

**AN INVESTIGATION INTO HOW MOBILE TECHNOLOGIES CAN ADVANCE SERVICE
DELIVERY FOR LIBRARY USERS AT THE UNIVERSITY OF PRETORIA LIBRARY SERVICES.**

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Abstract

Mobile technologies are seen as an emerging technology that affects individuals and organizations. These technologies are becoming more affordable and accessible over time with advanced designs and computing capabilities. These technologies affect how people use and access the internet, how people create and access content or services, and how people choose to communicate. In addition these technologies have infiltrated the educational sector, and effected how educational institutions such as a university deliver services to academics, students and staff.

As these technologies are effecting educational institutions academic libraries that support such educational institutions have had to embrace these technologies by adapting and adding additional services to accommodate users. Examples of such new and emerging services can be seen through the establishment of mobile library websites, mobile library applications available for users from various types of mobile devices such as cell phones, mobile tablets, and e-readers. Libraries are adapting traditional services such as catalogues, resources and other services to be accessible and usable from such devices.

This study is focused on a South African academic library, taking a closer look at mobile library service delivery, to investigate whether library services delivered from mobile devices can enhance service delivery. The study is focused on an established mobile library website, and looks at the post implementation of the mobile library website from the perspective of Natural and Agricultural Sciences students at the University of Pretoria, South Africa.

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CHAPTER 1: INTRODUCTION

1.1. Overview

Mobile technologies have been becoming more affordable and accessible over time as a result of engineering and design (Hahn, 2008: 274; Johnson *et al.*, 2010: 5). The computing capabilities of these devices make them the first option for internet access (Johnson *et al.*, 2010: 5; Lippincott 2010: 208). In America alone over 50% of mobile users use mobile devices to access the web on a daily basis (Smith, 2010). These types of technologies can be used to provide universal access to information and is a technology that can be used as an educational tool for learning and productivity (Johnson *et al.*, 2010: 5). Reports in literature, such as Johnson *et al.*, (2010); and the Association of College and Research Libraries (ACRL, 2011) provide insight into the effect mobile technologies have and will have on educational institutions.

Mobile technology is seen as an emerging technology that will enter and affect the education and learning industries (Johnson *et al.*, 2010: 4). For this reason educational institutions around the world are investing in mobile devices such as mobile phones, e-readers and tablets and developing infrastructure and applications for these devices to support their users (Johnson *et al.*, 2010: 13). In the education industry mobile technologies provide users with the opportunity to use, disseminate and generate information and they facilitate convenient and timely access to information on the move (Little, 2011: 267; Karim, *et al.*, 2006: 35). Lippincott (2010: 207) predicts that students will use mobile devices not only for access, but increasingly also for digital content creation.

Advancements in these technologies further influence the way in which libraries function and deliver their services to library users (ACRL, 2011). Services such as around-the-clock access to digital collections and resources, and librarian assistance via users' mobile devices are possible as a result of these technologies (ACRL, 2011). Consequently libraries will have to provide services according to users' needs in terms of their

technological advancement and enhance the way in which these services are delivered to the end-user.

Mobile technologies not only influence the way in which libraries provide services to library users, but also provide a change in the way in which services are provided by the library (Kataria & Anbu, 2011: 119). Mobile services and products such as mobile web sites, mobile online public access catalogues (OPACs), mobile journal databases, mobile reference works, mobile references services, short message services (SMS) and quick response (QR) codes to improve access to library products and services, have been implemented by many academic libraries (Dempsey, 2008; Kataria & Anbu; 2011; Lippincott, 2009). Furthermore, libraries such as the Ryerson University library in Canada has implemented in addition to the above-mentioned, other mobile services such as text messaging bibliographic information, computer availability and room bookings (Wilson & McCarthy, 2010).

To determine whether mobile technology can advance service delivery in libraries, libraries need to assess the effect that mobile technology has on the user to establish whether the library service needs to be enriched (Mbambo–Thata, 2010). Through this evaluation and monitoring, libraries are able to implement mobile services according to the needs and behaviour of the library user within the changing environment of mobile technologies (Lippincott, 2009: 9; Mbambo – Thata, 2010).

Because of the changing environment of technologies and international mobile trends in library services, the University of Pretoria Library Services conducted a survey during August 2010 (Appendix 1) to determine which types of mobile phones library users owned and which library services users required from their mobile devices. As a result of the online survey, a mobile library website was developed and launched in early March 2011, which provides access to mobile library resources and services via a mobile website.

The purpose of this study was to continue the research that had been conducted and to establish whether the mobile library service can advance service delivery for library users at the University of Pretoria.

The subsequent sections of this chapter discuss the problem statement and the research questions posed, and provide an overview of the research methodology and the limitations and value of the study.

1.2. Research statement and research questions

Mobile technologies in libraries should not be seen as a way of replacing a channel of delivery of services but as a delivery option that is an additional or new channel of service delivery or “doorway to content” (Choy, 2010; Herther, 2011: 11; Johnson *et al.*, 2010: 12). By integrating library services and products with mobile technologies, libraries are able not only to provide access to information via mobile devices, but also to support and add value to services for the library user in academic learning and research to get the most out of resources and services (Choy, 2010; Johnson *et al.* 2010: 210;).The objective of this research study was to investigate whether development and implementation of mobile library services can advance service delivery for library users at the University of Pretoria Library Services, thus the following research statement was formulated:

An investigation into how mobile technologies can advance service delivery for library users at the University of Pretoria Library Services.

To be able to determine how mobile technologies can advance service delivery, the following research questions needed to be answered:

- I. Which mobile library services and products have been implemented at the University of Pretoria Library Services?
- II. How do the mobile library services meet the needs of the library services users?
- III. Which mobile devices do library users own?
- IV. Which mobile library services and products are used, and which mobile library services are users not using?

- V. What library information/services do library users want to be available from mobile devices?

In order to answer the above research questions, the researcher uses the research methodology described in section 1.3.

1.3. Research methodology

The research study was a qualitative study and used an embedded research design approach. The research paradigms, research design, sampling method and data collection methods are discussed in the following sections.

In order to answer the research questions (chapter 1, section 1.2.) the researcher conducted a review of existing literature, which consisted of secondary sources, to gain understanding of the mobile technologies in the higher education sector and the use and effect of mobile technologies in academic libraries (chapter 2). The literature review was used to determine which mobile library resources and services had been implemented in libraries, both nationally and internationally. Through the literature review the researcher was able to identify mobile library trends, mobile library resources and services that had been implemented in libraries. Furthermore, a review was done of the mobile library services and products that had been implemented at the University of Pretoria Library Services, as well as university libraries in South Africa.

The primary design used for this study was an experimental design combined with and a case study to collect and analyse data. A quasi-experimental design was chosen for this research study, as the study was a continuation of work done previously at the University of Pretoria Library Services. An embedded research design was used in the study to provide a procedure or strategy to answer the research questions (chapter 1, section 1.2.). As a result of the continuation of work the pre-test–post-test quasi-experimental design was chosen and is discussed in chapter 3.

In view of the nature of the research study (mini-dissertation), time and cost associated with the study, the entire population was not studied; however, a case study was used.

The case study involved undergraduate and postgraduate students from the Faculty of Natural and Agricultural Sciences who are enrolled at the University of Pretoria.

The sampling technique used was convenience sampling, a non-probability sampling technique, as the members of the population were in close proximity to the researcher and conveniently available (Strydom & De Vos, 1998: 198; Thomas, 2003: 91-92). The following section discusses the limitations of the study.

1.4. Limitations of the study

The following limitations have been identified in connection with the research study:

- a. As a result of the constant change in mobile technologies and updates made to mobile library services and products, the relevance and importance of data collected may change as a result of the environment.
- b. The study will exclude research on the provision of library services to physically disabled users via mobile devices, as this aspect was outside the scope of the study.
- c. The study was limited to registered University of Pretoria students, both undergraduate and postgraduate, and excluded faculty members, lecturing staff and distance students of the university.
- d. The study was limited to resources and services that were available on the mobile library website and excluded all services that were still being planned or in process at the time of the study.
- e. The effect of mobile library services on the internal library operations were excluded from the study because of time and capacity constraints
- f. The nature of the research study (in terms of time) only allowed for a small-scale case study (pilot study)
- g. Owing to time constraints, students from only one of the nine faculties of the University of Pretoria were included in the study.

