Leedy and Ormrod (2014) reason that qualitative research enables researchers to understand and interpret the behaviour and experiences of their participants.

Another strength of qualitative research is the ability to use mechanisms to provide complex textual descriptions of participants' experiences in making meaning (Burns & Grove 2003:356; Creswell 2003:18-19). Denzin and Lincoln (2002) argue that qualitative research helps to understand participants' experiences of a specific setting (context). According to Mortari (2015), qualitative data support researchers in understanding a phenomenon better. Mortari (2015) further notes that qualitative research allows for an interpretive, rigorous and reflexive research design. Again, concerning the mechanisms of making meaning, the qualitative approach helps researchers to reveal and interpret results in a study (Oduro-Asabere 2017:64).

5.3.2.2 Disadvantages of qualitative research

Despite the strengths of qualitative research mentioned in section 5.3.2.1, qualitative research exhibits some weaknesses. One such weakness pertains to the fact that sensitive and private information observed cannot be reported by the researcher as it may be seen as intrusive (Patton 1990:39-40). Silverman (2010) also argue that qualitative research usually ignores sensitive contextual issues in research and often concentrates on meanings and experiences. Patton (1990) points out that not all researchers have good observation skills and therefore may not be able to take note of the issues that are relevant to the study.

Apart from this, Richards and Richards (1994:450-454) mention that interpreting qualitative research data may be difficult or complex. This view is supported by Berg and Lune (2012:4), emphasising that "qualitative research is a long hard road with elusive data and a stringent requirement for analysis".

However, despite these weaknesses, and because the study was focused on understanding phenomena, a qualitative approach seemed to be the best research approach for the current

study. This is because the researcher is interested in the doctoral students' explanations of their information needs and how they search for information while using their smartphones or tablets for learning. This helped the researcher to allow the participants to freely express their views, based on the research objectives.

5.4 RESEARCH DESIGN

Empirically, the concept of research design refers to the procedures used for conducting a study (McMillan & Schumacher 2010:20; Maree 2010; Creswell 2009:3). In the view of McMillan and Schumacher (2010:20), the objective of a research design is to set out the procedure or plan involved to enable researchers to come up with evidence in answering research questions.

The study of Creswell (2013:69) describes five qualitative research methods or styles to assist researchers in determining the best research method for their studies. Narrative investigation, phenomenology, grounded theory, case study and ethnographic research are these research methods. As Creswell (2014:5) explains, the objective and problem of the study form the basis of the research approach; the current study used the phenomenological approach.

A phenomenological research design was chosen as the design for this study. Creswell (1998) describe phenomenology as an approach used to investigate the daily life experiences of people. Therefore, according to Christensen, Johnson and Turner (2010), a phenomenological research approach and design is used when the study deals with participants' life experiences.

As Creswell (2009) points out, phenomenological research investigates subjective phenomena. This view is supported by Starks and Trinidad (2007:1373-1374). They confirm that phenomenological research is based on the underlying phenomenon structure.

Furthermore, a phenomenological research design can help to understand humans' lived experiences and their attempts to enrich those experiences (Pathak 2017:1719). In a similar vein, Burns and Grove (2003:360) state that phenomenological research investigates real, predetermined perceptions of specific respondents in a given circumstance.

A variety of phenomenological research designs exists. These include descriptive,

interpretive or hermeneutic and constructivist designs (Schwandt 1994:120-124). Hermeneutic phenomenological studies focus on personal experience and require interpretation of the meanings of phenomena experienced by the selected participants (Pathak 2017:1720). According to Wilson and Hutchinson (1991:266-270), the purpose of the phenomenological research design is to help researchers understand the participant's sense of reasoning. Seeing that the focus in the current study was on acquiring an understanding of the participating doctoral students' lived experiences and their reasoning behind the use of smartphones and tablets to search for information, hermeneutic phenomenology seemed the best research design for the study. Therefore, the following discussions focus on the hermeneutic phenomenological approach of data collection and analysis.

5.5 DATA COLLECTION

The concept 'data collection' encompasses having the authority to conduct the study, creating a means for writing down information, saving the data collected and getting ready to address the ethical issues that might arise (Creswell 2013:145). According to Creswell (2013:145), data collection means getting permission to conduct research, conducting a sampling strategy, developing means for recording information, storing the data and preparing how to deal with ethical issues that might arise. In line with Creswell's (2013) outline of data collection procedures, a number of steps are involved when collecting data. These include acquiring consent, sampling and the data collection instruments that were employed while collecting data by using interviews. In addition to discussing and describing these steps, the following discussion ,also considers reliability and validity issues that needed to be considered whilst collecting data for the current study.

5.5.1 Ethical considerations

Ethics in research refers to the beliefs and codes of conduct of what is morally and legally right or wrong in conducting research (Babbie 2010:64). Ethical issues are necessary in academic research and help researchers to protect the dignity of their participants and develop trust among participants (Creswell 2009:87). In the view of De Vos, Strydom, Fouché and Delport (2011:114), ethical issues are sets of moral principles that are taken as rules guiding behaviour and conduct between researchers and participants. Vanclay, Baines and Taylor (2013:244) stress the need for students to adhere to the ethical guidelines provided by academic institutions to guide them in their research work and to protect the reputation of an

institution.

The researcher adhered to the ethical principles of the University of South Africa (Unisa). The researcher got ethical clearance from Unisa and permission from the University of Cape Coast Institutional Review Board (UCCIRB) to conduct the study. The researcher also acknowledged all scholarly works and information consulted from journal articles, books, dissertations, theses and data from the field. Copies of the ethical clearance letters appear in Appendix I.

Getting permission from the participants is one of the important things' researchers do when collecting data (Du Preez 2015:179). This view is in line with Nunkoosing's (2005:699) view that researchers have the task or responsibility to explain the processes in the study (including the risks) to the participants. In turn, the participants have to agree to participate in the study and give their consent by signing a consent form. Creswell (2013:153) discusses the problems "that need to be included in the consent form. This includes the right of respondents to withdraw from the study, the aim of the study, data collection procedures, issues of confidentiality, the risks involved in the study" (Du Preez, 2015:179), the benefits of the study, and the signatures of participants and researchers. This view is supported by Shahnazarian, Hagemann, Aburto and Rose (2013:4). According to them, participants must be "informed that they are free to withdraw from the study at any time" (Desta, 2016).

Before collecting data, information was passed on to the participants that refusal to participate in the study would not affect them in any way. Therefore, the participants were not forced to take part in the study. To support the participants in deciding on their participation, the researcher explained the purpose of the study. The researcher also assured them that he would use the data for academic purposes only. Confidentiality was maintained as the participants' names were kept anonymous and they were not expected to write their names on the semi-structured interview guide. By endorsing the consent form, the participants gave their endorsement for the study and consent to participate (see Appendix II). The University of South Africa (Unisa) prescribes a consent form which includes the required information to deal with the issues identified by Creswell (2013). The researcher used the prescribed consent form and it appears in Appendix II.

5.5.2 Sampling

There are various definitions of sampling. One of these is Leedy's (1993) definition. He defines sampling as the process of choosing participants from a population so that the selected participants represent the total group. Sampling aims to understand the subjective reality of the study population, which involves reaching out to individuals who are ready to share their ideas on the issues under study (Bhatnagar 2012:934-938). There are no closely defined rules for sampling in qualitative research and the sampling normally relies on small numbers of participants to obtain in-depth and detailed data (Tuckett 2004:52-55). The sampling techniques that seemed to be appropriate for the current study include the following:

- Purposive or selective sampling. Babbie (2010:193) posits that where a researcher needs to select participants using judgement, purposive sampling technique is ideal. In a similar vein, Creswell (2012) states that purposive sampling involves finding and choosing participants who have used the phenomenon under study.
- Convenience sampling. Etikan, Musa and Alkassim (2016:4) explain that in convenient sampling the researcher selects participants that are more readily accessible. They mention that all the participants in the target group do not have an equal chance to participate in the study.
- Snowball sampling or "chain referral sampling". According to Showkat and Parveen (2017:9), "snowball sampling is a non-probability sampling method" (Du Preez, 2015:180) that is sociometric. This method assumes that each participant interviewed can be asked to suggest additional individuals for interviewing.
- Theoretical sampling. This technique as stated in the "study of Marshall (1995:523)" and mentioned in Du Preez (2015:180) "states that in theoretical sampling, the researcher builds interpretative theories from existing emerging data".

Purposive sampling was used to select representatives of the target population in accordance with the objectives of the research. Purposive sampling, according to Teddie and Tashaskkori (2003:3-6), involves the purposive selection of participants rather than random selection. In the view of Teddie and Tashaskkori (2003:3-6), purposive sampling is used in inductive studies to gather detail and in-depth information or data with a small number of participants, representing the target population, to yield detailed information about the issues. These sampling frames are mostly informal and are based on the expert judgement of the researcher (Gentles, Charles, Plog & McKibbon 2015:1785).

Creswell (2014:7-10) and Patton (2002:40) state that, in qualitative research, few participants are purposively selected and the outcome of the study may not be generalised. However, this sampling method supports the researcher in acquiring an understanding of a phenomenon. Because a purposive sampling technique was used in the current study, not all doctoral students at the UCC could be sampled. The researcher selected doctoral students whom he observed used smartphones and tablets for learning. Based on their observed use of smartphones and tablets, the researcher perceived them to be knowledgeable about the use of such devices and have some experience of using mobile devices to seek information that would support them in satisfying their information needs. This approach is in line with Grundmeyer's (2012:55) approach. He used participant experience as a criterium to select the participants for his study. As such, the researcher hoped that the sampled participants would share their experiences with him and freely express their views of the value that mobile devices have in providing in their information needs and their resulting information-seeking behaviour.

In all, fifteen Doctor of Philosophy doctoral students at the UCC were selected for the study from the following colleges as participants - College of Education Studies, the College of Humanities and Legal Studies, the College of Agricultural and Natural Sciences, and the College of Health and Allied Sciences. Some of the departments from which the participants were drawn included economic studies, entrepreneurship studies, supply chain management, human resource management, special education, hospitality management, accounting, special education, geography, population and health, educational psychology, science technology, physics, entomology as well as the department of crop science.

Table 5.1 reflects the responding doctoral participants' profiles.

Table 5.1: Participants' profiles

Responding Doctoral students	Department	Programme of study	Device used
Participant #A	Department of Economic Studies	Doctor of Philosophy (Economics)	Smartphone
Participant #B	Department of Finance	Doctor of Philosophy (Finance)	Smartphone and tablet
Participant #C	Department of Accounting	Doctor of Philosophy (Accounting)	Smartphone
Participant #D	Department of Human Resource	Doctor of Philosophy (Human Resource)	Smartphone and tablet
Participant #E	Department of Accounting	Doctor of Philosophy (Accounting)	Smartphone and tablet
Participant #F	Department of Education and Psychology	Doctor of Philosophy (Educational Psychology)	Smartphone
Participant #G	Department of Education and Psychology	Doctor of Philosophy (Special Education)	Smartphone
Participant #H	Department of Hospitality Management	Doctor of Philosophy (Hospitality Management)	Smartphone and tablet
Participant #I	Department of Population and Health	Doctor of Philosophy (Population and Health)	Smartphone
Participant #J	Department of Crop Science	Doctor of Philosophy (Crop Science)	Smartphone
Participant #K	Science and Technology Education	Doctor of Philosophy (Science Education)	Smartphone
Participant #L	Department of Geography	Doctor of Philosophy (Geography)	Smartphone

Participant #M	Department of Supply Chain Management	Doctor of Philosophy (Supply Chain)	Smartphone and tablet
Participant #M	Department of Supply Chain Management	Doctor of Philosophy (Supply Chain)	Smartphone and tablet
Participant #O	Department of Physics	Doctor of Philosophy (Physics)	Smartphone

Although the researcher could have included more participants in the study, data saturation was reached at this point and therefore no further interviews were conducted. This decision is in line with Morse's (2015:587) guidelines according to which data saturation is used as a criterion to discontinue data collection.

Nine of the fifteen interviewed doctoral students from the UCC were male and the remaining six participants were female. The majority of the participants (i.e., ten) used smartphones, whereas five of the participants indicated that they used smartphones and tablets when they searched for information.

5.5.3 Data collection instruments

Data collection is the "precise, systematic gathering of information relevant to the research sub-problems" (Burns & Grove 2003:373). Erroneous data collection can influence the results of a study and ultimately lead to unreliable or biased results (Šimundić 2013:12). There is a variety of data collection instruments for researchers to use. The approach that qualitative research employs to discover information in making meaning includes the use of interviews and observation, which focuses primarily on life experiences (Strauss & Corbin 1990:4). According to Strauss and Corbin (1990:4), it is effective in gathering specific information on the beliefs, views, behaviour and social contexts of a specific population. Therefore, interviews were employed to collect data for the current study.

5.5.3.1 Interview

An interview is defined as "a conversation between people whose purpose is to gather or exchange common interest of information or views on life-world between interviewer and interviewee" (Bogdan & Biklen 2007:103). According to Bogdan and Biklen (2007:103), researchers try to put themselves in the participants' position when chatting with them.

Interviews are used to seek the views, experiences, motives and beliefs of people concerning specific matters (Nunkoosing 2005:699). Thus, interview can be described as a conversation between two or more individuals which permits an exchange of ideas and information (Sidhu 2002:145). Sidhu (2002:145) refers to two-way conversations as being direct, verbal interactions between the interviewee and interviewer. Interviews require the actual physical proximity of the two or more people involved.

According to Braun and Clarke (2013:78), an interview has three tenets – structured, semi-structured, and unstructured which is available for a researcher to choose. Bryman and Bell (2011) define semi-structured interviews as a type of interview in which the interviewer has several questions, but the researcher can re-arrange the order of the questions. By this definition, researchers have the opportunity to ask further questions in response to comments made by the participants. A semi-structured interview gives the participants the liberty to answer questions using their own words (Sidhu 2002:149). With this in mind, Rubin and Rubin (2005:88) maintain that a semi-structured interview allows for the collection of in-depth information and also allows the interviewer to probe and expand participants' responses. Other types of interviews are structured and instructed. In the view of Fox (2009), unstructured interviews allow participants to talk freely about whatever they wish, whilst, structured interviews are highly structured which limit participants in answering direct questions.

In this study, the semi-structured interviews were used as a collection information technique to interview the participating doctoral students who use mobile devices for learning.

5.5.3.1.1 Advantages of semi-structured interviews

The use of semi-structured interviews for data collection has certain qualities that are beneficial to researchers. According to Denscombe (2007), semi-structured interviews are easy to arrange, easy to control the participants and also easy to transcribe when recorded. In a similar vein, Dorner, Godman and Calvert (2015) observe that semi-structured interviews help researchers to collect a large amount of data in a short period.

In addition, Humphrey and Lee (2004:512-513) view semi-structured interviews as being relevant due to their flexible design and the ability to refine the interview schedule.

Furthermore, Denscombe (2007) notes that interviewees are allowed to use their own words and develop their thoughts when a "semi-structured interview schedule is used" (Du Preez, 2015:184).

5.5.3.1.2 Disadvantages of semi-structured interviews

Regardless of the merits listed in section 5.5.3.1.1, a semi-structured interview has some weaknesses or limitations. According to Oduro-Asabere (2017:65) and Sidhu (2002:156), one such weakness is interviewer bias. According to them, if interviewers are allowed to vary their approach to suit the occasion, they are likely to project their personality into the situation and thus influence the responses they receive. Patton (1990:173-177) furthermore observes that "interviewees may distort information through recall error, selective perceptions and a desire to please the interviewer" (Eskaroos 2013:30). In this study, however, the bias was overcome because the research data used was collected solely by the researcher.

Another weakness is that it could be expensive to conduct semi-structured interviews (Patton 1990:173-177). Sidhu (2002:156) supports this view when he observes that the cost per case could be much higher when employing semi-structured interviews as opposed to any other data-gathering technique. In his view, when the survey covers a wide geographical area, interviewing all the participants is expensive, as travelling costs are incurred. In the current study, the costs involved in interviewing the participants were not a problem, as the participants were selected from one geographical area at the UCC.