1.5. Justification for the research

As a result of international trends and advances in mobile technologies, libraries are adapting their service delivery channels in order to stay technologically up to date and current. By staying up to date with technological trends, libraries are able to provide users with services and products through communication platform channels preferred by their users. South African libraries have started to mobilise library services, among others through the development of mobile library websites and mobile library catalogues or OPACs, and to provide access to contact information and service hours, which is in line with users' technological demands and needs.

As South African use of mobile technology differs from international use, this research study will be a contribution to the study of information science and may contribute to the industry to provide insight into whether mobile service delivery in libraries in South Africa is advancing library service delivery and whether monitoring and evaluation of new technology, such as mobile technology, has an effect on library service delivery. This research may also provide information as a base for further study into mobile technologies in libraries, especially from a South African perspective.

1.6. Value of the study

While many studies have been conducted on the use of mobile technologies (Cummings, *e. al*, 2010; Kataria & Anbu, 2011; Kroski, 2008; Lippincott, 2009; Lippincott, 2010; Little, 2011; Ragon, 2009, Wilson & McCarthy, 2010), this study focuses on the use of these technologies in the educational sector and more specifically in academic libraries. In the changing environment of mobile technologies this study provides insight into the use of mobile technologies as a supplementary service delivery platform, which may be able to enhance service delivery for library users.

The data collected can be used for further study in the library science environment and may be relevant for South African libraries in further endeavours concerning implementation and design of mobile library services. The study will aid in understanding the library user's perception of mobile delivery of services and assist the library in the future implementation of new mobile library services, which may be relevant for other academic libraries in South Africa.

1.7. Clarification of terms

This section provides a list of core concepts used throughout the research report, with a definition of each concept to provide the reader with the background necessary for understanding this research.

Library service

Library services are the facilities that libraries provide in order to use resources and disseminate information (Prytherch, 2005: 440).

Mobile devices

Mobile devices are small units that can be carried around and are used to access wireless services; these devices include mobile phones, laptops, PDAs, tablets, MP3 players and e-readers (Parsons, 2010: 232; Webb 2010:80). Mobile devices are devices that come in different shapes and sizes, and may have some or all of the following characteristics: portability, allows networking, friendly means of internet access, wireless connectivity, cameras, voice recognition, touch screens, location awareness, requires one-handed operating, can be used as universal alerting devices and allows the integration of social networking (Barnhart & Pierce, 2011: 279; Canuel & Crichton, 2011: 108; Kosturski & Skornia, 2011; Lippincott, 2010: 206; Vollmer, 2010: 3; World Wide Web Consortium (W3C)). These devices are typically laptops, MP3 players, smartphones, tablets, netbooks, audio players, iPods, PDAs and e-readers (Barnhart & Pierce, 2011: 279; Canuel & Crichton, 2011: 108; Kosturski & Skornia, 2011; Lippincott, 2010: 206).

Mobile services

Mobile services, according to Fling (2009), include activities on mobile phones such as accessing of the internet and text messaging

Mobile technologies

Mobile technologies are defined by Willis (2008: 613) as new resources that are used to accomplish everyday activities on the move through the use of devices. Willis (2008)

further states that mobile often refers to devices and the technologies associated are often related to handheld portable devices.

Mobile web

The mobile web is the World Wide Web, which is accessible through a mobile device (Kroski, 2008)

Mobile website

A mobile website is a website that is designed for mobile devices and is simplified with drill-down architecture to navigate to a page a level deeper (Fling, 2009).

1.8. Division of chapters

This research report was divided into five chapters, of which a detailed overview is provided below:

Chapter 1: Introduction

Chapter 1 sets the scene for the research report with an introduction to the research problem, followed by the research statement and sub-questions. Furthermore, the justification and value of the study are discussed and the limitations of the study are mentioned. A brief overview of the research methodology is provided.

Chapter 2: Literature Review

Chapter 2 discusses a review of literature on mobile technologies in the higher education sector and their application in academic libraries. This chapter provides insight into the various mobile initiatives, mobile resources and services already implemented by libraries and addresses challenges and opportunities mobile technologies may encounter in academic libraries. An evaluation is provided of the various mobile library services initiatives in South Africa and the mobile library services implemented at the University of Pretoria Library Services are discussed.

Chapter 3: Research Methodology

Chapter 3 provides a detailed description on the research methodology and design used in the research study. The chapter focuses on the embedded research design used for data collection and analyses, the sampling methods, the data collection methods and the selection of the research location and it provides an introduction to the data analysis and interpretation.

Chapter 4: Data Analysis and Findings

Chapter 4 reports the research findings and analyses the data collected. A discussion on the interpretation of the data is provided.

Chapter 5: Recommendations and Conclusion

Chapter 5 provides a summary to the research study and recommendations and provides a conclusion to the research study.

1.9. Conclusion

Chapter 1 provided an overview, which serves as a background to the study. The research statement and research questions were discussed and an overview of the research methodology was provided. Furthermore, the value of the study was discussed and the limitations of the study were mentioned. The following chapter provides a discussion on the literature reviewed for the purposes of the study.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Mobile technologies are becoming increasingly important because of the new and improved capabilities mobile devices are offering, in terms of changing the way that people are communicating and advancements in data connection (Barile, 2011: 222; Barnhart & Pierce, 2011: 280). This chapter focuses on the literature review, which serves as a clarification and consolidation of ideas found in existing literature (Kumar, 2005). The chapter further focuses on what constitutes mobile technology, its importance in education and the effects on the academic library as a core source of information to the educational institution. The changes in libraries as a result of mobile technology are discussed with the emphasis on service delivery. This is followed by a discussion on international mobile initiatives and mobile services and resources implemented in libraries. This chapter will be concluded with a short discussion of the current view of mobile technology initiatives in South African academic libraries and a brief view of challenges libraries face with regard to mobile service delivery.

2.2. An overview of mobile penetration

Mobile penetration/distribution statistics show that at the end of December 2010 South Africa had over 50 million mobile cellular subscriptions, compared to over 10 billion internationally (ITU, 2011). According to the most recent statistics available from the International Telecommunications Union (ITU), the 2012 statistical highlight (released in June 2012) shows that global mobile cellular subscriptions increased and at the end of 2011 numbered over 6 billion. Developing countries contributed significantly to this increase in terms of the new mobile cellular subscriptions that were added during 2011, which accounted for 80% of new mobile cellular subscriptions (ITU, 2012). South Africa has seen an increase in mobile cellular telephone subscriptions from 2005 to 2010. According to the ITU (2012) access to mobile cellular telephone subscriptions in Sub-Saharan African increased from 12 per 100 people in 2005 to 44.9 per 100 people in 2010. In South Africa mobile cellular telephone subscriptions increased from 71.1 per 100 people in 2005 to 100.5 per 100 people in 2010 (ITU, 2012).

The reasons for the high mobile penetration rate can be linked to prices, infrastructure (or lack thereof), network connectivity and even the capabilities of mobile devices. Bornman (2012) states that Africa in many ways lacks the infrastructure that is necessary to use technology such as computers. Computers need electricity and in some instances networking capabilities, which are dependent on Information and Communication Technology (ICT) infrastructure that is not always available. In many African states there is a lack of such infrastructure, as well as of adequate bandwidth and fibre-optic cables (Bornman, 2012; Etzo & Collender, 2010). In comparison, mobile phones are more affordable, portable, multi-functional and easier to use compared to technologies such as computers (Etzo & Collender, 2010: 659).

Mobile technologies are cheaper and provide people with quick ways of communicating compared to the need for fixed line and broadband technologies (Etzo & Collender, 2010: 659). “Mobile technology is altering and extending the ways we communicate, conduct business, teach, learn, entertain ourselves, and make consumer decisions” (Vollmer, 2010: 1). Mobile technologies are already used in Africa for banking, health, business and education because of their flexibility, affordability, portability and less expensive nature compared to computers (Etzo & Collender, 2010: 659). Mobile technology provides people with new ways of accessing medical information, new ways of communicating and sharing information, and keeps people connected, as it is able to provide people with capabilities such as email, text messaging, internet capabilities of browsing and banking and access to social networking applications (Vollmer, 2010: 2). In the higher education sector institutions are already leveraging the benefits of mobile technologies, which are discussed in the section 2.3.

2.3. The use of mobile technologies in the educational sector

“The trend in mobile learning may see a change in new ways of learning, research and instruction”(Barnhart & Pierce, 2011:279). With the increase in the availability and use of mobile devices, the uptake of mobile applications in the higher education environment has also been affected and Johnson *et al.* (2012) predict that the time to the adoption of these mobile applications will be one year or less. Mobile technologies not only provide easier and faster ways of access to information, but are used in educational institutions to provide

users with tools and resources to learn wherever and whenever they want (Johnson *et al.*, 2012). In the Horizon Report Johnson *et al.* (2012) discuss how the advances in mobile operating systems have “given new life” to educational resources such as newspapers, journals and subscription-based publications.

Mobile devices, more specifically tablets, are now infiltrating the market and the educational industry, as they are becoming more ideal for learning in terms of their capabilities and wider screens compared to e.g. smartphones. They are supplementing smartphones and enhancing the learning experience (Johnson *et al.*, 2012). The use of mobile devices in education affects the way in which students seek information and allows them to work collaboratively, providing new ways for individuals to share (McEwen & Scheaffer, 2012:92). Mobile technologies in education are expected to change the way in which people retrieve information and communicate using a single device (Barnhart & Pierce, 2011: 280).

In the higher education sector libraries are the central places that supplies university users with information and are expected to face similar service transformation to that experienced in the education industry (Karim *et al.*, 2006: 36). By leveraging mobile technologies, libraries are able to provide “round the clock service” and new ways of enhancing digital literacy skills (Vollmer, 2012: 3), similar to the internet. The advances in mobile technologies are making it easier for libraries to render services to clients on the move and to provide users with a spectrum of library services and resources, making services more relevant to users (Kataria & Anbu, 2011: 115). The use of mobile technologies in academic libraries will be discussed in section 2.4.

2.4. Mobile technologies and academic libraries

As academic libraries are the central place for supplying academic information to their parent institutions and the academic community, they are also expected to face the effects of mobile technologies in service delivery (Hahn, 2008: 274; Karim, *et al.* 2006: 36). For libraries, mobile technology capabilities facilitate the integration of traditional library services and mobile technologies (Kroski, 2008: 40; Lippincott, 2010: 207). Section 2.4.1 describes the opportunities mobile technologies offer for use in the library sector.

2.4.1. Mobile technology opportunities for libraries

The advancement of mobile technologies not only influences the educational institution, but also the library that supports the educational institution to which it belongs (Lippincott, 2009: 2). For libraries, mobile technologies have the potential to enhance service delivery, provide convenience and provide access to e-books on e-readers and tablets, which in turn may raise the library profile and encourage use of library services (Lippincott, 2009: 4). These technologies and devices are proving to become a new communication channel for libraries that bridges the gap between the user and the “mobile-enabled patron” (Buczynski, 2008: 267). With the flexibility, growing features and capabilities of mobile devices, libraries are able to provide users with more advanced and growing services and potentially interact with underserved groups, assist in teaching and literacy skills and outreach, and provide “on-demand content”, “around the clock”, with access anywhere and anytime to library resources (Vollmer, 2010: 2-3).

Mobile technologies in libraries should be seen as more than library resources on a mobile device, but as an “unequivocal resource that can reshape scholarship, study, research, and librarianship” (Hahn, 2008: 283). These technologies enable librarians to create new services, explore, engage and reach out to library users (Hahn, 2008: 283). These technologies have various effects on library services that will be discussed in the following section.

2.4.2. Effect of mobile technologies on library services

As discussed in the introduction to this chapter, mobile technologies have the potential to assist librarians in service delivery because of their capabilities and functionalities. These technologies provide users with a supplementary means of access to library resources, enabling them to access the required information on the go. Library users are able to access library information from whichever location they are in; e.g. by introducing mobile OPAC's, libraries are able to reduce queues for the use of desktop computers that elevate the frustration of users (Buczynski, 2008: 266).

2.4.2.1. Effect on Infrastructure

The use of and need for library space are affected by increased use of mobile devices in libraries, as users need spaces to recharge and synchronise their devices and share content and media (Dempsey, 2009; Goodwin *et al.*, 2012: 15; Lippincott, 2010: 208-209). Libraries are now providing spaces that offer these facilities and other devices, such as large monitors and keyboards, to support mobile device users (Lippincott, 2010: 208-209). Alternatives, such as the provision of lockers with electrical outlets so that users' devices can be recharged while secured and the ratio of desktop computers to open tables are becoming issues to be considered (Lippincott, 2010: 208-209).

2.4.2.2. Effect on library operations

The implementation of mobile library services does affect library operations, decision-making and methods of delivery. Dempsey (2009) explains that these technologies have shifted the way in which libraries' workflows are processed in terms of workflow integration around the user. New relationship-building is becoming more apparent between the library and other departments and faculties on university campuses in order to integrate different services on mobile devices (Dempsey, 2009). Libraries are starting to collaborate with on-campus mobile initiatives to deliver course-specific content to academic programmes on mobile devices (Lippincott, 2009: 5). These initiatives are taking forms such as providing library services via campus portals and ensuring content and services are embedded in learning management systems, such as Blackboard mobile (Lippincott, 2009: 7). Lippincott (2009: 7-8) also explains that at some universities students are required to purchase a mobile device for a course and libraries should ensure that they have the capacity to offer their services and resources in such cases.

2.4.2.3. Effect on service

In addition, librarians are able to use their existing skill of collection development and apply their skills to mobile technologies to provide new services, e.g. identifying and searching for mobile applications, which will be relevant for their user groups, and recommending them to their users (Havelka & Verbovetskaya, 2012: 22). At MIT a librarian (Nicole

Hennig) is currently recommending apps for mobile devices to her users and placing them in a list that is accessible to users (Figure 2.1).



Figure 2.1: Screenshot of MIT Libraries: apps4academics available from: <http://bestof.libguides.com/mobile>

To be able to deliver mobile library services, librarian skills are affected in terms of use of different mobile devices that are available; devices' capabilities and librarians' knowledge about mobile apps for mobile devices for educational purposes (Havelka & Verbovetskaya, 2012: 22). As a result, another new service for libraries is to teach users how to use mobile devices effectively for learning (Havelka & Verbovetskaya, 2012: 22). This was reported by Havelka & Verbovetskaya (2012: 12) to explain how the Lehman College piloted a project to introduce students to mobile literacy classes, where librarians teach students how to search and access reliable information on their mobile devices. Librarians are able to provide a support service to users for their devices, in terms of configuration and teaching (through workshops) (Lippincott, 2009: 5-6).

2.4.2.4. Effect on reference services

To reference librarians or reference services in libraries, mobile technologies provide new ways of reintegrating in-personal communication, transform the ability to share content with users, and reinvent an embedded librarianship (roving librarian) service, which improves virtual reference services (Barnhart & Pierce, 2011: 282, 283). By using mobile devices librarians are able to implement embedded librarianship and roving librarian services successfully by providing e-resources to users at a point of need, immediately if needed, and are able to move between locations while having access to resources wherever users are located (Barnhart & Pierce, 2011: 285).

Mobile technologies allow librarians not only to provide library resources to users on mobile devices, but also to support users in their research in terms of information management, access, availability and teaching of technologies (Lippincott, 2010: 210). Librarians are investigating and identifying tools and resources that will be compatible on mobile devices and implementing them, creating guides (instruction and help guides) for use on mobile devices to assist users with resources in order to facilitate reference services (Barnhart & Pierce, 2011: 285). International studies (Barnhart & Pierce, 2011; Buczynski, 2008; Choy, 2010; Dempsey, 2009; Hahn, 2008) are reporting on how libraries are integrating chat facilities, SMS services for reference enquiries, text messaging for notifications and alerting to support user queries, which offers convenience to the user who does not require face-to-face communication or email.

2.4.2.5. Effect on collection development

Furthermore, collection development practices have been affected, changing from librarian-driven acquisition to user-driven acquisitions in terms of, for example, purchasing and uploading of e-books to e-readers such as Kindles (Goodwin *et al.*, 2012: 16). Libraries buy audio and e-books in order to provide users with book content on mobile devices and purchase mobile devices for users to borrow from the library with uploaded content, replacing the need for users to carry stacks of books to and from the library (Dempsey, 2009). This has resulted in many libraries also introducing new services, such

as lending programmes where they lend mobile devices such as Kindles and iPads to users, via their circulation activities (Dempsey, 2009; Goodwin *et al.*, 2012: 15). In turn these devices are now catalogued and circulated like other resources in the library (Dempsey, 2009; Goodwin *et al.*, 2012: 15).