5.5.4 Interview schedule

To collect the data, a semi-structured, open-ended interview schedule was used. In line with Creswell's (2003:20-23) suggestion, the researcher formulated the interview schedule with the aid of the information derived from the literature reviewed, which addressed the research questions. The interview schedule had questions structured and organised as indicated below:

1. Personal information. To acquire some demographic information of the participants, the Doctor of Philosophy doctoral students were asked to state their college, their study programme, and the type of mobile device they used for learning. This question was asked to determine the type of smartphone and tablet applications available with the potential to facilitate research and assist students with their information needs.

2. To gain an understanding of the information needs and information-seeking practices of doctoral students of the Doctor of Philosophy registered at the UCC.
3. To investigate the potential contribution of smartphones or tablets in the learning environment of Doctor of Philosophy doctoral students.
4. To establish which resources are available for Doctor of Philosophy doctoral students who use smartphones or tablets for learning at the UCC and to determine whether the available resources meet students' information needs.
5. To examine the information needs of doctoral students and to how to satisfy that need effectively. Knowing this helped to establish the information-seeking barriers that manifest when using mobile devices for learning, and which might prohibit students from making use of different sources available for them.
6. The participants' responses to the interview questions can support the researcher in developing a framework or model that could guide future studies focusing on the information needs and seeking behaviour of students in a mobile technology environment.

The interview schedule is presented in Appendix III.

5.5.5 Administering the interview schedule

Researchers should consider the conditions under which the interview should be conducted (Clandinin & Connelly 2000:110). With this in mind, interviews with all the participants were conducted when they were not so busy. The reason for this was that the researcher did not want to interrupt their studies. Before the interview, the researcher gave the interview schedule to the participants to enable them to prepare for the interview and to enable them to ask questions about issues that were not clear to them. The participants were also given enough time to consider their responses.

In line with Creswell (2014) and Yin's (2014) advice, the participants for the semi-structured interviews data collection were audio-recorded to support the production of a correct transcript. For this purpose, the researcher used the digital recording application on his mobile device to digitally record the interviews.

All the interviews were conducted in a face-to-face situation because the researcher wanted to

observe the reactions of the participants. All interviews were conducted during October 2019 and each interview took about one hour to complete. The language adopted for the interviews is English.

The researcher encountered some challenges while conducting the interviews. Some of the challenges pertained to scheduling a suitable time for the interviews. This occurred because some of the participating doctoral students were not available for the interviews, despite having agreed on meeting on a particular day and time. In addition, some of the participants did not understand the terminology used in the field of information science. For example, some of the participants did not understand what information needs and seeking behaviour were and thus an explanation was offered before they could respond to that interview question.

5.5.6 Pilot testing

In line with the suggestions made by Bell and Woolner (2012:270-274), the interview schedule was pilot tested before the actual data collection took place.

Pilot tests are used to assess whether an intervention was effective (De Vos, Strydom, Fouché & Delport 2011:195). In pilot testing the interview schedule, the researcher ensured that the interview questions would achieve what they were meant to achieve. Furthermore, De Vos, Strydom, Schulze and Patel (2011:12-16) stipulate that the participants of the pilot study should be people who have similar experiences to those selected for the final study. The interview schedule was pilot tested at the University College of Education, Winneba, in the Central Region of Ghana. Doctoral students from this institution have characteristics similar to the sampled study participants. The doctoral students at the University College of Education, Winneba, also use mobile devices for learning. Following the pilot study, ambiguous questions were modified for clearer meaning and questions that were difficult to understand were deleted before the data collection exercise was carried out with the instrument. For example, the initial question number six under the heading ‘How do doctoral students registered at the University of Cape Coast search for information?’ was *Do you also look at how others search for information in your department?* But after the pilot testing, that question was changed to: *Do your academic colleagues and lecturers influence how you search for information?*

Five doctoral students were selected from the University College of Education to participate in the pilot testing. Although their responses were very similar to those of the participants from the target population, they were not used in the current study.

5.5.7 Reliability and validity

Reliability and validity are important aspects to consider in data collection to determine how accurate the measurement reflects the real-life situation of the study. These are consequently discussed in the following paragraphs. One of the ways that quantitative researchers maintain reliability and validity is the replication of a study (Freese & Peterson 2017:148-152). Qualitative analysis, however, "cannot be simulated in the same manner as quantitative studies" (Du Preez 2015:189). In the view of Patton (2001:39) and Pendleton and Chatman (1998:742-744), researchers are advised to devise the appropriate means of addressing validity and reliability issues associated with qualitative research. This supports Vakkari's (2008) view that researchers of information behaviour are now using several research techniques to address empirical research.

5.5.7.1 Reliability

The concept 'reliability' refers to the ability of a research method to consistently produce the same results over repeated periods at different times (Maree 2010:25; Rubin & Babbie 2008:180). In a similar vein, Babbie (1992:129; 2010:150) views reliability as the extent to which a particular technique is applied to an observation or object and whether it would yield the same results each time. This view of reliability as yielding the same outcome is supported by Pendleton and Chatman (1998:743). According to them, reliability is the degree to which research observations yield consistent results each time. Likewise, Yin (2003:36-37) contends that, if under similar circumstances the results of a study can be reproduced yielding the same or similar findings by administering the same interview schedule, it is an indication of reliability.

As explained in section 5.5.3, all the selected participants were interviewed when they were free and less busy. This interview scheduling arrangement supported the researcher in conducting the interviews in a more relaxed atmosphere. As a result, the participants' minds were not otherwise occupied and they felt more comfortable to describe and explain their experiences of using mobile devices for learning.

Moreover, there seem to be some issues that could affect qualitative research data. Noble and Smith (2015:34) mention the concept of interpretation and subjectivity as a potential reliability problem. This is in line with Babbie's (2010:151) view that the attitudes of different interviewers could influence the responses they get from participants. Thus, the problem of subjectivity was overcome in this study when the researcher solely conducted the interview for data collection. Moreover, the stability of the responses was achieved by doing this. Furthermore, the researcher himself transcribed and analysed the recorded interviews, thus ensuring the correctness of the transcriptions and consistency in the data analysis process.

Asking participants questions which they do not have any idea about is another issue that could affect the reliability of the data (Brink 1993:36). For this study, probing questions were used in situations where the participants did not know the answers initially. Also, the researcher sometimes changed the order of the questions in the interview schedule during an interview to help the participants when they responded to the questions.

5.5.7.2 Validity

The concept of validity refers to "how much a measurement tool provides data that is similar to the usually agreed meaning of a certain concept" (Babbie 1992:135). Considering validity as a measurement tool, Case (2012:208) describes it as a procedure that precisely replicates the concepts of this study. Validity in research simply means the extent to which the data collection instruments (e.g., interview schedules) measure what they intend to measure (Oduro-Asabere 2017:76; Creswell 2013). Gadd (2004:398-400) also notes that validity ensures that the questions asked must appear as if they are measuring what they claim to measure.

Golafshani (2003:602) argues that the term 'validity' does not apply to qualitative research; however, he realised the need to use some kind of check or measuring procedure for achieving that. As a result, studies conducted by Shenton (2004:64) and Lincoln and Guba (1985:32-35) adopted their concepts of validity to be appropriate for qualitative studies.

Shenton (2004:85) and Lincoln and Guba (1985:32-35) identified four criteria that could

ensure qualitative research validity. These underlying criteria include transferability, credibility, confirmability and dependability. The following discussion explores those four criteria to ensure validity for this study.

a. Credibility

The concept of credibility is defined as the trust that can be put in the reality of a study finding (Ary, Jacobs, Razavieh & Sorensen 2006:498; Holloway & Wheeler 2002). According to Graneheim and Lundman (2004:107-109), credibility determines whether the outcomes are plausible evidence obtained from the data of the participants, which are congruent with reality. A qualitative study is credible when its findings are applicable to people who share the experience or phenomenon that is being studied (Hammarberg, Kirkman & de Lacey 2016:500). As a way to ensure validity for this study, the researcher adopted some strategies to defend the credibility of the study. The strategies employed were in line with the strategies adopted by Shenton (2004:64). These included the adoption of established qualitative research methods, random sampling strategies and triangulation (including interviews).

Triangulation involves the use of different sources or different methods to obtain corroborating evidence (Creswell 2013:251; Onwuegbuzie & Leech 2007:239). Shenton (2004:66) explains that the researcher, when triangulating, compares the responses of individual participants in the study. In the view of Anney (2014:277), the use of triangulation helps researchers to reduce bias and gives an opportunity to also examine the integrity of the participants' responses. In this study, responses to each question from fifteen participants were compared to achieve triangulation and the reported findings are discussed in the literature review chapters (i.e., Chapters 2–4).

b. Transferability

Transferability refers to the extent to which the findings of qualitative research can be applied to other contexts or other groups (Bitsch 2005:83-85; Tobin & Begley 2004:389-392; Shenton 2004:69). According to Bitsch (2005:85), researchers improve the transferability judgement by using 'thick descriptions' of the data. In the view of Li (2004:305), thick descriptions enable judgements about how well the research context can be compared with other studies. He further elaborates that a thick description involves the researcher shedding

light on all the research processes, from the collection of data, the context of the study to the final findings.

In turn, Shenton (2004:69) and Guba (1981:86) argue that to determine the degree to which findings "ring true" for a reader of the research findings, there must be an easy comparison of the context with other possible contexts. Therefore, to ensure transferability in this study, the research findings were compared with other studies that focused on information needs and its accompanying term information-seeking behaviour of students using mobile devices for learning.

c. Confirmability

Another criterion to ensure validity for a study is the use of confirmability. Baxter and Eyles (1997:505-506) define confirmability as the degree to which a study results could be c extent to which results of a study could be supported or validated by other studies. This view is supported by Shenton (2004:72) and Tobin and Begley (2004:392). According to them, confirmability involves establishing whether data and the subsequent interpretations of findings are not someone's imagination but rather reflect the experiences and ideas of the participants.

In this study, the research findings were confirmed by alluding to the information in the literature on the role of mobile technologies in the information needs and seeking behaviour of students. Confirmability was applied in this study by also ensuring that the research findings were based on the experiences of the doctoral students who participated in the study, rather than the preferences of the researcher.

d. Dependability

Dependability refers to "the stability of findings over time" (Mills 2007:86; Bitsch 2005:86). This view is supported by Cohen, Manion and Morrison (2011:202) and Tobin and Begley (2004:391-395). According to them, the value of dependability in qualitative research is in helping to evaluate findings, interpreting the data received from the participants and making recommendations.

According to Bitsch (2005:86-87), peer examination is similar to member checks in principle.

Guba (1981:85) explains that peer examination occurs when data and interpretations are continuously tested over time. In this instance, peer examination entails the comparison of data with other researchers. Dependability pertains to the level according to which the data in a study concurs with the data reported on by other researchers. Dependability was achieved in this study by comparing data in this study to what was reported in the reviewed literature.

To ensure this, the semi-structured interview schedule was carefully set up by the researcher. One common language, namely English, was used to maintain consistency in the use of the language for collecting data. Content validity in this study was enhanced by asking my supervisor, who has experience in research in the field, to go through the interview schedule questions before it was administered to the participants. The basis of validity is to see to it that the appropriate questions are asked without ambiguity and to minimise bias in the study as much as possible.

For this study, an attempt was made to comply with all the issues involved in reliability and validity in research. Further, to reduce bias, the study paid attention to specific credibility, confirmability, and transferability issues with the ultimate aim of ensuring validity and reliability of the study.

5.6 DATA ANALYSIS

Data analysis is defined as the process of making sense from participants' opinions and views of situations to correspond with patterns or themes (Cohen, Manion & Morrison 2007:461). By this definition, some sort of logic needs to be applied when analysing data. As Best and Kahn (2006:354) explain, this involves applying deductive and inductive logic to the study. The application of deductive and inductive logic is, according to Saunders et al. (2018), necessary in following the data analysis requirements of an interpretive study.

The analysis of qualitative data transcripts begins during the interviews. According to Onwuegbuzie and Leech (2005:376-380), data analysis is a systematic search for meaning. Data analysis in qualitative research means organising and interrogating data in ways that allow researchers to see patterns, identify themes, discover relationships, develop explanations, make interpretations, consider critiques or generate theories (Cohen et al. 2007:461).

According to Creswell (2013:179-182), “there are many qualitative methods to analyse the collected data. These include the use of thematic, discursive, structured and instrumental methods” (Desta, 2016) and supported by Madill and Gough (2008:257). In the view of Braun and Clarke (2013:175), thematic analysis is “a method for identifying themes and patterns of meaning across a dataset about a research question”. The data in the current study were analysed thematically and the five data analysis steps identified by Schutt (2011:330-334) were employed in this process. These steps are documentation, organisation and categorisation of data, the connection of the data, corroboration and reporting the findings.

5.6.1 Documentation

Documentation is producing transcripts of the recorded data (Schutt 2011:330-332). According to Schutt (2011:330-335), documentation is formally the first step in qualitative data analysis.

In the current study, fifteen face-to-face interviews were conducted with the participating doctoral students. Due to the number of participants that were interviewed and the length of the interviews, a large amount of data was collected and transcribed. Once the recorded interview data were transcribed, the transcriptions were edited and reviewed to make meaning of the participants’ experiences. The meaning-making process supported the researcher in reducing the data into manageable chunks which, in turn, were split into different files in accordance with the various research questions.

5.6.2 Organisation and categorisation of data

The second step, according to Schutt (2011:335-340), is the organisation and categorisation of the data into concepts. To get an in-depth understanding of such data, the information had to be read through several times. Re-reading through the text and comparing it with the recorded interviews helped the researcher to group or organise statements made by the participants and edit them. The collected data were summarised and important categories were identified and saved in files to make it manageable.

During this part of the analysis, the researcher eliminated possible errors in the data. The researcher identified key themes that emerged from the research questions, as well as from the literature review. The identified key themes pertained to the information needs of doctoral students registered at the UCC, the registered doctoral students’ information-seeking

behaviour, the role that smartphones or tablets play in the doctoral students' information-seeking behaviour and, lastly, the students' suggestions on how the library can meet their information needs more effectively. The derived data were categorised under the various themes and summaries were made.

5.6.3 Connection of the data

During this stage, the collected data are organised according to various concepts to establish how the concepts are interrelated with one another (Oduro-Asabere 2017:75). According to Oduro-Asabere (2017), the researcher then reflects on the findings collected from the participants' experiences. During this stage, the researcher compared the participants' responses to identify similarities and differences in their responses. The responses were also compared to see if the identified concepts influenced one another.

5.6.4 Corroboration

The collected data are compared to find out whether it could be corroborated "by evaluating alternative explanations, disconfirming evidence and searching for negative cases" (Desta, 2016; Oduro-Asabere 2017:75). The findings were compared with the transcribed data to validate the data gathered. The transcribed data were compared with the reviewed literature to confirm if the collected data corroborated or contradicted the findings reported in the literature.

5.6.5 Reporting the findings

Finally, the findings were reported and conclusions established. According to Altheide and Johnson (1994:492-493), qualitative research is assessed by its findings in providing a clear explanation. The analysis involves narrations from transcribed responses, describing the data to derive meaning from and interpret the raw data, when compared with existing literature on the topic.

In the current study, the researcher compared the participants' responses with the existing literature and interpretations were drawn from the responses. The empirical findings were presented, based on the research objectives of this study. These objectives are the doctoral students' information needs, students' information-seeking behaviour, the role smartphones or tablets play in the doctoral students' information-seeking and how the library can meet

students' information needs more effectively.

5.7 CHAPTER SUMMARY

This chapter discussed the research approach and methodology adopted in the study for an in-depth understanding of the study concepts of information need and seeking behaviour of doctoral students using mobile devices for learning. The study adopted the phenomenological approach, which helped to understand the participants' sense of reasoning. Therefore, a phenomenological research design was employed and the relevant qualitative techniques for data collection were explained.

Purposive sampling was used to select representatives of the target population. The selected representatives (participants) were interviewed. A semi-structured interview schedule was used to gather data for the study. The ethical considerations needed for this study were also highlighted. An attempt was made to comply with all the issues involved in reliability and validity in research. Attention was given to issues such as credibility, transferability, confirmability and dependability to ensure the reliability and validity of the study and to help minimise bias. All the recorded semi-structured interviews were transcribed and edited to make meaning of the participants' experiences. Moreover, the selected participants were restricted to doctoral students as information users and not to all users of an academic library in UCC. The inclusion of other academic library user groups could have brought different insights. Chapter 6 presents the empirical findings that were collected from the participating doctoral students.

CHAPTER 6

FINDINGS

6.1 INTRODUCTION

The purpose of this chapter is to narrate the empirical data about the use of mobile devices for learning by doctoral students at the University of Cape Coast (UCC).

In Chapter 2 it was indicated that certain personal characteristics and contextual aspects, such as tasks and situation in action, give rise to information needs. However, mobile devices such as smartphones and tablets could affect students' information-seeking activities, which are focused on retrieving information that would meet their information needs. To establish the role played by mobile technologies in this regard, the report of the empirical data is subdivided into the following: the information needs of doctoral students registered at the UCC, the registered doctoral students' information-seeking behaviour, the role smartphones or tablets play in the doctoral students' information-seeking behaviour and, lastly, the students' suggestions on how the library can meet their information needs mor effectively. These themes are in line with four of the research objectives of the study.

6.2 INFORMATION NEEDS OF DOCTORAL STUDENTS

The first research objective was to examine the information needs of the doctoral students who are registered at the UCC. As indicated in section 2.3, different subject fields could influence the information needs of students. To establish their subject-related information needs, the participants were asked the following question*: As a doctoral student, what are your information needs?* The question was formulated rather broadly so that the participants could consider all their information needs and not only focus on their academic-related needs. As a result, most of the participants' responses focused on their subject-related information needs, whereas some participants also provided information on how their academic situations prompted their information needs. In addition to their academic-related information needs, some participants also reported on their everyday life information needs. The participating doctoral students' responses are discussed in the following sections.

6.2.1 Information needs of specific subject areas

The participants' responses revealed that their academic-related information needs pertained to their specific areas of study. The participants identified the following subject areas for

which they needed academic-related information:

- **Economics**: To be more specific, Participant #A noted international trade, international economics, and finance as his specific subject areas, which prompted his information needs. Participants #C and #E reported similar subjected-related information needs. However, whereas Participants #A and #C were more interested in international trade and finance, Participant #E was interested in information about the state of the national economy.
- **Accounting**: Participant #B noted that he needed information on accounting, informatics and law.
- **Politics**: Participant #I stated that issues of national politics were of interest to him. Similar reports were given by Participants #D, #N and #O.
- **Geography**: Participant #L indicated that due to his subject area, he always needs information on the weather.

The participants' responses are similar to the findings reported by Okonoko, Njideka and Mazah (2015:1-2). They found that students' information needs usually revolve around their specific areas of study.

6.2.2 Academic situation that gives rise to students' information needs

In section 6.2 it was noted that some participants indicated their information needs arising from specific academic-related situations. The primary situations giving rise to their reported information needs included the writing of assignments or preparing for examinations. Desta et al. (2019:365) and Desta (2016:29) reported similar findings. They found that preparing for class and group discussions, course work and preparing for conference and seminar presentations are all academic situations for which students need information.

In addition to writing assignments or preparing for examinations, most of the participants also identified attending lectures and participating in academic debates as being situations for which they needed information. For example, Participant #L expressed this when he noted that he needed information to *"present"* his side of an issue and to be *"able to debate well with facts".* Participant #E's comment concurs with Participant #L's when he stated that he needed information to enable him to *"contribute to the debate".* The literature reviewed for this study did not report on the use of information to contribute to academic debates.

Therefore, it seems as if this finding of information needed for academic debates is exclusive to the current study.

6.2.3 Everyday life situations that prompt information needs

In addition to academic-related information needs, doctoral students also have everyday life information needs, that is, information needs that are related to their daily activities. Although the participating doctoral students were not asked to identify or discuss any of their everyday life information needs, some of their responses are indicative of this type of information need. Their responses about their everyday life-related information needs can also be subdivided into health-related information needs and religious information needs.

6.2.3.1 Health-related information needs

Health-related information seemed to be an important everyday life information need among the participating doctoral students. Participant #F indicated a need for information on medicine, whereas Participant #L needed information on family life, personal hygiene and for leading a healthy lifestyle. Also, some of the participating doctoral students have families they care for. For example, Participant #M indicated her need for health-related information to support her in caring for her two children. She explained:

"I need information on health and medicine. I have two children that are sickle cell patients, so I always resort to checking information on that. The least symptoms they show up, I have to use my tablet to check on the characteristics and causes of that and know what to do to calm down the situation before calling the family doctor."

She further added that she wanted to learn more about the disease *"to be able to deal with the problem when it arises"*. Learning more about the disease supports Participant #M in dealing more effectively with situations arising from the disease when they manifest. The information she needed therefore was not needed immediately. This is in line with Cole's (2011:1216-1220) suggestion that "information needs could be somehow unnecessary and that information is not needed immediately".

6.2.3.2 Students' information needs regarding religion

Aside from health-related everyday life information needs, some of the participants reported on everyday life situations for which they required information on religion. For example,

Participants #C and #H are church leaders and their roles as church leaders prompt certain religious-related information needs. Participant #H explained this when he said: *"Many people come to me with their problems and for biblical explanations, so I usually need the information to answer their questions."*

However, unlike Participants #C and #H, whose roles as church leaders prompt certain religious information, the situation of Participant #K was different. For Participant #K, his "doubts" on issues related to religion prompted his need for religious information. Participant #K explained this when he said: *"I have doubts on religious issues, I seek for more information in that area as well."*

In the foregoing section 6.2, various situations that give rise to the participating doctoral students' information needs were discussed. From the responses given by the participants, the quest to understand their subjects of study leads to their information needs. Aside from their subject of study, the participants indicated that their everyday life situations and academic situations, like course assignments and preparations for examinations, prompted their need for information. Having ascertained the information needs of the participants, the section to follow explains how students' information needs influence the sources of information that they use, and the information channels from which such information is retrieved.

6.3 THE INFLUENCE OF INFORMATION NEEDS ON SOURCE SELECTION

Users' information needs, and for that matter the doctoral students' information needs, are believed to influence the sources of information they use and the information channels from which such information is retrieved. To identify the information sources used, the participants were asked to indicate how the kind of information they need influenced the sources of information they choose to use. The participating doctoral students' information needs seem to influence the sources or channels of information they usually select. However, some of the participants also revealed that they use whatever information is available to them that has the potential to satisfy their needs. For example, Participant #B uses any credible source that could be used to improve his knowledge. He would then *"download information from that source"*. Participant #B's comment concurs with the comments made by Participant #A when he stated that he used information from high-quality published journals as his *"priority source of information".* In addition to Participants #A and #B's comments, Participant #I

indicated that he resorted to academic journals that are widely accepted for his area of study.

Some of the participants on the other hand suggested that the sources of information they used were largely dependent on the kind of information they needed at that time. For example, Participant #N noted that, depending on the kind of information he needed, he searched for the corresponding sources that dealt with those issues. Similarly, Participant #D also noted that the kind of information he needs usually influences his information seeking and the source he chooses to use. If the kind of information he needs is related to purely academic activities, he tries searching for information using high-impact factor journals.

The collected data about information needs indicate that, on a larger scale, the participants' information needs influence their selection of information sources. This finding concurs with the discussion in section 3.3, which indicated that users purposefully search for information from a particular source to satisfy a need or to fulfil a perceived need for information.

Moreover, the participants' responses confirmed the findings in Agyapong's (2005) study, which was conducted in Ghana. The findings of that study revealed that students are motivated by diverse reasons to search for information while using the information resources in the University of Ghana's library. Agyapong (2005:70-74) also found that graduate students use resources available to them within their immediate environment and that they use various information sources when they search for information.

In addition to the information sources the participants select when they search for information that meets their information needs, the participants also shared information on their information downloading, organising, and information use activities. The participants indicated that they work on their respective academic activities daily. This includes downloading information from online journals using their mobile devices. This view is best explained by Participant #K when he stated: *"I download a lot of information in my research area using my mobile device to improve my knowledge. I start reading the acquired information to satisfy my need or curiosity."*

In turn, Participants #J and #O explained their use of online journals as follows:
"I download journals and read them and relate them to my course of study. And again, I read

concepts to get a deeper understanding of those concepts and theories" (Participant #J).
"I read related articles or scan through journals to get relevant ones in my field of study. After that, I review them for understanding. I save the relevant 'ones' on my Google Drive so that I can go through them again" (Participant #O).

He also noted that his use of the 'cloud' to save documents enables him to access that same information from other devices.

Whereas Participants #J and #O explained their use of online journals, Participant #E indicated that he sourced information from *"e-resources via the Internet and store the relevant ones on the mobile device for later use".* Most of the participants reported similar behaviour. For instance, Participants #A and #B also noted that they would first read about their areas of interest before downloading the required information using their mobile devices.

The participants' responses about their academic-related information-seeking and information-use behaviour indicated that most of the participants download the information they need from the Internet, including online journals and other e-resources. Some of the participants, after downloading the information they need, save the downloaded information on Google Drive, to which they have access on their mobile devices, for future use.

6.4 INFORMATION-SEEKING BEHAVIOUR OF REGISTERED DOCTORAL STUDENTS

The second research objective was to establish the information-seeking behaviour of doctoral students who are registered at the UCC. In section 3.3 it was shown that information seeking is prompted by information needs. It was further explained in section 3.2 that, when the right source of information is not identified and the needed skills to acquire such information are not learnt, chances are that students will not retrieve the information they require to support them in their learning. To better understand the doctoral students' information-seeking behaviour, the following questions were asked: *What information sources are available to you? How do your personal preferences for certain information sources affect your study-related information-seeking behaviour? How often do you use the Sam Jonah Library website to search for information with your mobile device of the UCC? Do your academic colleagues*

and lecturers influence how you search for information? The responses to these were captured as follows:

6.4.1 Information sources available to doctoral students registered at the UCC

Information sources are ubiquitous as far as academic studies are concerned. However, as shown in section 6.3, the information sources that are needed and used depend on the user's subject areas of interest and information needs. In response to the question about the information sources that are used, most of the participants indicated that they use electronic books, electronic journals, online dissertations and theses. They also noted the value they attach to information resources such as online databases, the library (including digital libraries), digital archives and Google Scholar. For example, Participant #J specifically noted: *"I have access to electronic journal articles, online databases, online dissertations and theses, digital archives and electronic books."*

In turn, Participant #N stated that, *"I have access to the e-resources and I sometimes use the Sam Jonah Library at the University of Cape Coast in searching for information. I also use the online databases, digital archives, e-journals and articles."*

The responses from the participants coincided with the findings reported by Joo and Choi (2015:272-275), Esfahani and Chang (2012:6) and Appleton (2006:20). They noted that some of the information resources that are important to doctoral students include electronic journal articles, online databases, online dissertations and theses, digital archives and e-books.

In addition to mentioning the information sources available to doctoral students registered at the UCC, the participants also shared information on their preferences for certain information sources.

6.4.2 Personal preferences for certain information sources

The question, *How does your preference for certain sources affect your study-related information-seeking behaviour?* was asked to acquire an understanding of how the students' personal preferences affected their information-seeking behaviour. The participants' responses indicated that their personal preferences affect their choice of sources from which they source the information for their studies. Others also indicated that, because they have

different information needs, each need dictates the information they seek and subsequently also dictates their preferences for specific sources. For example, Participant #A normally uses Google Scholar, because he usually gets all the information he wants. According to him, this is because Google Scholar includes information on a large range of subjects. Participant #F offered a similar explanation by stating: *"You know, as humans as we are, as you have your preferences, so in case of any search that will be your first option to look for. So, I normally rely on online journals and e-books in seeking information concerning my studies."*

In other words, the participating doctoral students consult their preferred sources of information when they start an information search and they only consult other sources if their information needs have not been satisfied during their initial searches.

In addition to a need for specific information, Participant #F also indicated that the trust he places in online journals and databases is the reason why he prefers using these types of sources. Similarly, Participants #B, #H, #I and #O expressed similar reasons. Furthermore, Participant #O indicated that his trust in certain channels affects his study-related information seeking. He noted: *"I trust e-books so I always rely on them for my information search."*

Trust also affects users' personal preferences and experiences of using a particular source. This view was confirmed by Participant #C when she stated that her trust in online information sources is dictated by her personal preference for using that source. Similarly, Participant #N noted that his choice of using online journals was prompted by his personal experiences of using online journals.

These responses supported Byström and Järvelin's (1995:195-200) comment on the effect that personal experiences can have on information-seeking behaviour. They indicated that personal experience in information seeking usually evolves from successful previous attempts when searching for information. In turn, Carlson and Zmud (1999:157-162) maintain that users' experiences with information channels and sources frequently contribute to frequent use of those channels and sources.

Given the trust that the participants place in certain sources, the participating doctoral students were asked why they preferred specific information sources. Most of the participants

suggested that the reasons why such sources were chosen included the ease with which they can access the source, as well as the quality, reliability and credibility of the information source. For instance, Participant #C noted that *"because it is easy to access information from online journals and databases and you get credible peer-reviewed journals from there"*. In turn, Participant #D also indicated that she preferred to use online journals because it is easy to access the information she required for her programme of study. She continued by saying that, *"… those sources have high impact factor articles."*

Similarly, Participant #G noted that he preferred using electronic online sources because the information from those sources is general and not restricted to a specific subject or programme of study. According to him, he accesses information from open access journals that have a lot of online information. Participant #G's preference is therefore based on the accessibility (non-restrictiveness) of credible information, which is not necessarily related to his area of study. Similar responses were given by Participants #I, #L and #O.

The third reason why the participants prefer certain sources includes the perceived quality, reliability, credibility and accessibility of the open access sources. For example, Participant #D noted that: *"because it is easy to access and I usually get* credible *information relating to my course or programme of study and they have high quality impact factor articles there"*.

In turn, Participant #C stated that, *"because it is easy to access*, in getting reliable *information from there and you get credible peer reviewed journals from there"*.

These responses are consistent with the findings reported by Bertulis and Cheeseborough (2008:187). Similar to the current findings, these authors found that the credibility and reliability of information sources are the reasons why students prefer certain sources.

6.4.3 Steps doctoral students take when searching for information

In addition to asking the participants about their personal preferences for certain sources, the researcher was also interested in learning more about the steps they took when searching for information. The participants were therefore asked: *What are the steps you take when searching for information?* In response to this question,

- Participant #E revealed that she connects her mobile device to the Internet and types in *"certain keywords to generate several results".* After that, she scans through the

results she has retrieved and downloads what she needs and saves the sources she has selected for future use.

- Participant #O also noted that he downloads a lot of information on his research area using a mobile device to improve his knowledge. He then starts reading the information to satisfy his information needs or curiosity and evaluates the relevance of the information he has downloaded.
- Participant #J added: *"I plan and structure my searches. I start by downloading the articles first and after that, I sit down and do scanning reading to save the relevant ones."*

The reported responses in section 6.4.3 showed that tasks and related activities shape the doctoral students' information needs and determine the information sources they seek and use. The participants' responses are similar to the findings reported by Alazemi (2015:99). He found that users scan, evaluate and interpret the results obtained to establish which sources suit their information needs. He further elaborates that, when users find the information that they need, they extract or download the information for later use.