For example, at the Texas A&M University's Medical Sciences Library, librarians are working on an iPad checkout project, in which iPads are purchased and catalogued. In addition, they are loaded with content and users are able to check out the iPads for fixed periods, and also make recommendations on which content they would like to be loaded on the iPads (Shurtz, et al, 2011). Librarians have added cataloguing changes to records to allow users to place holds on iPads that are circulating so that they can be placed on a waiting list (Shurtz et al, 2011).

Librarians' need for support of mobile devices in terms of the devices owned, resources needed and general support for devices, seems to be a growing interest and librarians will need to extend services to be able to provide this support to users (Kim & Ball, 2010: 62). In order to provide mobile services or implement mobile services, it is necessary to understand library users' needs first, which will be discussed in the following section.

2.5. Understanding the user's mobile needs

In order to provide users with mobile services, libraries must consider the changing environment of these technologies as they are changing rapidly, as do user preferences and needs (Lippincott, 2009: 8). Each institution's users may have their own requirements for content and resources, which may differ between institutions (Anderson & Andrews, 2011: 29). It is therefore necessary when planning for mobile service delivery, that librarians understand the user population in terms of the users' needs before implementing any mobile service. These assessments, data collections and surveys can assist librarians in:

- identifying the user's expectations
- identifying mobile users' patterns of use

- identifying the library resources needed and wanted
- knowing how users use their mobile devices and which devices users own
- determining the number of users who own mobile devices (Canuel & Crichton, 2011: 110; Kim & Ball, 2010: 62, 66; Lippincott, 2009: 3; Lippincott, 2008: 2).

By understanding the user, the library is able to:

- Develop services and resources for mobile devices based on users' needs and expectations;
- Development services for actual tasks identified by users;
- Deliver relevant mobile content ;
- Avoid and minimise under-utilisation of mobile services and resources;
- Adapt services that may have been implemented;
- Re-evaluate existing plans and strategies;
- Keep abreast with development within the mobile industry in terms of ownership of devices (Anderson & Andrews, 2011; Canuel& Crichton; 2011; Kim & Ball; Hahn, 2008).

Paterson (2011: 413) suggests that libraries not only use specific mobile services (such as mobile catalogues) but look further and provide a range of services to users on their mobiles devices. Librarians should understand the opportunities and consequences of mobility before planning and implementing mobile services (Lippincott, 2008: 2). Anderson and Andrews (2011: 29) suggest that libraries not only do assessment of user mobile needs once, but re-run assessments to ensure that appropriate services and resources are supplied to users. Many libraries are developing and implementing mobile library resources, which are discussed in the next section.

2.6. Mobile resources and services in academic libraries

Many projects are being carried out and implementation strategies are being applied concerning the use of mobile services in libraries internationally and in South Africa. The next section provides an overview of various mobile services in libraries from literature and provides a brief summary of the services, with examples from libraries.

2.6.1. Mobile websites and mobile library applications

A mobile library website provides a means of accessing a website from a portable mobile device that can connect to the internet (Vila *et al.*, 2010). The content on mobile websites is simplified because of the small screens of the devices (in comparison to desktop computers), has minimal graphics and pictures and has real time content (Vila *et al.*, 2010). In comparison, mobile applications are software applications that are developed and coded for specific operating systems and in comparison to mobile websites must be downloaded before a user can access the application (Wong, 2012: 107). Mobile applications provide users with access to “networked information that is linked by the app” (Wong, 2012: 107). The main difference between a mobile website and a mobile application is that a mobile site is a “mobile version of an internet website” (Wong, 2012: 107), which can be accessed by using the mobile phone’s browser, whereas an application needs to be downloaded or “pre-installed in order to access it” (Wong, 2012: 107).

Libraries are making use of mobile sites or mobile applications or a combination of these to provide users with access to library services such as reservation of facilities, library catalogues (OPACs) or mobile library catalogues, vendor mobile resources, library hours, access to patron records, help functions and other library resources (Vila *et al.*, 2010; Lippincott, 2009: 5). These services will be discussed in the following paragraphs.

2.6.2. Library catalogues on mobile

The use of catalogues on mobile phones can eliminate user queuing for workstations to access the catalogue and reduce the time spent in trying to locate computers available to access the catalogue (Buczynski, 2008: 266). In the library environment the library management system Millennium (an integrated library system of innovative interfaces) has developed a mobile version of an OPAC called AirPAC (Kroski, 2008: 41). This mobile OPAC (Online Public Access Catalogue) is able to perform searching on the catalogue, retrieve information about available items, place holds on unavailable items and access users’ personal information (Kroski, 2008: 41).

A study conducted by Zhou *et al.* (2011) reports on the evaluation of mobile solutions to catalogue access. The study found that most of 22 libraries surveyed use a mobile website or a blend of a mobile website and a mobile application to facilitate access to library catalogues (Zhou *et al.*, 2011). The study found that features of mobile catalogues included the provision of a search box with search options, status of books and results lists from a search conducted. In addition, the study also reported on special features that mobile catalogues provide, such as a scan option - the user is able to use to scan an ISBN to search the catalogue - customisation options of results lists, emailing or texting of results, and mapping systems that indicate the locations of books using Google maps (Zhou *et al.*, 2011).

An example of the university of Texas Austin library catalogue demonstrates how a library is able to create a mobile library catalogue with similar features as the web version catalogue (Zhou *et al.*, 2011). In addition, this mobile catalogue has a feature that allows users to request books from their mobile devices that are not available in the library and a feature that links users from the catalogue item to Amazon reading reviews and a link to compare prices of books (Zhou *et al.*, 2011).

2.6.3. Mobile databases and e-journals

Vendors who are supplying library resources are customising and providing tools to their content, which can be used on mobile devices, and are offering mobile platforms for their resources (Barnhart & Pierce, 2011: 279, 283). Through these platforms libraries are able to share their content with their mobile library users (Barnhart & Pierce, 2011: 283). For librarians the challenge is keeping up with websites that are offering these services and knowing the device compatibility of databases, bibliographic citation tools and e-journals (Lippincott, 2009: 5). Libraries are, however, dependent on vendors of these services for the development of mobile access to the vendor content. As mentioned in the above paragraph, vendors are also taking one of two routes to provide mobile access to their content: either developing mobile applications specific to phone type or creating mobile websites to their journal interfaces (Wilson & McCarthy, 2010: 224). The next section provides examples of such vendor initiatives.

2.6.3.1. Examples of vendor initiatives

a) Example of mobile application for subscription database

Elsevier's products, i.e. ScienceDirect and Scopus (bibliographic database and full text platform), are available as a mobile application downloadable from the device application store, and are available for download for Apple, Android and Blackberry devices (Sciverse, 2012). The application can be downloaded and users are able to access the application by connecting through their institutional personal accounts and email addresses (Sciverse, 2012). Below are images of the normal browser interface of Scopus (Figure 2.2.) and a mobile application for Scopus for Android devices (Figure 2.3).