6.4.4 Use of the Sam Jonah Library Website, UCC

University libraries are regarded as a primary information resource used by students when they search for information. Because of this, the participating doctoral students were asked: *How often do you use the Sam Jonah Library Website to search for information with your mobile device of the UCC?*

In response to this question, seven of the participants, namely Participants #A, #B, #F, #H, #J, #K and #N, indicated that they use the library's e-resources when they search for information. However, as Participant #A noted, he does not necessarily visit the library to use the library's resources. According to him, *"I prefer reading in my room, but I use my mobile device to access the university's e-resources."* Participants #G, #I and #O reported the same kind of behaviour when they indicated that they do not visit the Sam Jonah Library very often. Participant #I noted that, instead of walking to the library, she uses her tablet to access the e-resources provided by the library, whenever possible.

The answers provided by the participants revealed that most of them use the university's

library to search for information. However, most of the participants use their mobile devices to search for information. To get access to these resources, they then need to sign in, using the library's access codes and passwords. The responses given by the participants confirmed what was reported in section 6.4.1. Most of the participants rely on the information sources that are available in the library. The sources they use include online databases, e-libraries, e-books, electronic journals and online databases.

The participants' responses are the same to the findings revealed by Desta et al. (2019:364) and Desta (2016:54-55). They found that students use the library resources to provide in their information needs.

6.4.5 Information search support

It has been noted by Agyapong (2005) that users' environmental situations and the support they receive could influence their information seeking. Therefore, to establish whether the participants received any support when searching for information, they were asked if they also learned from their colleagues and lecturers to search for information. The findings revealed that, although the majority of the participants indicated that they look at how others search for information, some of them do not. Most of the participants indicated that their colleagues and lecturers guide and help them in getting the information that they need. For example,

- Participant #O noted that most of the lecturers show them how to search for information using the DOI (document identification number) of an article. He has learned certain skills and ideas from his interaction with them. Also, he learns from his peers, observing how they search for information, to improve his information-searching skills. With regard to improving his information-searching skills, Participant #O further revealed that he once received information-searching training from an information literacy lecturer who is also the department librarian. The training he has received 'sharpened up' his search skills.
- Participant #K indicated that, since he is not a repository of knowledge, it is better to follow the way in which others search for information. According to him, watching how others search for information could either improve his information search strategies or widen his scope of information searching.

In addition to how lecturers or librarians, academic colleagues guide and support students when searching for information, the participants also shared information on the potential that mobile technologies have in providing access to library resources and, as such, support them in their learning.

6.5 USE OF MOBILE DEVICES WHEN SEARCHING FOR INFORMATION

The third research objective was to understand the experiences of doctoral students at UCC in the use of mobile technologies in their information seeking process. The integral role of mobile technologies and modern information-seeking behaviour was well explained in sections 4.3 and 4.4. To understand how smartphones and tablets can be used to support information search and use, the following questions were asked: *How experienced are you in using smartphones to search for information? Do you collaborate with your peers when searching for information? What are the challenges you face when using your smartphone or tablet to search for information?* The responses to these questions were captured as follows:

6.5.1 Students' use of smartphones and tablets when searching for information

Smartphones and tablets have the potential to influence students' information-seeking behaviour. However, students need to be familiar with the use of these mobile devices and be aware of the potential these devices have to support them when searching for information. In response to the question about their experiences of using their smartphones or tablets when searching for information, most of the participants indicated that they have been using smartphones and tablets for a considerable period of time. They therefore have the needed technical knowledge and skills to effectively use these devices to search for information. Participant #B noted: *"I have been using smartphones and tablets in information seeking for some time now; even from my undergraduate days and I'm very conversant with using my smartphone in searching for information in all areas."*

In turn, Participant #O reckons he is very good when it comes to using a smartphone to search for academic and non-academic information. According to him, he is experienced in using his smartphone and tablet when he searches for information. Participant #O's comment concurs with Participant #K when he stated that he knows how to use his mobile device when searching for information. In addition to the comments of Participants #K and #O, Participant #E indicated that when looking for information, she was familiar with the use of a mobile

device.

Similar findings were reported by Qayyum and Smith (2015:15-17). They found that doctoral students were able to connect to the Internet and search for information while using their mobile devices. They, as well as Rowlands, Nicholas, Williams, Huntington, Fieldhouse, Gunter and Tenopir (2008:291-295), also noted that students appeared to be comfortable in using these technological resources for learning.

6.5.1.1 Advantages of using smartphones and tablets when searching for information

As indicated in section 4.4.1, it was shown that users use their mobile devices to access learning management platforms for study material. The participants' responses indicated that mobile devices made it easy for them to move around while still being able to read study-related material on their devices. For instance, Participant #O noted that *"you cannot always carry books with you, but if you have your smartphone with you, you can have access to any information with ease when connected to the Internet".* Participant #O's comment concurs with the comments made by Participant #D. According to her, she connects to the Internet with her mobile device and downloads material even when she moves around.

Similarly, Participant #G noted that when a colleague or lecturer wants to recommend a journal article as a possible source of information, a mobile communication application such as WhatsApp makes information searching very easy. Using WhatsApp supports her in getting more information to understand the concepts and tasks she finds difficult in her studies. This is because she can discuss subject-related issues with her colleagues. She noted that her colleagues have varied levels of expertise and knowledge of the subject and they use their mobile devices to post comments and deliberate on various topics on the social platform. She further stressed a need to use a common platform for such discussions.

The participants' responses are similar to the findings reported by Mahama (2015:9-11) and Al-Menayes (2015:43-45). They noted that the opportunities that were available to users when they use their mobile devices to search the Internet for information have made the Internet the best information resource for learning. These researchers observed that students found the use of mobile devices very appropriate to search for information. Fuuthermore, using mobile devices to search for information has also improved students' ability to

download information for the purpose of learning (Omidian & Seifi Maleki 2013:164-165; Omidian 2011).

6.5.1.2 Using mobile devices to collaborate with peers

In section 4.5.1 it was explained that users used their smartphones and tablets to create a familiar platform to share information in real time. The overall responses from the participants revealed that they collaborate with their peers when searching for information. This is best explained by Participant #K. According to him, he shares information with his peers if he does not understand something and his peers explain it to him. In turn, Participant #J also revealed that she preferred reading in her room, but if she does not understand something, she relies on her peers to explain things to her by using a common social media platform on which they can discuss subject-related issues.

This response is in line with other findings by researchers such as Kiryakova (2017:278-279), Schuler, Hutchins and Lashell (2012:11-15) and Hanewald and Ng (2011:7). They observed that mobile devices generally enhance the possibilities for collaboration in learning among students.

In addition to the advantages that mobile devices have when searching for information, the participants also reported on a variety of challenges.

6.5.2 Information-seeking challenges posed by the use of mobile devices

As discussed in section 4.4, users encounter various challenges when they use smartphones and tablets to search for information. The participants' responses can be grouped as being network-related, device-related, cost-related and environment-related.

6.5.2.1 Network-related challenges

In section 4.4.2.2 network signal failure was identified as a challenge or barrier affecting the use of mobile devices for learning. The participants' responses also showed how the usage of their mobile devices was influenced by poor Internet connectivity. For instance, Participants #C, #D, #F, #J, #L, #M and #P noted that poor internet connectivity made it difficult to download more than one article.

Some of the participants indicated that power outages obstruct them when searching for information as power outages affect their ability to connect to the telecommunications network, through which they can access the Internet. For example, Participant #E noted that power outages made it difficult to use a mobile device for learning.

These responses are in line with the findings of researchers such as Husnjak, Forenbacher, Perakvić and Periša (2016) and Zhang and Adipat (2005:295-300), who found that poor internet connectivity affected users' information searches. In a similar vein, Ganaie and Rather (2014:66-69) and Al-Moumen, Morris and Maynard (2012:445-450) also found that slow download speed and weak internet signals affected students' information searches. Additionally, the findings reported by Ahmed (2013) and Ingutia-Oyieke and Dick (2010:69) indicated power outages on campuses as a major setback that affects students when searching for information.

In addition to network-related challenges, the participants also shared information on device-related challenges that affect their use of mobile devices when they search for information.

6.5.2.2 Device-related challenges

The device-related challenges that participants experience include:

- **Memory capacity**. Participants #A and #F stated that mobile devices' limited memory makes it difficult to save a sufficient amount of academic content. The participants' responses are consistent to the findings reported by Sharples (2013:5-9) and Bao (2012:66-6). Their findings revealed that the limited memory of some of the mobile devices made it difficult to save the required amount of learning content and information.
- **The device's screen**. Participant #I stressed that images and text viewed on a smartphone are usually small and this forces her to strain her eyes so that she can read it. This response is consistent with the findings of researchers such as Cheng, Lam, Li, Au, Ma and Ho (2018:91) and El-Hussein and Cronje (2010:12-18). These researchers noted that mobile devices are usually equipped with small screens which are not conducive for learning. Moreover, constant scrolling up and down on the phone sometimes becomes tedious when using a mobile device for reading or for searching information (Nowlan 2013:142-150). Suki and Suki (2011:51-53) also

noted that images and text on the screen may cause eye strain when using it for learning.

- **Processing power**. Participants #B, #E and #L noted that the mobile device's processing power makes it difficult to load documents for learning purposes. The participants' responses are identical to the findings reported by Wilson and Bolliger (2013:220-224) and Suki and Suki (2011).
- **Battery capacity**. Participants #C and #O noted that they lose information when their smartphones' batteries die unexpectedly. The findings from the participants correspond with previous findings. For example, similar findings were reported by Bao (2012:66-68) and Zhang, Yuan and Wang (2011:29-31). They noted that short battery life may lead to an inadequately short time for learning activities and even the loss of information due to unexpected battery failure.

The participants revealed that memory capacity, screen size, processing power and battery capacity were the major mobile device-related challenges that they commonly encounter. Aside from device-related challenges, some of the participants cited cost-related challenges as another barrier that militate against the smooth use of mobile devices for information seeking.

6.5.2.3 Cost-related challenges

The use of mobile technology comes with a cost and sometimes such costs could hinder the quest for and subsequent use of information. Most of the participants commented on the effect the cost of data has on their ability to search for information. For example, Participant #J noted that mobile data is expensive, especially when he needs to use his data to search for information. According to him, due to the cost of mobile data, information searching becomes challenging when he is away from campus and therefore unable to use the campus Wi-Fi. Participant #J's comment concurs with that of Participant #C when she stated that *"it is costly when you are not using the campus Wi-Fi for information search".* She indicated that she can spend around 40 or 50 Ghana cedi on mobile data per week.

In the case of Participant #H, the cost of mobile data affects his ability to search for information using his mobile device. He indicated that doing academic research work on a mobile device costs more when compared to campus Wi-Fi, which restricts him from

exploring new ideas.

The participants' responses are similar to the findings reported by Donner and Walton (2013:353-355) and Wilson and Bolliger (2013:220-223). They found that the use of mobile data to search for information was costlier in a mobile technology environment than when Wi-Fi was available. In addition, Dunaway, Searles, Sui and Paul (2018:110-115) and Farley, Murphy, Johnson, Carter, Lane, Midgley, Hafeez-Baig, Dekeyser and Koronios (2015:7-10) noted that doing research for schoolwork, learning new things, and discussing and participating in project assignments on mobile devices cost more.

When commenting on the costs involved when searching for information by using their mobile devices, Participants #C and #J noted that it has become too expensive for them to use their own data for information-seeking purposes. The participants' responses support Donner and Walton's (2013) findings. They found that a lack of financial resources affects users' ability to search for information when using their mobile devices because they need to buy data to access the available mobile digital services or information for learning. In turn, Participant #H's response supports West's (2015:3) findings. He found that it is costly for mobile users to access data and noted that the more students use their mobile devices for learning, the more expensive it is to search for information using these devices.

When asked to indicate the challenges they face as doctoral students when searching for information, the expectation was that the participants would discuss network-related, device-related and cost-related challenges. However, the participating doctoral students also chose to discuss the environment-related challenges they experience.

6.5.2.4 Environment-related challenges

The majority of the participants indicated that the main university library does not give them the information or material they need. For example, Participant #C noted that she does not get current 'material' from the library. Participant #C's comment concurs with a comment made by Participant #B. He also stated that he does not get current 'material' for his course of study. It seems as if these two participants required current printed resources at that time. It is also possible that they were not aware of the availability of e-books on the full-text databases. This could therefore be an example of a lack of awareness of what is available in the library,

which challenged the participants in accessing the information they needed.
Aside from the non-availability of current 'material', the participants noted that it takes longer than expected to receive the material they had requested from the library. According to Participants #G and #H, this is a problem, especially when they need the information for a class assignment. Therefore, the time it takes to receive library resources negatively affected the time the participants had available to complete their assignments.

In addition to the time they needed to wait for information sources they had requested from the library, Participants #A and #L found the arrangement of books at the library challenging. According to them, the library's shelving system is confusing.

In seeking for online journals to complete a task, most of the participants commented on how restrictive the access to online journals is. For instance, Participants #D, #E and #F complained that the access codes or passwords they need to use make it difficult for them to download more than one article from full-text databases, such as EBSCOhost and Emerald, to which the library subscribes.

On the other hand, Participant #D also noted that disturbances coming from the study carrels were some of the environmental challenges they faced when searching for information.

This finding concurs with the discussion in section 3.4.2, which indicated that institutional barriers (e.g., information access restrictions) act as sociocultural barriers in information searching. Pajares (2000) maintains that the sociocultural context plays a significant role in information searching. Sociocultural contexts are the human barriers or man-made factors that affect users' search for information. This could include situations where an institution consciously or unconsciously denies users some vital information or where there is a lack of information resources for learning.

Pajares (2000) also reported on the issue of not getting the desired information from the library and on possible disturbances from other students in the library.

The literature reviewed for this study did not report on the non-availability of current 'material' and the library's shelving as challenges that users face when searching for

information. Therefore, it seems as if this finding of environment-related challenges is exclusive to the current study.

6.5.3 Seeking assistance

Sometimes it becomes important to either seek assistance or consult other sources for further information or for the purpose of clarification. Most of the participants indicated that they normally seek assistance if they encounter problems. For example, Participant #C indicated that his assistance comes specifically from colleagues and senior lecturers. He also noted that, in addition to colleagues and senior lecturers, he normally resorts to professional librarians at the UCC for help.

In turn, Participant #F stated that he usually asks for assistance from friends and other people. Other participants indicated that their need to seek assistance from others is typically prompted by the level of their information-searching skills and their knowledge of information systems. For instance, Participant #L reported that his information-searching skills were very poor. Participant #L's comment suggested that he lacked the necessary information literacy skills to effectively search for information. These findings support those made by Desta et al. (2019:369-370) and Spink and Cole (2006:2). They found that academic colleagues and library assistants support users in improving their information-searching skills.

6.6 SUGGESTIONS FOR THE IMPROVEMENT OF LIBRARY SERVICES AT THE UCC

One of the rationales behind the study was to solicit suggestions from the doctoral students on the improvement of library services at UCC for mobile technology users. To achieve this, the study solicited responses from the participants as to how their information needs as students could be satisfied. The ways in which information needs of students could be met are multifaceted and rest within the jurisdiction of the university authorities. It could therefore be seen as an institutional responsibility to provide access to sources that would support users in satisfying their information needs. Some of the questions asked were: *How can the UCC provide a friendly atmosphere to help doctoral students get the information they need? What can the UCC do to enhance students' information-searching experiences? Should professionals be involved in students' information seeking?* And, finally, *Should the entire*

library be digitised? The participating doctoral students' responses are discussed in the following sections.

6.6.1 What the institution can do to enhance students' information searching on mobile devices

The first question, as stated in section 6.6, was to solicit responses from the students on what they (students) think the institution (UCC) could do to help them to satisfy their information needs. From the participants' responses, it was observed that the students mainly used the Internet to satisfy their information needs. Unfortunately, internet connectivity seems to be a problem and the participants were of the view that the university should improve the Wi-Fi infrastructure on campus to ensure better connectivity. This view is best explained by Participant #F who suggested that the university management should invest more in the university's IT infrastructure. Participants #A, #C, #K and #N noted that mobile data is costly. It would be beneficial for the students if the university management improved the current IT infrastructure to ensure better connectivity. Similarly, Participant #H indicated that, although there is a Wi-Fi service on campus, the coverage is not wide enough to serve all the students.