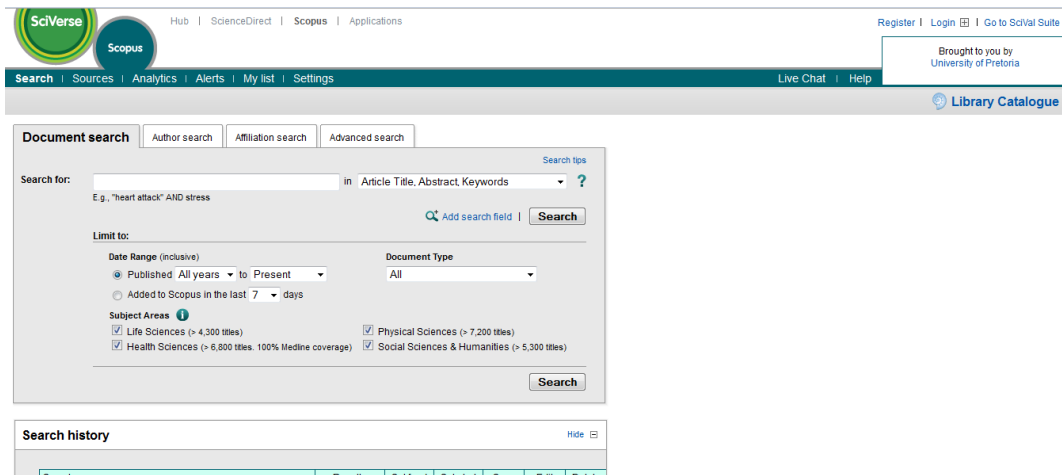


Figure 2.2: Screenshot from the University of Pretoria, Scopus database homepage on a normal internet browser available from <http://0-www.scopus.com.innopac.up.ac.za/home.url>

App Screenshots

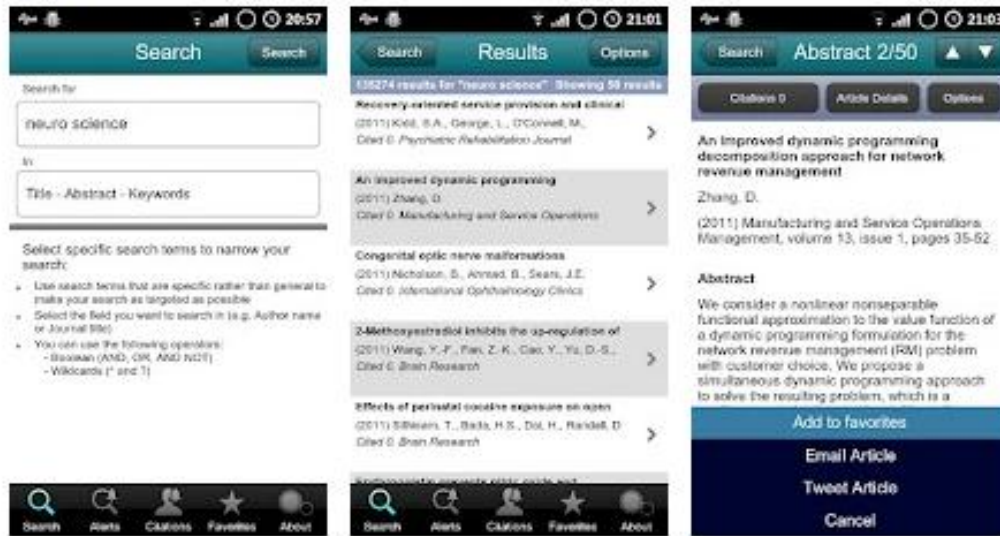
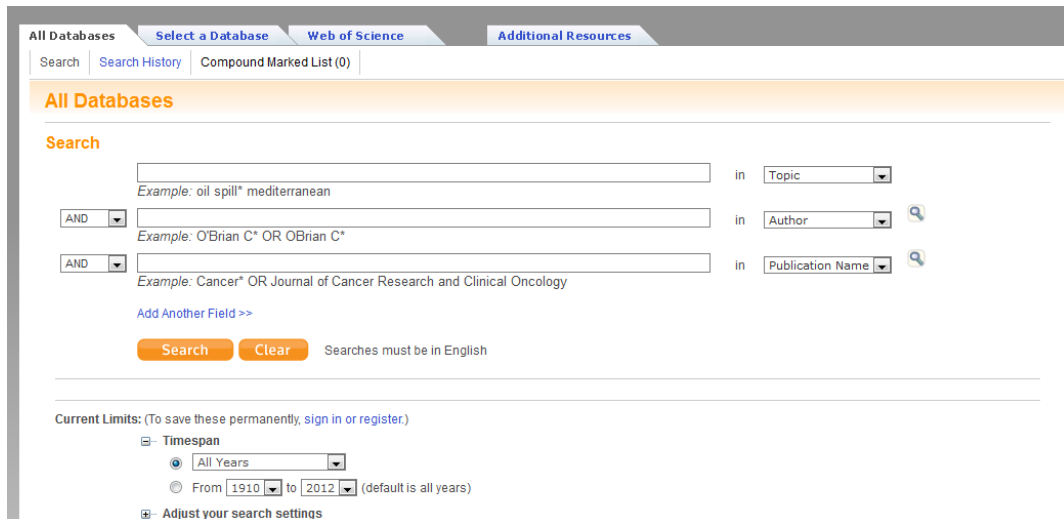


Figure 2.3: Screenshot from Google play, Shop Android apps of the Scopus mobile application for Android devices <https://play.google.com/store/apps/details?id=com.service2media.Scopus&hl=en>

b) Example of a mobile website of a subscription database

EbscoHost, another full text subscription database, is available on mobile devices as either a mobile website accessible through the mobile device browser (<http://search.ebscohost.mobi/>) or as a downloadable application from the device application store (Ebsco Publishing, 2012).

ISI Web of Knowledge, a literature database, is only available as a mobile website that users are able to access from a mobile device's browser; they can connect to <http://m.webofknowledge.com> followed by connecting to their personal accounts (Web of Knowledge, 2012).



All Databases | Select a Database | Web of Science | Additional Resources

Search | Search History | Compound Marked List (0)

All Databases

Search

in

Example: oil spill mediterranean*

AND in

Example: O'Brian C OR O'Brian C**

AND in

Example: Cancer OR Journal of Cancer Research and Clinical Oncology*

[Add Another Field >>](#)

Searches must be in English

Current Limits: (To save these permanently, [sign in](#) or [register](#).)

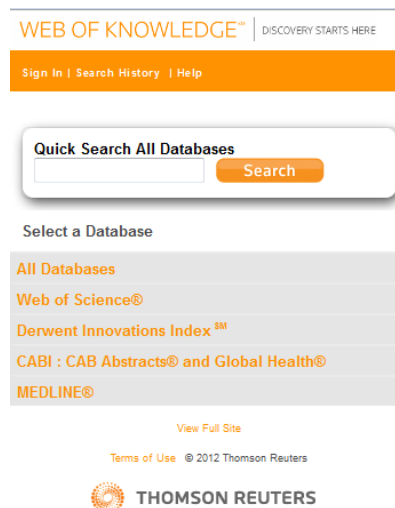
Timespan

All Years

From to (default is all years)

Adjust your search settings

Figure 2.4: Screenshot from the University of Pretoria, ISI web of Science, database homepage on a normal internet browser



WEB OF KNOWLEDGE™ | DISCOVERY STARTS HERE

[Sign In](#) | [Search History](#) | [Help](#)

Quick Search All Databases

Select a Database

- All Databases
- Web of Science®
- Derwent Innovations Index™
- CABI : CAB Abstracts® and Global Health®
- MEDLINE®

[View Full Site](#)

[Terms of Use](#) © 2012 Thomson Reuters


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Figure 2.5: Screenshot from ISI Web of Science Mobile website, viewed as through a mobile phone's browser

2.6.4. Reference services

Library references services are seen as a key service provided by libraries and through the use of mobile technologies libraries are able to provide this service to users, but on mobile devices through the use of email, messaging or texting and SMS. Librarians are also able to use the devices themselves to answer questions (Lippincott, 2009: 2). Many libraries

are offering references services on mobile devices, as explained by Vila *et al.* (2010: 327). These mobile references services will be discussed in the following section.

Mobile information literacy

Libraries are experimenting with using mobile devices to provide information literacy materials to users for instruction and help functions by enhancing existing services and making them more interactive in order to assist users virtually (Barnhart & Pierce, 2011: 283; Lippincott, 2009: 5). Libraries are making use of podcasts to supply users with quick instructions on databases or instructions on how to access the web and screen casts to capture screens in order to answer reference questions, as well as videogames as an instruction tool, which are all reference services on mobile devices (Barnhart & Pierce, 2011: 283; Lippincott, 2009: 5; Vila, *et al.*, 2010). Vila *et al.* (2010) explain the use of mobile help instruction on using mobile websites and mobile OPAC and searching help on the mobile databases directly accessible from the user's mobile device.

The Washington State University Libraries are using MP3 audio recordings, which are loaded on iPods to assist library users with how-to-help recordings (Kroski, 2008: 43). The recordings consist of help tutorials on instructional audio casts on how to use Boolean operators, a guide to using the map collection and using online databases to search for journal articles (Kroski, 2008: 43).

Notification services on mobile

SMS services are used as notification services to keep users updated about the availability of technologies, namely library loans to users (such as laptops), and to give patrons access to waiting lists to borrow iPads from the library (Vila *et al.*, 2010; 327). Kroski (2008: 45-46) describes how the University of Illinois library is using texting services to alert users on the availability of librarians and their office hours in order to offer users assistance. Texting is also used to inform users of the due dates of their borrowed items and fines applicable to overdue items (Kroski, 2008: 45). The Orange County Library established an SMS service that can be used either for reference services that allow users to SMS their reference questions to librarians or for the user to send an SMS with a

keyword to the librarian; users receive instant results related to their keywords (Kroski, 2008: 46).

Ask-a-librarian and feedback services

One such service is “Ask a Librarian”, that the Rector Gabriel Ferrate library is offering via mobile. Through a mobile device, such as mobile phones, users are able to access a form from the library’s mobile website through which their “questions, opinions and suggestions” are sent from their mobile phone. Users have the option to request a response from the library via text or email (Vila *et al.* 2010: 327).

2.6.5. The use of QR codes in libraries

A QR code is a type of two-dimensional barcode (unlike one-dimensional barcodes), that is read or decoded by smartphones through the smartphone’s camera (Ashford, 2010: 256; Walsh, 2009: 7). Unlike barcodes that decode data horizontally, QR decodes horizontally and vertically (Ashford, 2010: 256). QR codes are types of barcodes that provide a link between the physical and virtual world (Lippincott, 2009: 6). QR codes can contain more data than barcodes and are able to contain various types of data, such as text, uniform resource locator (URL), SMS messages, contact details or phone numbers (Ashford, 2010: 256; Walsh, 2009: 7). Figure 2.6 below is an example of a QR code containing contact information.



Figure 2.6 QR code from the University of Pretoria Library Services Contact us webpage

The use of QR codes has increased in libraries and is especially important in service delivery and marketing in libraries. In libraries QR codes can be used to link users to

websites or social networking sites, or to provide users with information or tips that would be helpful, e.g. author information (Lippincott, 2009: 6; Walsh, 2009: 7). Some mobile phones have pre-installed QR code reader software available, and on those that do not have such software, QR reader software can be downloaded from the internet, in many instances free of charge (Walsh, 2009: 7). The user accesses his/her mobile device, opens the QR reader software and scans the QR codes, thus decoding the data contained in the QR code (Walsh, 2009: 7).

The University of Catalonia uses QR codes in the library to create posters containing information about new services and to provide access to information (Vila *et al.* 2010). An article by Yee (2012) explains that the University of Queensland Library and Queensland University of Technology Library use QR codes in their catalogue as embedded codes; these are generated per item and contain information on the catalogued items, their location and call numbers (Yee, 2012). These libraries also use QR codes to supplement normal communication and use these codes for self-help facilities that could be linked to web pages, videos and text (Yee, 2012).

By using QR codes as a tool to provide users with information and links to URLs to services, users do not have to remember information, which eliminates writing down of locations or information, and are able to have information available on their mobile phones ready to access URLs or services directly (Yee, 2012). At the Hong Kong University of Science and Technology Library, QR codes are used to make downloading of their mobile catalogue on phones possible and for bookmarking of library account pages and access (Yee, 2012). At the Claude Moore Health Sciences and University of Virginia libraries QR codes are used to recommend resources to users (Yee, 2012). Vila *et al.* (2010: 331) state that QR codes are also used to give users usernames and passwords that are needed to use equipment in computer facilities and used to provide users with access to registration forms for computer facilities.

The University of Virginia's library is using QR codes to support users with information about mobile e-resources by providing users with direct links via QR codes to the device

application store to download an e-resource, which saves users additional steps required to get to the actual download page (Barker *et al.*, 2012: 69).

From another point of view Barker *et al.* (2012: 70) explain how QR codes were used at the University of Virginia to provide users with information and instructions about circulation of equipment from the library's mobile website. Furthermore, QR codes were used for special collections to provide users with information, creator information, and backgrounds of paintings that hang on the walls of the library (Barker *et al.*, 2012: 70). By providing this information on the paintings through QR codes, the library is able to save space and save on printed brochures on paintings (Barker *et al.*, 2012: 70).

2.6.6. Special collections/tours on mobile

Libraries such as the Duke University Library and the North Carolina State University Library are offering institutional content for mobile devices and combining these mobile locations with location-based services that facilitate access to campus tours and information about features on campus (Lippincott, 2009:6).

Libraries are using audio tours via mobile devices to provide users with audio tours of the library using their mobile device, such as MP3 players. The Simmons College Library uses mobile phones to conduct audio tours of the library and users are able to follow a linear or modular route, or access audio devices at specific points in the library (Buczynski, 2008: 263). This library also makes it possible for users to borrow and check out iPods with pre-loaded audio tours of their library and information commons (Kroski, 2008: 44). At the Duke University library users are able to download audio tours to their own devices, such as an MP3 player or cell phone, and at the University of Southern California users are able to download a video tour from iTunes from the "University Campus Life" channel (Kroski, 2008: 44).

By using these types of tours of facilities, libraries are providing users with convenient self-service tours, which allow users to tour or see facilities at their own leisure from their own devices without having to make appointments with librarians (Kroski, 2008: 44).

2.6.7. E-books

E-books on mobile devices are becoming more popular in libraries (Zimmerman, 2011:92; Ashcroft, 2011: 398). The shift from e-book availability on computers to e-books available through mobile devices is escalating, and many libraries are making e-books available through the library system for users to access from mobile devices (Kosturski, 2011: 13). E-reader devices such as the Amazon Kindle, the Nook, the Sony e-reader and other similar devices are making viewing and reading of books on mobile devices possible, providing users with features to browse wirelessly, purchase books, view and read books and link to additional information (Kosturki & Skornia; 2011; Zimmerman, 2011). In addition, users who do not own e-reader devices are also able to download e-reader applications to mobile devices that assist users in using e-book mobile devices such as cell phones and tablets, e.g. Amazon Kindle, iBook store and e-Reader mobile applications (Anderson & Andrews; 2011: 23; Kroski, 2008). These applications provide users with features such as viewing and reading books, highlighting text and adding annotations to text similar to the e-reader devices (Johnson, 2012; Kosturski & Skornia, 2011; Kroski, 2008).

Libraries are already engaging in activities to make these types of devices and e-books on mobile devices accessible to their users. Overdrive™ is an example of such a service through which libraries are able to create digital collections of eBooks, audio books and other digital content or custom-branded websites and make these digital collections available to users via audio players, e-readers, tablets and smartphones (Overdrive, 2012).

Libraries are also circulating eBooks on e-reader devices to library users. The following section discusses the lending of mobile devices in libraries.

2.6.8. Circulating or loaning of mobile devices

Many libraries have created loan services or circulation services of mobile devices. Studies by Vila *et al* (2012) and Shurtz *et al.* (2011) explain these types of loan services. Shurtz *et al.* (2011: 320) explain how the University of Texas Austin makes the circulation

of iPads to users possible and provides a hold, recall and waiting list service for devices. By circulating devices the University of Texas Austin was able to create a new service, which enhanced the collection development service in the library by giving users the option of recommending tools and applications that were not downloaded on the circulating devices (Shurtz, *et al.* 2011: 322). At the Rector Gabriel Ferrate library, users are able to borrow e-readers from the library accompanied by an SD card of e-books, and a user guide and operating manual for the device, which are issued through the normal library management system (Vila *et al.*, 2010: 330). Zimmerman (2011:92) reports similarly on how libraries, such as the Sparta Public Library, circulate e-readers with books to users.

2.6.9. Additional services

Other than the categories of services mentioned in the previous section, libraries are offering additional mobile services to users, such as help, mobile surveys, room-booking systems, directories, awareness and general information on user's mobile devices. At the Rector Gabriel Ferrate library a number of additional mobile library services not mentioned above are available to users:

- Help on a mobile device through their mobile library service, which explains the use of the mobile site and provides users with information about the services that are available on the mobile site (Vila *et al.*, 20120: 327).
- User surveys are conducted on their mobile site by asking short questions in multiple choice answer format and users are able to track the poll and access the previous poll results (Vila *et al.*, 2012: 327).
- A study room reservation facility is available on the mobile site, which can be used to assess the availability of rooms. However, the actual reservation site is not adapted for mobile use (Vila *et al.*, 2012: 325).
- A mobile facility can be used to assess the availability of laptops in the library and to reserve a laptop, if one is not immediately available, by using a link on the mobile site that places the user on a waiting list (Vila *et al.*, 2012: 325). When a laptop becomes available, the user is notified via SMS of its availability (Vila *et al.*, 20120: 325).