Some of the participants indicated that the library could subscribe to more e-resources. For instance, Participant #B noted that if the university management subscribed to more e-resources, the possibility to have unrestricted access to information will be improved. Similar comments were made by Participants #D, #F and #L.

The responses from the participants are consistent with the findings of Desta et al. (2019:369) and Al-Moumen, Morris and Maynard (2012: 445-450). These studies indicated that slow and unreliable internet connections affected users' information seeking. In turn, studies conducted by Al-Moumen, Morris and Maynard (2012:445-450) and Ganaie and Rather (2014:66-69) identified improved internet connectivity as a basis for responding to or meeting doctoral students' information needs. An improved IT infrastructure would ensure better internet connectivity, more bandwidth, and vibrant high-speed network connectivity (Voelkel & Bennett, 2014:50-56; Bao 2012:66-68; Menkhoff & Bengtsson, 2012:230-238).

6.6.2 Enhancing students' information searching

To enhance the doctoral students' information-searching skills, Participant #I suggested: *"The teaching of the Information Literacy Skills course should be made more popular and then it should not end at the first-year undergraduate level."* Participant #A's comment concurs with those made by Participant #I when he stated that the university should provide for the teaching of information literacy skills courses, even at doctoral level. According to him, they should introduce more practical work in the information literacy course for students to learn hands-on skills for using mobile devices in searching for information.

Students are primary users of information on university campuses. The participants' responses revealed that students' literacy skills should be enhanced right from the undergraduate level to the doctoral level. This would help students improve their information searching or widen their scope in using mobile devices for information searches.

The suggestions of Participants #A and #I support Ganaie and Rather's (2014) observation that doctoral students have different information literacy skills, computer skills or experience and knowledge of using electronic information sources. Desta (2016:16-19) noted that doctoral students' information literacy skills shape their information behaviour-related activities.

6.6.3 The use of information science professionals in helping students

Conducting information searches while using a mobile device can sometimes be difficult and time-consuming. Consequently, the services of librarians and other information professionals are important to support students in finding the information that they require. The responses revealed that the participants strongly believe that the use of professionals would largely benefit them. Participant #N indicated that librarians are the best professionals to help them in this regard. Participant #A suggested that the library should use a common instant messaging platform so that the librarians can instantaneously help students who have difficulties in searching for information. Also, the participants indicated that this is only possible if the academic librarian or reference librarian is using the same instant messaging platform as their users.

These findings are consistent with Ifijeh and Isiakpona's (2013) suggestions. They suggest

that academic libraries can use instant messaging platforms to improve the services they provide to their users to support learning. Furthermore, Ifijeh and Isiakpona (2013:13-15) and Harinaarayana and Raju (2010:72-78) indicate that an instant messaging platform can be used to enhance libraries' reference services since it allows for immediate responses to library users' enquiries. In addition, Sahu and Bhoi (2015:122), Lippincott (2010:205-210) and Gibbons (2007) suggest that libraries can use an instant message platform to provide services that allow users to ask questions and receive feedback from librarians during stipulated contact periods.

6.6.4 Digitisation of the library

With the influx of technology, the numbers of digital libraries are gradually increasing. The answers from the participants indicated that almost all of them want the library to be digital. The participating students further indicated that, if the library were fully digitised, they would find it easier to access information wherever they find themselves, by using mobile devices. Participant #I furthermore maintained that the digitisation of the library would make information searching easier. Similar comments were made by Participants #A, #C, #D and #O.

Participant #C pointed out that there was a need to get rid of the hard copies of books and other learning material. Participant #K also indicated that a digitised library was needed to lessen the time used to search for credible information manually. The responses from these participants indicated that they want to use the library off-campus and do not want to visit the library to borrow books.

The answers from the participants are in line with the findings of Esfahani and Chang (2012:6). They noted that academic or university libraries provide access to different kinds or types of information sources, such as online databases, printed books and online journals. The physical availability and accessibility of these information sources in the library affect students' information-seeking behaviour. This has led to changes in the manner in which information users, such as students, access information and how libraries deliver information in the digital environment (David 2002:13).

What is interesting is that the participants idealise digital libraries, yet they do not seem to

realise that the library, due to its subscription to resources on online discovery platforms such as EBSCO host, Emerald and SAGE, is already partially digitised. As it is, some of the participants seem to find it difficult to retrieve information from these platforms due to a lack of information-searching skills. It was also mentioned in Chapter 1, section 1.2 that training is given on how to search for information using mobile devices, but despite the training being offered, many students are still not competent searchers. Therefore, having a digitised library will not benefit them because they could still be unable to find the information they require.

6.7 CHAPTER SUMMARY

This chapter reported on the findings of the participating UCC doctoral students' information-seeking behaviour and how they used their mobile devices for learning. The data in this chapter were discussed in terms of the doctoral students' information needs, students' information-seeking behaviour, the roles mobile devices play in the students' information seeking and how the library can meet students' information needs more effectively. The findings observed that the use of mobile devices for information seeking is inevitable among doctoral students whose core mandate is to establish current debate in their academic research. The reported findings are discussed in Chapter 7.

CHAPTER 7

DISCUSSION OF THE INFORMATION NEEDS AND INFORMATION-SEEKING BEHAVIOUR OF DOCTORAL STUDENTS WHO USE SMARTPHONES AND TABLETS FOR LEARNING

7.1 INTRODUCTION

Chapter 6 reported the empirical findings of the information needs and information-seeking behaviour of registered doctoral students while using their mobile devices for learning. The focus of this chapter is to discuss the empirical findings. The concepts 'information needs' and 'information seeking' were clarified in Chapter 2 and Chapter 3. The role of context in users' information needs and information-seeking behaviour was also explained. In this chapter, the discussions focus on how the interplay between users' personal dimensions and their contextual elements prompts the information needs and information-seeking behaviour of doctoral students. The barriers that these doctoral students experienced are highlighted and the discussion shows how those barriers influenced their information-seeking decisions.

7.2 BACKGROUND

In section 1.3 the researcher observed that, although information users are certain they will find the required information, the same users are often confused or uncertain about their information searches. In section 2.3 it was stated that there are two approaches to information needs studies, namely subjective and objective. The objective approach focuses on the user's context (i.e., situation in action, task, etc.) that gives rise to information needs. The subjective approach looks at what prompt's information needs in users' mental structures. Whereas objective information needs are cognitive needs, subjective information needs are affective needs. The interplay between these cognitive and affective structures gives rise to information needs which, in turn, determine what information is needed and from where it is sought. The current study adopted Ellis's (1989) model of information-seeking behaviour to empirically investigate information needs and information-seeking behaviour of doctoral students who use smartphones and tablets for learning. The empirical data gathered from the participants are presented in this section, comparing it with what is reported in the literature.

7.3 INFORMATION NEEDS

In section 2.2 it was explained that the interaction between users' mental structures and context gives rise to their information needs. As indicated in section 2.3, information needs and users' desire to satisfy such needs transpire within a specific context. The academic environment in which the doctoral students find themselves could therefore provide the context within which academic-related information needs arise. In the academic context, students encounter situations in action, tasks, technology and information resources that affect their information needs. The same contextual elements are also present in their everyday life contexts. The empirical data reported in section 6.1 revealed that, although the focus of the study was on the students' academic-related information needs and information-seeking behaviour, some of the participating doctoral students did not distinguish between their academic and everyday life information needs. This could be because the participants' information needs are embedded in both contexts and it is equally important for them to satisfy their information needs deriving from both contexts. The discussions to follow explain the participants' specific context-related information behaviour.

7.3.1 Context

In section 6.3 it was noted that the participating doctoral students' academic-related information needs are influenced by their subject field of study. Within the academic context, certain situations in action arise, in which tasks are given and the participants must contribute to class debates. These situations in action, in combination with the available information resources and technologies that were available at the time when the information was needed, commonly affect the participants' information needs.

As indicated in section 2.4.1, McCreadie and Rice (1999:58) argue that a situation in action is a type of circumstance from which a need for information arises. The empirical data in section 6.2.2 specified actions like class debates that prompt information needs. Participant #E indicated that to present a sound argument during a debate in class, he needs to gather information.

The information Participant #E needs to deal with the debate-related situations in action not only reflects a need for information to deal with the situation but also reflects the participant's motivation or desire to present a sound argument. In this instance, the debate (situation in action), coupled with limited knowledge (a cognitive information need), suggests

a path (motivation) towards the satisfaction of a goal, which is seeking information that could fill his knowledge gap. Motivation is an element in Participant #E's sensorimotor structure. The empirical reports concur with Nahl's (2001:1) explanation that the sensorimotor structures of the inner person act as motivators (triggers) for users to react and do something about their information needs.

Furthermore, the situation in action could be spatial. Julien and Michels (2004:547-548) note that some information needs require information urgently and this is what is referred to as spatial situation in action. For instance, Participant #C talked about how he once needed urgent information to locate the nearest branch of the commercial bank to meet a fee payment deadline. In this instance, the need for information reflects a situation in action which has some spatial time constraints. It could be that information needs and the mode of satisfying them do not have a common feature. It is therefore worthy to note that the cognitive, affective and sensorimotor structures of individuals play a significant role in prompting their information needs.

Tasks are the second contextual element that prompts cognitive information needs (Savolainen 2012). Tasks are things users do to achieve goals (Hackos & Redish 1998:56). From the perspective of Byström and Järvelin (1995:193), these tasks have a recognisable purpose, beginning and an end. The empirical reports concur with Byström and Järvelin's (1995) explanation of a task, seeing that the tasks that the participants need to complete have set objectives and time frames (i.e., a beginning and an end of the task). The specific tasks the participants need to complete include preparing for class and preparing for conferences and seminar presentations (Participants #E, #I and #L). The tasks the participants have to complete can be seen as a series of actions that are undertaken in pursuit of a goal. Participants' preparation for examinations or presentations, which give rise to information needs, thus become recognisable tasks that begin when the participating students start to gather information for the examinations or presentations and end when such examinations or presentations are completed.

Tasks as a contextual element within the academic context imply that the academic tasks set the criteria for the information that is required. As such, tasks give rise to a cognitive need for information. In addition to experiencing a cognitive need for information, the participants

also reported that they experienced subjective needs for information. As Case (2012:78) explains, subjective information needs are needs that are characterised as thoughts that act as motivation, which in turn prompts action. This then reflects the interaction between the participants' cognitive and sensorimotor structures. Therefore, when users obtain and use the obtained information, their needs can be met. To obtain information for all task-related activities, the participants have to use information resources that are available in the university library (an element of the participants' sociocultural context).

Information resources also prompt participants' information needs. In section 2.4.3 it was revealed that information resources are resources in an electronic information system and which are accessible through electronic systems and networks. The empirical reports in section 6.3 showed that the participants mostly rely on non-restrictive online resources for their information needs. Most of the participants indicated that information from sources that are electronically stored in various online journals contributes to satisfying their information needs. It could be that the participants generally source the information they require to satisfy their information needs from online journals, as opposed to using their books or books they could borrow from the UCC Library.

Throughout the literature review, information resources have consistently been recognised as an integral platform from which information is sourced. Sometimes users could find retrieving information from information resources challenging and, in turn, the challenges they experience prompt new information needs and embarking on a different avenue to satisfy their information needs. This is explained by Participant #B, who noted that he found it difficult to get access to the right online journal. Participant #B's comment can imply that he did not know how to get access to the journal he needed to use, or that access to the journal was restricted. He therefore had to find different means of getting access to the actual information he required. As such, the information resources the participant cannot access could act as information barriers, and to deal with the problem, he finds alternative ways or sources to support his information needs. Alternatively, the challenges Participant #B experienced in getting access to the right journals could also be an indication that he had not yet acquired the necessary information literacy skills to effectively search for information.

In section 3.4.4 technologies were observed to play an important role in information seeking

(Meyer 2016). Rieh (2004:749) observed that technology has changed the information-seeking and retrieval behaviour of users. The empirical data support the view that the use of smartphones and tablets could aid users in gathering the required information to deal with their situation in action and task-related information needs, as explained. This implies that the participants can access information while using mobile devices (e.g., smartphones or tablets) without having to visit the university library physically. However, to use their mobile devices effectively, the participants need to be skilled, and a stable network connectivity is required. At times the participants encountered connectivity issues and, to deal with such situations, they subscribed to multiple service providers so that they could change their connection to a different network.

The empirical data revealed that the participants needed information for their daily lives. To the participants, it was equally important to satisfy both their everyday life information needs and their academic-related information needs. Examples of everyday life information needs that were shared by the participants included a need for religious information. This need for religious information was not only to support the participant's curiosity about a religious topic, but also reflects a need to help others. Participant #M's need for health-related information is a further example. She needed information on sickle cell disease, a condition from which her children suffered, to deal with disease-related situations that could arise. Except for the need for information on banking issues, the reported everyday life information needs were not urgent. This shows that not all information needs necessarily justify the urgent completion of a task but there could be the anticipation that the retrieved information could be needed in future at some point.

7.3.2 Information users

Information needs arise due to the interaction between the context and the information user (Meyer 2016; Savolainen 2012). An information user is anyone who needs information to fill some knowledge gap, irrespective of whether the knowledge gap is task-related or curiosity-related. In the current study, the term 'information user' refers to the participating doctoral students who have earned a master's degree and are studying at the UCC for a higher qualification, such as a doctoral degree.

The users' mental structures include but are not limited to their knowledge, skills, experience, personal preferences (cognitive structures), motivation (sensorimotor structures) and feelings

of uncertainty and trust (affective structures). The interaction between the participants' social context and their mental structures affects their information behaviour. For instance, Participant #C's knowledge of living a healthy life serves as a motivation to remain updated on the latest trends and research to maintain his healthy lifestyle.

The interaction between context and user implies that users' information needs are not static as information needs are determined by the context in which the need arises, as well as users' knowledge and skills. For instance, Participant #B was given an assignment and he identified a specific online journal as an applicable source that could fulfil his information need. However, Participant #B was also challenged by his lack of knowledge and skills in using online resources that would support him in getting access to the journal he had identified. In this scenario, two knowledge gaps can be identified, namely, information that could support him in completing his task (i.e., conceptual and task knowledge) and the knowledge required to get access to the journal he had identified, which had the potential to provide him with the conceptual knowledge he required (i.e., knowledge of the resources to be used). The knowledge gap about the information resources the participant needed to use for his assignment reflects a lack of information literacy skills.

In turn, Participant #M's need for information on sickle cell disease is indicative of an affective information need as she was concerned that she would not know what to do when a disease-related situation arose. However, in her attempts to find relevant information about sickle cell disease, Participant #M faces issues concerning trust, confidence and frustration. The reason why Participant #M would experience feelings of trust, confidence and frustration pertains to the fact that she is not a health professional or a physician. Therefore, she is not very knowledgeable about the disease and, as a result, her confidence level in gathering health-related information may be low. Also, because of her lack of knowledge, she might not be able to evaluate the trustworthiness of the information she gathered. This could cause feelings of uncertainty, which in turn could give rise to feelings of frustration.

7.3.3 Reflection on information needs

The participants' academic and everyday life contexts give rise to information needs and, in turn, set the requirements for the information that is needed. Certain elements within the academic context, such as tasks, situations in action, information resources and technologies,

prompt the participants' information needs. It was also revealed that the interplay between the elements in the context and the participants' cognitive and affective structures supports the participants in recognising their need for information and on deciding on how to satisfy those needs.

7.4 INFORMATION SEEKING

It was shown in section 3.3 that information seeking is prompted by information needs. The empirical data reported in section 6.4 indicated that the participants were involved in two information-seeking activities, namely awareness of the information sources and information searching.