- A directory of library staff with contact details (such as email addresses and phone numbers), which users are able to add to their mobile contacts or call directly from the mobile site using their mobile phones (Vila *et al.*, 2012: 325).
- The Rector Gabriel Ferrate library has adapted its news facility for mobile services to alert users about new developments about both the library and campus to keep users updated with new information (Vila *et al.*, 2012: 324).
- Information on the mobile site about the location, hours, maps and contact numbers (Vila *et al.*, 2012: 324).

The mobile services discussed are from international examples of libraries. The next section provides a view of mobile initiatives in terms of mobile services available in South African higher education libraries.

2.7. Mobile library activities in South Africa

In South African higher education libraries many mobile initiatives are taking place. The University of Johannesburg, University of Pretoria, University of Stellenbosch, University of the Witwatersrand, University of the Free State, University of KwaZulu-Natal and University of South Africa were used as examples to assess the implementation of mobile library services in South African libraries. These initiatives at various higher education institutions in South Africa will be discussed in the following paragraphs.

2.7.1. Mobile activities at university libraries in South Africa

2.7.1.1. Mobile websites

The University of Stellenbosch library provides users with a mobile website (available from <http://m.library.sun.ac.za/>). This mobile website is available in two languages (Afrikaans and English) and users are able to toggle between the two interfaces. The mobile websites provide access to a mobile search function to search for journal articles and reference

materials, subject guides, mobile databases (where a list is provided with access to each database), library information (locations and contact details) and news.

2.7.1.2. Mobile library OPACs

The University of Johannesburg offers a simple and smartphone mobile interface to their users; this provides users with access to the mobile library catalogue and library information such as location and contact details. The library also makes use of AirPac, the mobile version of the Innovative Interfaces Library Management System (the mobile site is available from <http://ujmobilelink.uj.ac.za/> and <http://ujmobilelink.uj.ac.za/search>).

The University of the Witwatersrand library (also known as Wits library), as well as the University of South Africa (UNISA), provides mobile access to the library catalogue using AirPac (available from <https://m.innopac.wits.ac.za/> and <http://millennium.unisa.ac.za/airpac/>). The figures below depict the difference in display between the University of Johannesburg and the UNISA mobile OPACs.

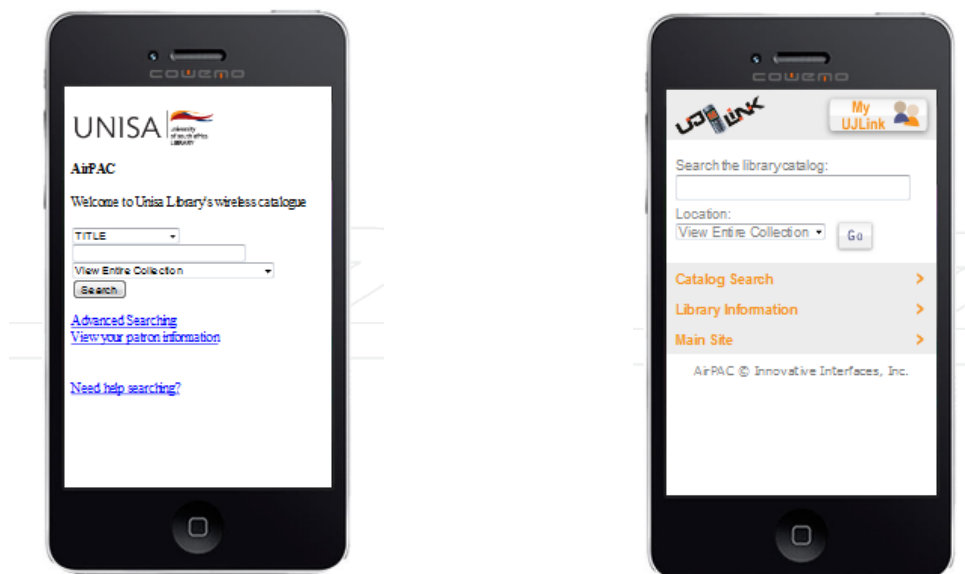


Figure 2.7: Screenshot from University of Johannesburg and UNISA mobile library catalogues

2.7.1.3. Access to mobile library resources (vendor applications and mobile websites)

The University of KwaZulu-Natal library provides information and links to mobile databases on the normal website, which lists the library databases (available from: <http://library.ukzn.ac.za/TopNav/ElectronicResources/databases700.aspx>).

2.7.1.4. SMS services

The University of the Free State library has an SMS service that allows users to SMS a request to the library using a specific cell phone number (for the specific cell phone provider), accompanied by a service code (the codes used in the SMS service are for information service, circulation and interlibrary loans (available from: <http://library.ufs.ac.za/content.aspx?uid=179>). Should the response from the library take longer, the users receive a link to a URL via SMS to answer their question.

2.7.1.5. Other mobile library services

The University of Stellenbosch uses the mobile library website to provide access to the following:

- a mobile search function to search for journal articles and reference materials
- subject guides, mobile databases (where a list is provided with access to each database)
- library information (locations and contact details)
- News.

The University of Stellenbosch mobile library website also offers users access to frequently asked questions, plagiarism and copyright information.

2.7.2. Adoption of mobile services: The case of the University of Pretoria Library Services

At the University of Pretoria mobile library services have been implemented providing users with access to the library resources from their mobile devices through three options: the university mobile website, the university's mobile application and the library mobile website. All three of these access points are discussed in the following sections.

Access through the university mobile website

Access to the University of Pretoria Library Services is through the University of Pretoria mobile website, normal web version, or version for smartphones. Figure 8 provides screenshots of the library access through the University of Pretoria mobile website accessible from <http://m.up.ac.za>. This mobile application is based on the mobile applications of the Blackboard e-learning system. Figure 9 presents a screenshot of the smart version of the mobile website. The following library services are available from the mobile website:

- Searching the catalogue: basic and advanced search facilities are available. A list of results is generated, the availability of items is indicated and a place hold option is visible.
- Contact information for the library is available (a telephone number and a fax number).
- The hours of operation per day are indicated.
- The address of the main library is available, with links to other branches and their contact details
- Links are available to the other library mobile site (which was first established in 2009, the library Facebook profile and Twitter profiles).