The same data revealed that the participating doctoral students were aware of their information needs. However, as Bates (2009) suggests, there is a difference between being aware of an information need and being aware of which information sources have the potential to satisfy the identified information need. The latter is what the participants lacked. Most of the participants were oblivious about the information that was available in the library, which would support them to fill their knowledge gaps. As such, their lack of knowledge of the information sources and resources they needed to use challenged them. For instance, all the participants who drew attention to their awareness of what information to use, also talked about how difficult it was to get credible sources of information or to get access to such information. When describing the challenges that they experienced in getting access to credible sources of information, Participants #B and #C noted the non-availability of printed documents, which would be easy for them to use. Meanwhile, the documents the participants were trying to get access to were most probably available in an electronic format, but the participants were not aware of the availability of such documents in a different format.

Those participants, like Participants #E and #H, who were aware of the online sources, indicated that they usually search through online journals to get access to the required information. To get access to the required articles, Participant #E had to identify journal articles that would satisfy his information needs and then download the articles onto his tablet for use. Participant #H also searched through e-books to access information. These two participants' information search activities ended once they had downloaded the articles or

chapters from the e-books they needed. This is then the final feature in Ellis's (1989) information-seeking behaviour model.

The information from Participants #E and #H is observed to follow Ellis's information-seeking behaviour model. The reason is that these participants indicated that their information search activities ended after they had obtained the required information from downloaded material. This means that they first begin (starting an information search) by typing in the keywords into a search engine or mobile app and by also identifying the relevant information system (database) to be used. After this, the search process continues (browsing). Through browsing, different online materials are searched. Thereafter, the information is downloaded (extracted) onto their mobile devices (i.e., their smartphones or tablets). The retrieved information that was downloaded is verified to establish which sources would best meet their information needs (end). The selected material is then used to fill their knowledge gap.

However, despite the perceived ease with which Participants #E and #H searched for information in the library catalogue and online databases, most of the participants found searching for information challenging. Due to the challenges they experienced, some of the participants opted to ask colleagues and other people in their departments, including lecturers, for support. One of the reasons they gave for asking their lecturers pertained to the fact that their lecturers were more experienced information searchers and had previously guided them in the information-searching process. Participant #O revealed that he learned new ideas and developed certain searching skills through his interactions with lecturers. The participants' reliance on their lecturers for support is indicative of the trusting relationship that has developed between the participants and their lecturers, due to the guidance given on how to search for information. The participants' need for support to search for information, as well as the comments made by Participants #F and #L, revealed that they lacked the necessary information-searching skills to effectively search for information. These responses reflected their low information literacy skills which, in turn, reflect on their cognitive abilities.

In section 7.3.2 it was observed that the interplay between users' social contexts and their mental structures prompts information needs. Having identified a knowledge gap, the user goes through the searching processes or information-seeking activities. The discussions to follow examine the role that user-related characteristics, such as users' cognitive and

affective mental structures, play in the information-seeking process.

7.4.1 User characteristics

Information needs prompt information activities, but different users could engage in information-seeking behaviour activities which are different from their peers in identical or similar situations. This happens because users have a different understanding of their situations, which is centred on their experience, and skills. In this study, most of the participants had a better experience on the use of the different mobile devices and technologies to search for information. Moreover, Participants #A and #O knew what information was needed to fill their knowledge gap. They were also familiar with where to get such information. Contrary to these two participants, Participants #F and #L reported that their information-searching skills were poor. Their comments suggested that they lacked the necessary information literacy skills to effectively search for information. Their responses suggested that the information literacy skills training they had received was inadequate. This could explain why some of the doctoral students required assistance while conducting an online search, even though they were comfortable using their mobile devices.

The participants' personal preferences seem to affect the sources they use to complete their academic tasks. Some of the participants also indicated that their information needs differ and that each need dictates the information they seek and subsequently dictates their preferences for specific sources. It was observed from the responses that, given the same task requiring the same or similar information, some of the participants resort to using online journals whereas others use online theses, dissertations and e-books as well as printed books. For example, Participants #B and #C noted that they get information from e-books. These students' need for printed material reflects their personal preferences and their personal preferences are often based on their cognitive structures, because they know how to use a book to complete an academic task.

Besides the types of information sources used, the participants' information-seeking activities are affected by their personal experiences of using certain sources. For example, Participant #C indicated that he has been using online journals for a long time and hence knows which journal will give the required information for a given task. The information on the users' personal characteristics revealed that cognitive structures like user experiences, skills and

knowledge are important features that affect information seeking. Similarly, affective structures like personal preferences affect the way and manner in which information is sourced and used.

7.4.2 Context

In section 7.3 it was observed that the doctoral students' information needs arise from their academic and everyday life contexts. Similarly, in information seeking, context again plays a key role. The discussions to follow focus on the role that certain contextual elements, like tasks in the academic context, play in information seeking.

7.4.2.1 Academic context

In the information-seeking process, one of the key elements in the academic context is the library. Furthermore, the library serves as an information resource for information seekers. Esfahani and Chang (2012:6) argue that academic or university libraries provide access to different kinds of information sources. The empirical data revealed that the university library provided the participating students with different types of information sources. Unfortunately, most of the participating students acknowledged that they do not use the library when they search for information. This notwithstanding, the few participants who reported having used the library indicated that the library provides them with access to e-resources. For instance, Participant #K indicated that he normally uses the e-resources provided by the library. Because of his experiences of using e-resources, Participant #K was also aware of what information is available in the library, which could satisfy his information needs.

However, the participants enumerated some challenges that they face when using the university library. These challenges typically act as barriers to their information seeking. Notable of such challenges are the non-availability of current material for students and the time duration for getting the required information, which was observed as being too long. For example, Participants #B and #C noted that they did not get current library material relevant to their courses of study. These two participants, in response to a question about their personal preferences, indicated their preferences for printed material. It could also mean that the participating students know where to find books on the shelf but do not know how to access an e-book in the library's databases. However, these two participants also indicated their preference for printed sources. Therefore, they were most probably looking for the most

current printed sources in their field of study and they did not consider the fact that the library could provide them with online access to current sources. In this instance, the participants' personal preferences, rather than the availability of information, acted as a barrier to information.

One other notable challenge was the fact that, as indicated by Participant #B, the time duration for getting the required information was observed to be too long. Participant #H indicated that the lag in time was mainly due to two reasons. The first rationale was the librarians' lack of experience in providing the needed material (books) for students. The second reason was mainly due to poor internet connectivity, which made it difficult to access the e-resources that were available in the library. This means that the absence of experienced librarians to support users and a slow and unreliable internet connection serve as barriers to information seeking.

Similarly, it was revealed that there were inconsistencies in the shelving system of the library, creating confusion for patrons when trying to locate the particular information source. The inconsistency mentioned here refers to how books are sometimes shelved. From the previous paragraphs, it was reported that inexperienced librarians are unable to support students in getting timeous access to the information they have requested. Furthermore, the presence of inexperienced librarians contributes to the inconsistent shelving of books. Shelving books incorrectly makes information searching difficult.

Furthermore, it was identified that students who use the library are often disturbed by noise from within the university library setting. This could be that the library is by itself creating a contextual barrier and this barrier affects the information-seeking behaviour of students. Therefore, whenever faced with a need for information, students would seek alternative sources, other than the library. One of the reported alternative sources is open access journals. From previous observations, if the other sources cannot provide the desired information, due to students' lack of understanding or experience regarding the right source of information, the library becomes the last resort. Therefore, if students fail to use the library due to erratic shelving, it means that the library is not living up to its responsibility as an academic context for information seeking.

Another challenge was the restrictive nature of some of the journals. For instance, Participants #D and #F talked about some online journal with restricted access. When access to online material is restricted, students are denied access and this makes getting credible information a cumbersome task. The restrictive nature of some of these journals, as reported by the participants, is the reason why students have to browse through several journals in search of information for a single assignment.

7.4.2.2 Tasks

A task is an element of context that affects information seeking. Doctoral students are given tasks to complete for the purpose of academic development. Participant #E described some of the steps he follows when seeking information for his tasks. For instance, to complete an assignment, Participant #E searches from one online journal to the other in a quest for credible and reliable information. Additionally, Participant #O reported that to complete a task, he reads through or scans the relevant journals in his field of study, downloads as many articles as possible, and saves the downloaded information on his Google Drive, which he accesses on his mobile devices.

The foregoing information has varied implications for the study as far as information seeking is concerned. The task of completing an assignment, which requires that students search for information, shows a link with the Ellis model of 1989. All the processes that students use in searching for information are consistent with the features of the Ellis model. As previously discussed, in the Ellis model, searching for information involves eight features (see section 3.7). The information collected from Participant #O illustrates that most of the features are utilised for information seeking.

7.4.3 Reflection on information seeking

The preceding discussions revealed that an awareness of the information sources and resources they need to use and their information-searching skills are some of the factors that affect the participants' information-seeking activities. However, to satisfy their information needs, factors like information sources and information resources affect these students' information-seeking activities. The discussions further revealed that context plays a significant role in initiating information seeking. Elements in the context of the doctoral students which play a role in their information-seeking activities include the academic

context (library) and tasks. In completing an academic task, it was observed that doctoral students follow the different features in Ellis's model of information-seeking behaviour.

7.5 MOBILE TECHNOLOGIES FOR LEARNING

Throughout the literature review, and especially in Chapter 4, mobile technologies and their role in information needs and information-seeking behaviour were extensively discussed. In this section, the discussion is focused on the literature and the empirical data collected from the participants. The discussion is based on mobile learning and the advantages and disadvantages of mobile technologies.

In section 4.3 it was noted that mobile learning involves the use of mobile devices that enable learning. The mobile devices that are being used for mobile learning purposes must have the ability to connect to other devices to provide educational information and exchange ideas between students and instructors (Stevens & Kitchenham 2011:1-4). This means that mobile learning takes place when users have the means and the ability to use their mobile devices in the presence of other interconnecting devices.

Mobile technologies are also used to deploy information services that aid the transmission of information from one end device to the other. From the empirical data, it was realised that mobile technologies aided the participating students to collaborate. The relationship between mobile technologies and collaboration is observed in the manner in which the participating students were able to exchange knowledge and ideas. With the use of mobile technologies (mobile applications like WhatsApp), the transfer of information from one information user to the other becomes easier. However, the use of mobile technologies has some advantages and disadvantages. The next section discusses the advantages and disadvantages of mobile technologies, based on empirical data.

7.5.1 Advantages of mobile technologies

The participating students reported the following benefits that they experienced from using their mobile devices to search for information:

- Downloading of online material
- Storage of documents for future use
- Transfer of learning material

- The ability to collaborate.

Some of the participants use WhatsApp to collaborate with their peers. For this purpose, they 'share' information and 'explain' things to one another.

WhatsApp is a short messaging application which is used not only to collaborate but also to improve knowledge and skills by using mobile devices. WhatsApp offer a forum or platform for collaboration. The participating students were able to work in groups and it is during this groupwork that collaboration becomes effective as they were able to solve information-related problems that are too demanding for individuals to accomplish by themselves. The participants could also share information that was related to their field of study and even edit their colleagues' assignments. Sometimes the participating students needed to have certain concepts explained to them. This suggests that the participants experienced a knowledge gap (cognitive structures). Additionally, a need to have something explained suggests 'uncertainty' as the participants could have had an idea of what was meant with a specific concept but required additional explanation to improve their understanding of it. Also, the identification of a knowledge gap creates an information need, which in turn prompts the user to search for information using a mobile application such as WhatsApp.

The use of WhatsApp for collaborating and sharing of knowledge also connotes the application of the Ellis model for understanding the participants' information-seeking process. Through collaboration, Ellis's feature of monitoring comes into play by setting up alert systems or checking databases to remain current on the latest information available. The database or alert systems are linked to common platforms where students in a group could place any new information on a topic. Thus, with the monitoring feature, students frequently set these alerts to get information whenever an update occurs. Additionally, with the use of short messaging while using the WhatsApp application, Ellis's feature of differentiation is utilised where ideas of different people (perhaps participants might be on different groups) are sourced for a particular subject. Users can also share ideas on WhatsApp and comment on other participants' activities. The overall implication is that the use of technology facilitates collaboration and collaboration, in turn, affects how information-seeking activities are carried out to fulfil an information need.

7.5.2 Disadvantages of mobile technologies

In section 6.5.2 the responses from the participating students highlighted some challenges that affected their information seeking. Some of the problems that were stated by the participants include the screen size of the mobile device, power outages and poor internet connectivity. Not only do these challenges affect the participants' ability to connect to the telecommunication network through which they can access the Internet, but it also affects their information seeking and their ability to use their mobile devices for learning purposes.

7.5.2.1 Device-related challenges

One of the barriers that users experience when using a mobile device to seek for information pertains to the small screen size of tablets and smartphones (Alwraikat 2017:124-128). The reported findings of the current study concur with Alwraikat's (2017) observation. In describing how the screen size of his mobile devices affected his information seeking, Participant #H indicated that, since his mobile device had a smaller screen size, he was unable to read the text of the online journals.

Therefore, considering Ellis's model, the screen size of a mobile device could make it difficult for the participants to evaluate the information they retrieve in terms of whether the retrieved information is suitable for the task at hand.

7.5.2.2 Network-related challenges

The main physical barrier to the use of technology when seeking information is related to technology infrastructure (Ingutia-Oyieke & Dick 2010:69). Mobile users need to have access to a power source because the battery of a mobile device does not have a long lifespan. As Participant #E explained, power outages obstructed her from searching for information while using her mobile device for learning. This implies that power outages affect her ability to connect to the telecommunications network through which she can access the Internet. This problem is twofold. If the problem is on campus, then the library systems are not working and the library users are also unable to use the institution's Wi-Fi. However, if they could still connect to their service provider, they would still be able to retrieve information from the library's systems as these are cloud-based, depending on the institution's setup. However, if the power outage affects a larger area than the campus, they would also be unable to connect to their service provider's network and therefore also be unable to get access to the library

systems. This view is supported by comments made by some of the participants. These participants indicated that poor internet connectivity affected their information seeking and their ability to use their mobile devices for learning purposes. For instance, Participants #C and #D explained that poor internet connectivity on campuses is a major setback that affects information seeking. These participants maintained that the university's Wi-Fi infrastructure was not sufficient to allow them to connect to the Internet.

7.5.2.3 Cost-related challenges

The cost involved in using technology to search for information affects users' information seeking (Dunaway, Searles, Sui & Paul 2018:116). This could be put to the fact that searching for information using technology is costlier in a mobile environment than when searching for information while using Wi-Fi. For example, Participant #H commented that buying mobile data is very expensive and therefore makes it difficult for him to access information on the Internet. As such, the cost of data acts as a barrier to information.

7.5.3 Summative thoughts on the factors affecting the use of mobile technologies

The discussion on mobile technologies dealt with mobile learning and the contribution of mobile learning in the concept of information needs and information-seeking behaviour of students. Moreover, the advantages and disadvantages of mobile technologies were discussed.

7.6 PROPOSED MODEL OF INFORMATION BEHAVIOUR (ADAPTED FROM ELLIS 1989)

The information needs and information-seeking behaviour of doctoral students seem to be affected by the academic context and by learning resources. This was illustrated graphically in Figure 3.1. Considering the responses of the participants, as reported in Chapter 6, and considering the discussion of the empirical data, it is possible to adapt the proposed model depicted in Figure 3.1 to include a more detailed information-searching process of doctoral students. This adaption of the model is in line with research objective 5.

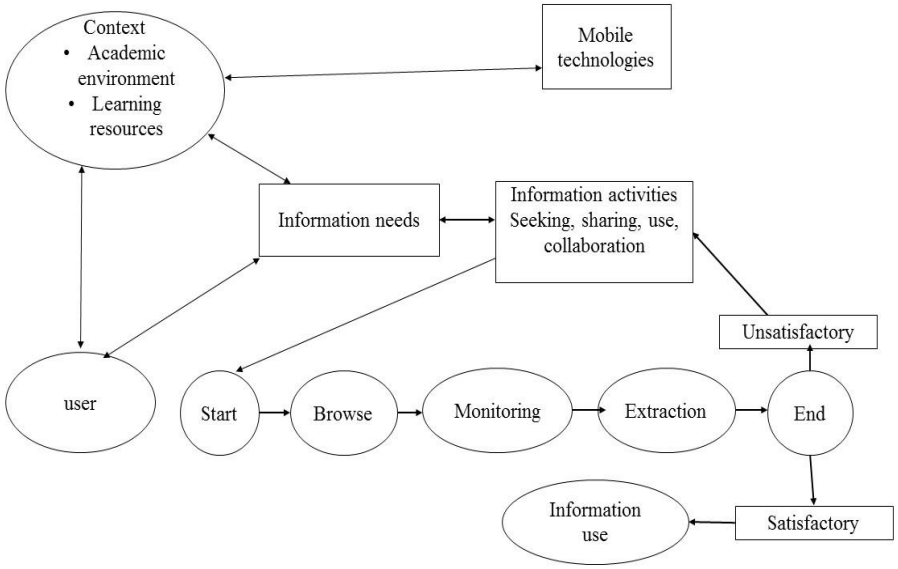

Figure 7.1: Information Seeking Behaviour Model in the Mobile Technology environment

Figure 7.1 presents a proposed model for adoption by universities to support researchers in better understanding the information needs and information-seeking behaviour of doctoral students who use mobile devices for learning. Figure 7.1 shows that information seeking has a bidirectional relationship with information needs. This is depicted by the double-pointed arrow. This means that as much as an information need leads to information seeking, the information-seeking process could similarly prompt an information need. Also, the interaction between the context and the user gives rise to information needs. These contexts are the academic environment and learning resources.

From the literature and empirical evidence, as discussed in Chapter 6 and Chapter 7, the academic context refers to students' subject areas of study such as economics, geography and accounting, and academic situations in which students must write assignments and prepare for examinations or presentations. Aside from academic situations, the participants reported everyday life situations, such as health-related and religious-related situations that gave rise to information needs.

Learning resources, as deduced from the empirical findings, include online journals, online dissertations and theses, e-books and other e-resources. Information needs give rise to information activities such as information seeking. The information-seeking activity includes some features. As seen in the literature review, these steps mostly depend on the user. The

empirical discussions revealed that the features include starting, browsing, monitoring, extracting and selecting or ending. The model further illustrates that the user, while seeking for information, evaluates the selected material by reviewing and refining the search. These are some of the features derived from Ellis's (1989) model. When extraction of the information is done, it brings the information search to an end and the user can move on to the next information activity, namely information use. However, if the information need is not satisfied, the user needs to repeat the information-seeking process.

This means that they first begin (starting an information search) by typing in the keywords into a search engine or mobile app and by also identifying the relevant information system (database) to be used. After this, the search process continues (browsing). Through browsing, different online materials are searched. Thereafter, the information is downloaded (extracted) onto their mobile devices (i.e., their smartphones or tablets). The retrieved information that was downloaded is verified to establish which sources would best meet their information needs (end). The selected material is then used to fill their knowledge gap.

From Figure 7.1 it could be observed that mobile technologies play a role in the participating doctoral students' information-seeking activities. Technologies make it easier for workgroups to collaborate. In this context, students work in groups and they not only support one another socially, but also collaborate in using technologies. The successful use of technologies (mobile applications, e-learning platforms and social networking sites such as WhatsApp) for learning is dependent on contextual factors that could be device-related, user-related or network-related. On the other hand, certain context-related factors affect the use of mobile technologies for learning. These factors include device-related factors (e.g., screen size and battery life) and issues related to network connectivity.

7.7 CHAPTER SUMMARY

The focus of this chapter was to discuss the empirical data thematically. Throughout the sections in the literature review, different models or frameworks have been developed on the information needs and information-seeking behaviour of doctoral students. These frameworks served as a guide from which a proposed model for information needs and information-seeking behaviour of doctoral students using smartphones and tablets was developed. The model is depicted in Figure 7.1.

The findings confirmed that, from the perspective of doctoral students using smartphones and tablets, certain situations within the academic context and their everyday life situations prompt information needs. The findings further revealed that students' information needs dictate the sources and channels from which such information could be retrieved. However, individual preferences play a critical role in the choice of sources, depending on a particular need.

The findings further revealed that the use of smartphones and tablets provided the participating students with the opportunity to work together, which implies collaboration. However, the use of mobile devices for learning is restricted by certain contexts and device-related factors such as the cost of internet connectivity.

Chapter 8 addresses the conclusions, limitations and recommendations of this study.

CHAPTER 8

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

The purpose of this chapter is to discuss the conclusions in terms of the research questions that were formulated in Chapter 1. The first part of this chapter deals with conclusions drawn from the study. The second part discusses the limitations of the study. Thereafter, suggestions for further research are made and the value of the study is discussed. The final summary and comments conclude the chapter.

8.2 CONCLUSIONS TO THE RESEARCH QUESTIONS

In Chapter 1 it was indicated that the book collections in the University of Cape Coast (UCC) Library are inadequate and many of the information sources are no longer current. The researcher observed that doctoral students often searched for information on their mobile devices. The question that arose in Chapter 1 was whether doctoral students use their mobile devices to access library resources and whether they can retrieve information that is relevant to their learning needs. Therefore, the problem requiring investigation in this study was to empirically investigate the information needs and information-seeking behaviour of doctoral students using smartphones or tablets for learning. To address this problem, the following research question was asked: What role does smartphones or tablets play in the information-seeking behaviour of the doctoral students who are registered at the UCC?

To answer the research question, the following sub-questions were identified:

1. What are the information needs of doctoral students using smartphones or tablets for learning at the UCC?
2. How do the doctoral students who are registered at the UCC search for information?
3. What role does smartphones or tablets play in the information-seeking behaviour of doctoral students who are registered at the UCC?
4. How can the information needs of doctoral students registered at the UCC be met effectively?
5. What model can support an investigation of the information seeking process of doctoral students in the mobile technology environment?

To answer these research questions, a theoretical and empirical analysis was conducted. Theoretically, various existing studies in the literature were examined. The literature review gave much information on information needs and information-seeking behaviour of information users. In this study, information users were the participating doctoral students who had earned a bachelor's degree and were studying at the UCC for a higher qualification, such as a doctoral degree.

8.2.1 Research Question 1: What are the information needs of doctoral students using smartphones or tablets for learning at the UCC?

Research question one was aligned to research objective one which was to acquire an understanding of those factors affecting the information needs of the doctoral students who are registered at the UCC. The literature review revealed that context and contextual elements, as well as certain user-related characteristics, give rise to information needs. In sections 7.3.1 and 7.3.2 it was observed that the information needs of the participating doctoral students resulted from the interaction between these information users and their contexts. This is because the participants' information needs were not static as their needs were determined by the context in which their needs arose, as well as their knowledge and skills.

8.2.1.1 Context

Some of the contextual elements that give rise to information needs include a situation in action, tasks and information resources. Concerning the contextual elements, the findings revealed that the students' assignments, information for debates in classrooms, and information for presentations prompted their information needs. The findings revealed that the specific tasks that the participating students needed to complete included preparing for class and preparing for conferences and seminar presentations.

The findings revealed that the participants also needed everyday life information. To these participants, it was equally important to satisfy both their everyday life information needs and their academic-related information needs. Examples of everyday life information needs that were shared by the participants included the need for religious-related and health-related information. The need for health-related information was prompted by a need for information to fulfil parental responsibilities and the need for information on religion was to satisfy the

participant's curiosity. These were found to be some of the actual information needs of doctoral students.

Additionally, the availability of information sources and resources affected the participating students' information needs. The findings revealed that the library was unable to provide the participants with all the current printed material they needed. This means that the participants had to use the e-resources at the library. In view of this, the participating students resorted to alternative means of accessing the information they needed through the use of smartphones and tablets. To effectively use mobile devices to access information, students needed Wi-Fi and mobile data.

8.2.1.2 Information users

As shown in section 8.2.1.1, the participating doctoral students needed information to deal with their academic-related situations and for tasks requiring completion. They also had to participate in class debates and be able to present sound arguments when they debate. Additionally, their need for information to deal with the situation and complete their tasks acted as motivator to engage in information-seeking activities such as searching, retrieving and using the retrieved information to present a sound argument. In this instance, class debates (situations in action), coupled with limited knowledge (a cognitive information need), suggest a path (motivation) towards the achievement of a goal, which is searching for information that could fill the knowledge gap.

The literature review in Chapter 2 further showed that the interplay between users' cognitive and affective structures prompts information needs. The information needs of the participating students, which arise from academic contexts and everyday life situations, bring forth a knowledge gap that requires to be filled. Due to the knowledge gaps that the participants identified, they also experienced feelings of uncertainty. Filling in the knowledge gap also supported the students in dealing with their feelings of uncertainty. Some of the everyday life contextual elements that were found to give rise to their information needs were issues of health and personal hygiene.

To use certain resources, such as the library catalogue and full-text databases, users require certain knowledge and skills to fully utilise these information resources. However, from the

findings it was revealed that most of the participating students lacked the required skills to efficiently utilise the various information resources, irrespective of whether they used their smartphones and tablets or computers to search for the information. The participating doctoral students' lack of technical knowledge and their limited skills reflected a need for training.

Despite the fact that some of the participants were not knowledgeable or skilled to use online information resources, there were participants who did have the required skills to use the library's online resources. The findings revealed that those participating students who had the technical skills to use the information resources had different preferences for the types of sources to use to complete their academic tasks, compared to those participants who did not have the required knowledge and skills. Their preferences for certain sources were based on their previous experiences of using the sources they preferred. Some of their reported preferences included a need for online journals, e-books and published theses and dissertations.

8.2.1.3 Reflection on information needs

As far as the information needs of doctoral students are concerned, the findings revealed that tasks like completing an assignment, preparing for debates, studying for examinations and preparing for presentations were contextual elements that prompted the participating students' information needs. The findings further showed that everyday life situations like personal hygiene and religious curiosity, as well as health-related issues, prompted the information needs of these doctoral students. Moreover, the interaction between the participants' social contexts and their mental structures affected their information behaviour.

8.2.2 Research Question 2: How do the doctoral students who are registered at the UCC search for information?

Research question two was aligned to research objective two which was to acquire an understanding of those factors that affect the information-seeking and searching behaviour of doctoral students who are registered at the UCC. The discussions on information seeking revealed that an awareness of the available information sources and resources that the participating students needed to use and their information-searching skills were some of the factors that affected the participants' information-seeking activities. From the literature

review and the empirical observations, it was evident that the information-seeking activities and behaviour of doctoral students were prompted by the context in which the information needs arose. Elements in the context of the participating doctoral students that played a role in their information-seeking activities included elements in their academic context, such as the academic library and their various tasks, as well as elements in their everyday life contexts.

8.2.2.1 Academic library

From the literature review, it was clear that the information-seeking processes or activities of doctoral students, which fell within the academic context, were largely confined to the academic library. The findings revealed that most of the participants were oblivious about the information that was available in the library, which could support them to fill their knowledge gaps. The findings revealed that the fact that the participants were unaware of the existence of information sources and resources in the university library became a barrier in their information-seeking process. This accounted for the failure of some of the participants who did not have the technical skills to easily access the required information. Alternatively, the findings revealed that the participating doctoral students resorted to using their tablets and smartphones to search for information. This points to the use of an alternative device to get access to the academic library's information sources.

Additionally, the empirical data revealed that the university library provided students with different types of information sources. However, only a few of the participating students indicated that they used the university library to search for information. This finding notwithstanding, the few participants who reported having used the university library indicated that they had access to the e-resources provided by the library. Besides the academic context, tasks as a contextual element prompted the information-seeking behaviour of the participating doctoral students.

8.2.2.2 Tasks

Academic tasks, such as assignments requiring completion, as well as preparation for examinations and class presentations, made it necessary for the participants to search for information. Depending on their preferences, the participants sought information in the available library resources such as online journals, e-books, online theses, dissertations and

other e-resources to satisfy their information needs. The ease with which the participating doctoral students were able to get access to these sources determined their use of such sources. To be able to complete an academic task, the participants needed a stable Wi-Fi infrastructure or network signal to connect to the Internet.

8.2.2.3 Participants as information users

From the literature review, it was evident that user-related characteristics like the user's cognitive and affective mental structures affect information-seeking behaviour of information users, including the participating doctoral students. From the empirical findings, it was revealed that the information-seeking behaviour of the participants was affected by their preferences, experiences, skills and motivation. Since the participants' knowledge and skills varied, they did not seek information from the same information sources, despite the similarity of the tasks they needed to complete.

8.2.2.4 Information-seeking challenges

The findings revealed that in their information-seeking activities, the participants were faced with certain challenges. Some of the identified challenges included the non-availability of current material for students, students' inability to access some restricted online journals, inconsistent book shelving in the library, and how long it took the participants to get access to a book requested in the library. Additionally, it was revealed that some of the participating students lacked the necessary technical skills to source information from these online journals, e-books and other e-resources.

8.2.2.5 Reflection on information seeking

It was confirmed that contextual elements like academic context and tasks affected the information-seeking behaviour of the participants. Additionally, user characteristics and other challenges experienced by the participating students also affected their information-seeking behaviour.

8.2.3 What role does smartphones or tablets play in the information-seeking behaviour of doctoral students who are registered at the UCC?

Research question three was aligned to research objective three which was to understand the experiences of doctoral students at UCC in the use mobile technologies in their information

seeking process. The literature review indicated that mobile technologies play a significant role in the information-seeking activities of information users. It was realised that mobile applications aid mobile learning. The empirical findings revealed that smartphones and tablets have mobile applications that help students in their information-seeking activities. For this purpose, the participants needed to connect to the Internet. The participants pertinently referred to using WhatsApp as an instant messaging platform and mentioned the ability to download and save information while using their mobile devices.

8.2.3.1 WhatsApp

The participating doctoral students used their mobile devices to share information and explain things to one another. For this purpose and for the purpose of collaboration, they used WhatsApp. Using WhatsApp made it possible for them to work in groups. Therefore, they were able to collaboratively solve information-related problems that were too demanding for individuals to accomplish. Also, the participants could share information that was relevant to their areas of study and even edit their colleagues' assignments on WhatsApp. The use of WhatsApp made it easy for participating students to explain certain concepts to their colleagues who experienced a knowledge gap.

8.2.3.2 Downloading and saving information

In discussing tasks as a contextual element in an information-seeking model, it became evident that most of the participants downloaded the information they needed from sources on the Internet, including online journals, electronic books, online dissertations and theses and other e-resources. These downloads were done with the help of smartphones and tablets. After downloading the information that they needed, some of the participants saved the downloaded information on their Google Drives (to which they have access on their mobile devices, i.e., smartphones and tablets) for future use.

8.2.3.3 Challenges

The study revealed that the participating students encountered various challenges when they used smartphones and tablets to seek information. The challenges they encountered affected their information-seeking activities. Some of the challenges the participating students encountered were:

- Device-related challenges, which included screen size and the lifespan of smartphone and tablet batteries.
- Network-related challenges, which included poor internet connectivity.
- Cost-related challenges. These challenges pertained to the costs involved when having to buy data, which would enable the participants to connect to the Internet when they were away from the university campus. When they were on campus, Internet access did not pose a problem as they were able to use the institutional Wi-Fi to connect to the Internet.

The findings thus revealed that most of the challenges the participating doctoral students identified were either device-related, cost-related or network-related challenges.

8.2.3.4 Reflection on mobile technologies

As far as mobile technologies are concerned, the findings drew attention to two key issues. Firstly, it was found that, with the help of mobile technologies, students were able to share information and collaborate when given tasks that required collaboration. Secondly, it was identified that the physical infrastructure that supports the use of these mobile technologies was either inadequate or poor in terms of service delivery.

8.2.4 How can the information needs of doctoral students registered at the UCC be met effectively?

Research question four was aligned to research objective four which was to solicit suggestion from doctoral students on the improvement of library services at UCC for mobile technology users. As shown in section 6.6, the participants made certain suggestions on how the UCC library's services could be improved to ensure that their information needs are met. These suggestions ensued from their experiences of seeking information that was needed for their doctoral studies. The participating doctoral students indicated that, due to their lack of technical skills to source online information, the introduction of information literacy training would be of immense help in their information-seeking activities.

The participants further advocated for the provision of a modern and reliable internet infrastructure on campus to curb the cost of having to deal with poor internet connectivity.

Moreover, the reported findings indicated that the limited availability of printed sources at the library and the time duration for getting the required information were observed as problems. The long waiting period to get access to the required printed sources made it difficult for them to complete their academic tasks within the set time limits. It was with this problem in mind that the participants suggested that the library be digitised.

8.2.5 What model can support an investigation of the information seeking process of doctoral students in the mobile technology environment?

Research question five was aligned to research objective five which was to develop a framework or model for research on the information-seeking behaviour of doctoral students in the mobile technology environment. The researcher developed a research model and that model was presented in Figure 7.1. This model showed how mobile technologies play a role in the participating doctoral students' information-seeking activities. In this context, doctoral students work in groups and they not only support one another socially, but also collaborate in using technologies. The successful use of technologies (mobile applications, e-learning platforms and social networking sites such as WhatsApp) for learning is dependent on contextual factors that could be device-related, user-related or network-related.

The model further illustrates that the user, while seeking for information, evaluates the selected material by reviewing and refining the search. These are some of the features derived from Ellis's (1989) model. When extraction of the information is done, it brings the information search to an end and the user can move on to the next information activity, namely information use. However, if the information need is not satisfied, the user needs to repeat the information-seeking process.

8.2.6 Concluding answer to the research questions

With the purpose and objectives of the study in mind, the following research question was asked:

> What role do smartphones or tablets play in the information-seeking behaviour of doctoral students who are registered at the UCC?

To answer this question, five different sub-questions were formulated to address the various elements embedded in the research question. These five sub-questions were further subdivided to comprehensively answer the research question.

In the discussions of the three literature review chapters and the empirical study, it became evident that it is important to consider the context in which an information need arises to understand how the context in which the participating doctoral students find themselves influences their information needs and information-seeking behaviour. The findings revealed that there are especially two contexts that affect students' information needs and information-seeking behaviour. These are their academic and everyday life contexts.

It also became evident that the user's cognitive and affective mental structures must be considered when studying the information behaviour of users, including the information behaviour of doctoral students. The study further confirmed findings in the literature that the interaction between elements in the context and the personal dimension give rise to information needs which, in turn, could prompt specific information-seeking activities. The participating students' knowledge and experience, as well as their personal preferences, determined whether a need arising in a specific context was perceived as an information need. Furthermore, the identified information needs also determined the information activities the participants embarked on, as well as the information sources that were selected to support their information needs. Generally, the participating students opted to use their smartphones or tablets to search for information that was available, either by conducting a search on a search engine such as Google, or to search the library's resources.

Additionally, it becomes evident that students used WhatsApp to collaborate with their peers. Students were also able to share assignment-related information via WhatsApp. The participating students also utilised their smartphones and tablets to download and save information for future use.

However, it becomes evident that factors like a lack of information-searching skills and individual preferences affected the participating students' information-seeking behaviour. As such, mobile technologies played an important role in the participants' information needs and information-seeking behaviour. Through their use of mobile technologies, the participating students engaged in collaborative learning where information sharing and knowledge transfer becomes possible.

8.3 LIMITATIONS OF THIS STUDY

The university community has a wide range of information users. This includes professors, senior lecturers, lecturers, doctoral students, research consultants, undergraduate students and many other people from within and outside the university community. There is also a large pool of university staff who performs administrative roles. Unfortunately, due to the nature of the study and the research objectives, the study focused only on doctoral students who use mobile devices for information seeking. It can be concluded that there were some limitations in the literature review as well as in the empirical study.

8.3.1 Limitations in the literature review

The literature review did not consider information sharing and collaboration. These two information activities manifested in the literature review and because the literature review did not address collaboration and information sharing, this could have affected the interpretation of the empirical data in a negative way. Moreover, the literature review was restricted to doctoral students as information users and not to all users of an academic library. The inclusion of other academic library user groups could have brought different insights.

8.3.2 Limitations in the empirical study

Although the study sought to investigate the information needs and information-seeking behaviour of doctoral students who use smartphones and tablets for learning, the participants did not provide much information on their use of specific mobile applications. Specific mobile applications like library apps and other information science applications were not extensively examined. Additionally, the empirical research did not cover a comprehensive report on how the participating doctoral students use printed material in the university library as sources of information that would satisfy their information needs.

8.4 RECOMMENDATIONS

The participating doctoral students revealed that the library provides access to a limited number of current printed sources and that these are not enough to support all the students' information needs. The participants suggested the digitisation of all library resources. It is therefore recommended that the university management acquire a library management system (a software application) that would effectively provide access to all of the library's resources and effectively manage the library's collections. It is also recommended that the library

develop a mobile app that is linked to the library management system. Such an application would allow the students to optimally use their smartphones and tablets to search the library's resources from their mobile devices.

The empirical study showed that some of the participating students lacked the required information literacy skills to make optimal use of the library's resources. Therefore, it would be prudent for the university to include information literacy skills training in the curricula for all subject areas and at all levels of study in the university. This requirement should also include doctoral students who have not previously completed an information literacy course.

Based on suggestions made by some of the participating students, which were reported in section 6.6, it is suggested that the university improve its Wi-Fi infrastructure to provide students with more free Wi-Fi access points on campus. In addition to this suggestion, the participating students also requested that more power outlets be installed, which would allow them to recharge their mobile devices.

Moreover, the UCC Library should carry out a need's assessment for the annual e-learning seminar, which is cooperatively organised by the School of Graduate Studies and the UCC Library. This will help determine the existing gaps in the provision of information sources for the current e-learning programme. It would support the university management in establishing the possible steps to be taken and provide the required feedback, which could be used to improve the annual e-learning seminar.

8.5 FUTURE RESEARCH

Based on the findings of the study, future research could delve into investigating the information needs and information-seeking behaviour of faculty members and administrative staff (non-academic staff) of the UCC.

Also, some of the participants indicated that the introduction of an information literacy skills course was needed to build their capacity to search for information. To establish such a course, information is required on what should be included in an information literacy course. Therefore, it is suggested that a future study should collect data from other faculty members and doctoral students to establish their actual needs for an introductory information literacy

skills course. The knowledge gap reported by the participants when searching for sources to provide in their information needs reflects on a lack of information literacy skills.

Furthermore, future studies could concentrate on the development of mobile learning applications to support e-learning and enhance collaborative learning.
The current study did not address collaboration or collaborative learning. Despite this limitation, the findings revealed that doctoral students use applications such as WhatsApp for collaborative learning purposes. Therefore, it is suggested that future studies could delve more into collaborative learning and how the use of mobile technologies could support mobile learning in this regard. Such a study should then include a focus on the use of other applications that support collaborative learning, which were not reported in this study.

Finally, the findings revealed that the participants fell prey to multitasking while using their mobile devices for learning. This practice has the potential to distract users' attention from the actual task at hand. Future research should focus on how practices such as multitasking challenge users when using mobile devices for learning.

It was revealed that specific key components in the conceptual framework have an effect on doctoral students' information needs and information-seeking behaviour. Therefore, future studies must compare these components with the information behaviour of other students and the academic staff of the UCC.

8.6 VALUE OF THE STUDY

Ellis's (1989) model of information-seeking behaviour was used as the conceptual framework for this study. This model was developed in an era before mobile technology and social media. The study showed that the existing model could not be used to study users' information-seeking behaviour in the era of mobile technology and social media, or to understand how users seek information in their bid to satisfy their information needs. The researcher used the elements in the Ellis (1989) model to develop a new information needs and information-seeking behaviour model which accommodates the use of mobile technologies in doctoral students' information needs and information-seeking behaviour. The newly proposed model explains and describes how doctoral students seek information for academic development or lifelong learning. As such, the proposed model could be used to

support researchers in acquiring a better understanding of the information needs and information-seeking behaviour when using mobile devices for learning.

Besides the theoretical value of the study, as explained in the preceding paragraph, the study also has practical value. Based on the findings and suggestions made by the participating students, various practical suggestions could be made on how to improve the UCC Library's services. These include providing more free Wi-Fi access points on campus, the provision of power outlets where students can recharge their mobile devices and offering information literacy training classes.

8.7 SUMMARY AND BRIEF COMMENTS

Chapter 8 concluded the qualitative study which investigated the information needs and information-seeking behaviour of doctoral students using smartphones or tablets for learning. The study population involved doctoral students from the University of Cape Coast (UCC) in Ghana. In this chapter, five research questions were answered and it was also shown how each research question were aligned to the research objectives. The literature review focused on the information needs and information-seeking behaviour of students and endeavoured to show how certain elements in the participating doctoral students' contexts, their mental structures and the information technologies available to them influence their information needs and information-seeking behaviour.

The findings revealed that the participants used mobile technologies when they sought information that would satisfy their information needs. For this purpose, they used information sources (and resources) such as online journals, online dissertations and theses, digital archives, e-books and other e-resources. Furthermore, the study ascertained that the participating students needed to collaborate with fellow students and showed how they used WhatsApp (a social media communication platform) to discuss and share information. Despite the use of mobile technologies, the participants' use of mobile devices for learning was restricted by certain contextual and device-related factors such as the cost of connecting to the Internet and the screen size of the mobile device. A lack of information literacy skills also proved to restrict the use of mobile devices for information seeking and learning.

The findings further pointed out that the information user, while seeking for information, evaluate the retrieved information, select the most appropriate sources and then extract the

information needed from the sources to complete their academic tasks. These are some of the features derived from the Ellis (1989) model. The model proved to be useful for this study but required some adaptation to accommodate those factors that influenced the participating students' information-seeking behaviour.

The limitations of the study, recommendations, suggestions for future research and the value of the study concluded the discussion.

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APPENDIX I

UNISA university of south africa

DEPARTMENT OF INFORMATION SCIENCE RESEARCH ETHICS REVIEW COMMITTEE

Date: 25 October 2017

Ref #: 2017_KABarfi_61291005_001
Name of applicant: KA Barfi
Student #:X
Staff #:

Dear KA Barfi,

Decision: Ethics Approval

Name: Title and name of principle applicant, address, e-mail address, and phone number

KA Barfi, Unisa Information Science, 61291005@mylife.unisa.ac.za; and +23 326 2282 138

Proposal: Information needs and seeking behaviour of postgraduate student using smartphones and tablets for learning: a case study of the University of Cape Coast, Ghana.

Qualification: PhD in Information Science

Thank you for the application for research ethics clearance by the Department of Information Science Research Ethics Review Committee for the above mentioned research. Final approval is granted for 4 *year*.

For full approval: *The application was reviewed in compliance with the Unisa Policy on Research Ethics by the Department of Information Science Research Ethics Review Committee on 25 October 2017.*

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Department of information Science Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*

Open Rubric

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UNIVERSITY OF CAPE COAST

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C/O Directorate of Research, Innovation and Consultancy

OUR REF: UCC/IRB/A/2016/541
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

14TH OCTOBER, 2019

Kwaku Anhwere Barfi
Department of Information Science
University of South Africa
Pretoria-South Africa

Dear Barfi,

ETHICAL CLEARANCE – ID (UCCIRB/EXT/2019/20)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted **Provisional Approval** for the implementation of your research protocol titled **Information Needs and Seeking Behaviour of Postgraduates students using smartphones and tablets for learning: A case of the University of Cape Coast, Ghana**. This approval is valid from 14th October, 2019 to 13th October, 2020. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST

APPENDIX II

CONSENT FORM FOR PARTICIPANT'S PERMISSION

Title of the research project: Information needs and seeking behaviour of doctoral students using smartphones and tablets for learning: a case of the University of Cape Coast, Ghana.

I ……

Hereby voluntarily grant my permission for participation in the project as explained to me by Mr. Kwaku Anhwere Barfi (Department of Information Science, University of South Africa). Participation will include an in-depth individual interview. I agree with interviews being recorded.

1. The nature, objective, and implications of the project have been explained to me and I understand them.
2. I understand my right to choose whether to participate in the project and that the information given will be handled confidentially. I am aware that the outcome of the study may be used for publication or conference presentations.
3. I understand that I am free to withdraw from the study at any time.
4. Upon signing this form, I will be provided with a copy.

Signed: …… Date: …….

Researcher: ……. Date: …….

APPENDIX III

INFORMATION NEEDS AND SEEKING BEHAVIOUR OF DOCTORAL STUDENTS USING SMARTPHONES AND TABLETS FOR LEARNING: A CASE OF THE UNIVERSITY OF CAPE COAST, GHANA.

INTERVIEW SCHEDULE QUESTIONS FOR DOCTORAL STUDENTS

Introduction

I am a Ph.D. student in Information Science at the Department of Information Science, University of South Africa (Unisa).

This interview will be conducted with some selected doctoral students at the University of Cape Coast to solicit information for the abovementioned study. I would be very grateful if you could make time to answer the questions below, providing as much detail as required.

The answers given will be used for academic purposes only.

Please be assured that the information provided will be treated with absolute confidentiality.

Many thanks for your cooperation and support.

Kwaku Anhwere Barfi

(Ph.D. Candidate)

BACKGROUND INFORMATION

INSTRUCTIONS FOR INTERVIEW

(i) Please read all the questions carefully and prepare the appropriate answers before the interview date.

(ii) The interview will be recorded and transcribed.

(iii) Please feel free to call me on 0262282138 in case you need clarification on any of the interview questions.

1. Gender: Male [ ] Female [ ]
2. 21-30 [ ] 31-40 [ ] 41-50 [ ] 51 and above [ ]
3. Programme of study: …….
4. Department: ……
5. What type of mobile device do you use for learning?

What are the information needs of doctoral students using smartphones or tablets for learning at the University of Cape Coast?

1. What are the specific areas of your information needs as a graduate student?
2. Can you identify the various situations that call for information to deal with the situation?
3. Can you tell me when you need information?
4. How often do you require information for academic and non-academic activities?
5. How does the kind of information you need influence the sources and channels you choose to use?
6. Could you tell me about what you usually do in your day-to-day academic work? What are the steps that you need to follow to finish your academic work?

How do doctoral students who are registered at the University of Cape Coast search for information?

1. What information sources are available to you?
2. Why do you prefer such sources?
3. Do you collaborate with your peers in your quest to search for information?
4. How often do you use the Sam Jonah Library website to search for information with

your mobile device to fulfil your information needs?

5. What are some of the challenges you face in search of useful information?
6. Do your academic colleagues and lecturers influence how you search for information?
7. How do your personal preferences for certain channels affect your information seeking during your studies?
8. Do you often use the same channels or sources, irrespective of the kind of information you need?
9. How does your department/faculty/institution influence the way in which you search for information?

What role do smartphones or tablets play in the information-seeking behaviour of doctoral students registered at the University of Cape Coast?

1. How conversant are you with regard to the use of smartphones or tablets for getting the needed information?
2. Does the internet speed on campus enhance your use of smartphones or tablets in searching for information?
3. In your opinion, does the use of smartphones or tablets increase the speed of getting information? Explain your answer.
4. How does the use of smartphones or tablets decrease the complexity of tasks of your workload?
5. Can you explain the cost involved in using smartphones or tablets for information searches?
6. What are the challenges you encounter when using smartphones or tablets in your information-searching process?
7. Do you seek assistance in solving challenges or do you resort to other sources for your information?
8. Do mobile technology platforms play any significant role in your information search processes?

How can the information needs of doctoral students be met effectively?

1. In your opinion, what can the institution do to help students meet their information needs more easily?
2. How can students enhance their information searches?

3. Should professionals be involved in helping students meet their information needs? Please explain your answer
4. In your opinion, should the library be universally digitised?

THANK YOU VERY MUCH FOR YOUR PRECIOUS TIME