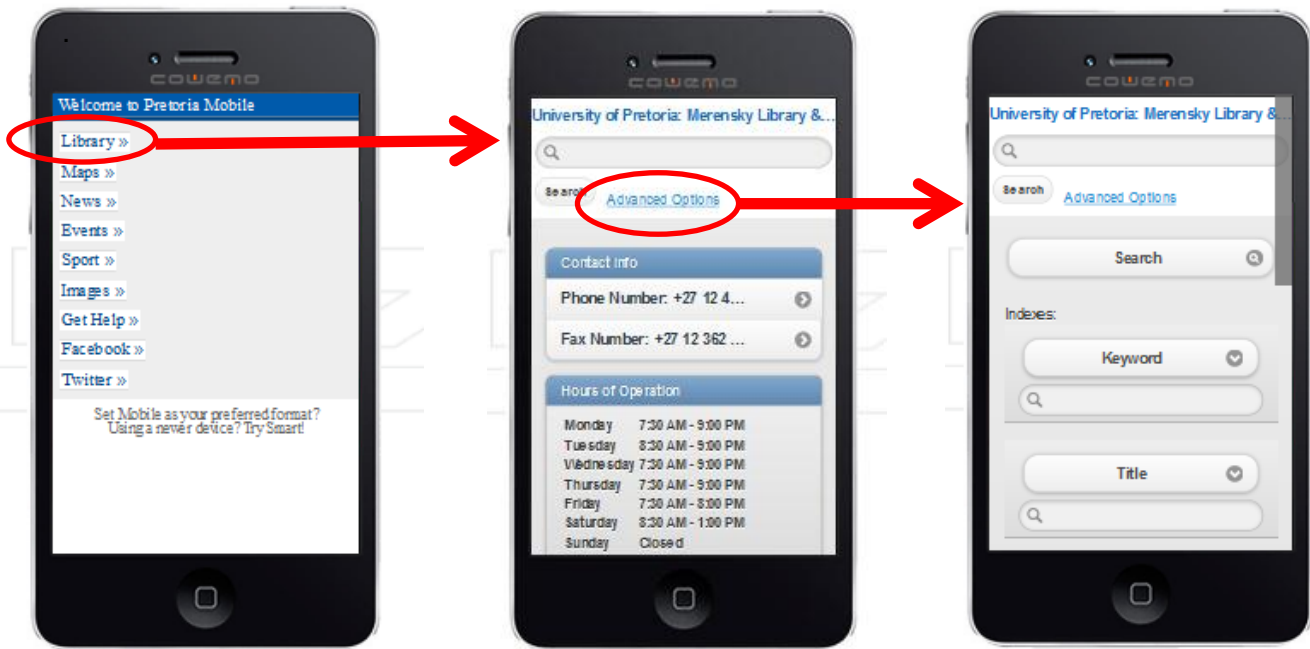


Figure 2.8: Screenshots from the University of Pretoria mobile website

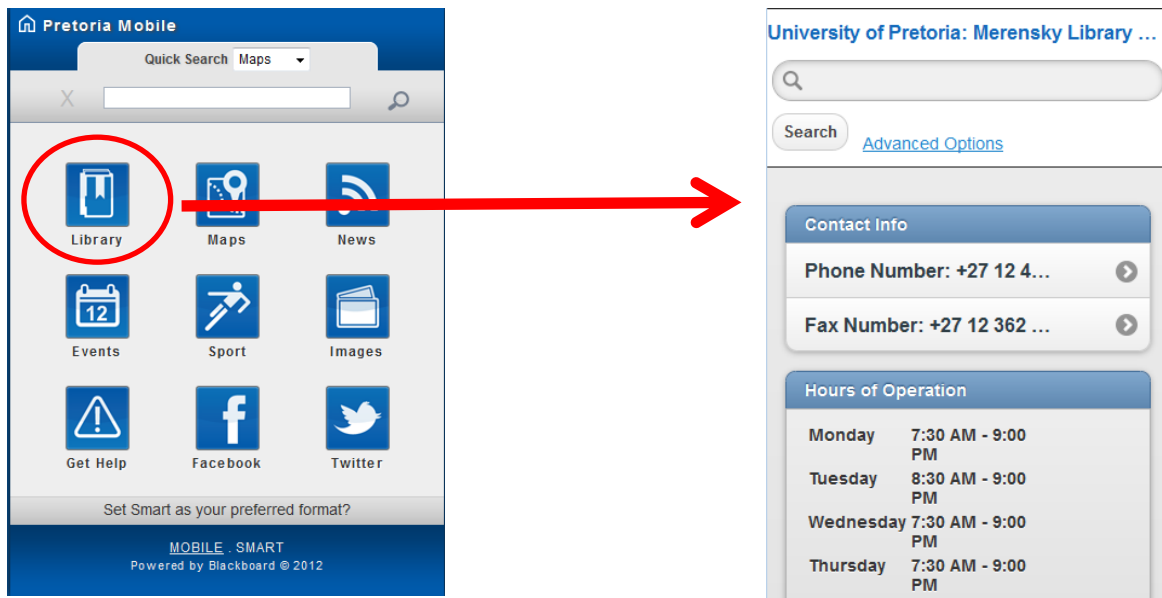


Figure 2.9: Screenshot from the University of Pretoria mobile application

Access through the university mobile application

The university mobile application is downloadable from the specific mobile device store, such as iTunes, Google play (for Android) and Blackberry app world. The same library services are available as from the mobile website mentioned above.

Access through the University of Pretoria Library Services

The mobile library website in Figure 10 represents the website that was initially designed as a result of a user needs survey.

This mobile website provides the following services:

- Mobile library catalogue (the library uses AirPac, a mobile version of Innovative Interfaces),
- Library hours, maps and directions to specific libraries (on different campuses)
- Mobile databases (the mobile website is divided into categories of mobile databases available through mobile websites and mobile databases available as applications to be downloaded)
- E-journals – however, the link from the mobile site links to the normal library website
- Mobile dictionaries and encyclopaedias.

From the examples shown in the section above, it can be seen that South African libraries are implementing similar mobile library services as the international examples provided. Many services in the South African examples rather have a mobile website nature, providing access to searching of the catalogue, contact information or library hours, compared to the international examples of mobile applications, or combinations of mobile applications and mobile websites, venue booking services and circulation of mobile devices. Although libraries are providing mobile services, concerns and challenges are faced in providing these services though the mobile channel. The following section discusses the challenges and concerns regarding mobile service delivery in libraries.



Figure 2.10: Mobile library website initially designed by the library

2.8. Challenges of mobile services in libraries

Although many library mobile services are provided to users in various forms (mobile websites and mobile applications or a combination of mobile websites and applications) there are still challenges or concerns that face librarians. These challenges will be discussed in the following section.

2.8.1. Reference services

Regarding reference services, Barnhart and Pierce (2011: 282) explain that librarians are struggling with concerns about the quality of reference services and transactions via mobile services in terms of the quality of answering complex questions (and being able to respond well to complex questions relating to text and chat, compared to the traditional reference service). It is important that responses provided through this medium are understood and received, since SMS and chat services imply a loss of verbal and tonal communication (Barnhart & Pierce, 2011: 282) which is different from email or personal communication.

2.8.2. Technological concerns

Many technological concerns and challenges exist when providing mobile services and products in libraries. The challenge of provision of mobile services is the devices, in terms of their batteries and bandwidth capabilities and the rapid change in development. The challenge is to stay current and not have out dated or obsolete technology (Anderson & Andrews, 2011: 24; Barnhart & Pierce, 2011: 286). The rapid development of mobile devices poses challenges to libraries in terms of services that are accessible to a wide range of devices (Barnhart & Pierce, 2011: 285).

For libraries it may not be possible to provide mobile library access or mobile products customised for all devices, because of the wide spectrum of devices available. However, libraries may be able to cater for the most popular devices, as in the case of the Ryerson library that caters for specific devices such as iPhones and Blackberry smartphones (Wilson & McCarthy, 2010: 221). It is important for libraries to keep up to date with developments in technology and to investigate how these can be used within libraries to apply and use technologies for service delivery (Goodwin *et al.*, 2012: 16). It is important for libraries to be able to determine the proportion of service delivery needed about delivery channels in order to allocate the appropriate resources and support for the channels and the development of channels (Choy, 2010: 2).

2.8.3. Challenges with circulating of devices

Much time is dedicated at the circulation desk to ensure that the devices that were checked out are checked in, and to ensure that content loaded by users is removed (Anderson & Andrews, 2011: 24). A questions arising about the borrowing of devices is whether loanable devices should be open for users to download content or whether libraries should pre-load content on the devices (Anderson & Andrews, 2011: 24). Another concern about circulating devices is the measurement of use. Anderson and Andrews (2011: 24) report on the difficulty of obtaining usage statistics of content on devices that are circulated to determine usage or usefulness of content. Other challenges authors discuss concerning the circulation of devices is those of costs and liability which are discussed in the next section.

2.8.4. Liability, cost and licencing

In a study by Shurtz *et al.* (2011) the authors explain that owing to the high price of devices such as the iPad, users may be discouraged from borrowing the devices. In addition, the high prices of the devices may affect the number of devices that libraries may be willing to purchase (Shurtz *et al.*, 2011: 322). The price of the equipment (such as e-readers) and the expense of purchasing and replacing it in case of damage, theft or loss are further concerns for libraries when providing mobile services (Zimmermann, 2011: 93). The possible costs associated with damage or loss of the devices has to be taken into consideration when offering the service (Shurtz *et al.*, 2011: 322).

Shurtz *et al.* (2011: 321) explain that at the University of Texas, Austin a restriction setting was activated to ensure that users did not remove content that had been loaded on the device when checked out. However, such restrictions prohibit the user of the device from adding any applications and at the University of Texas, Austin users were then asked to make recommendations on content be added to the devices by the library (Shurtz *et al.*, 321). Shurtz *et al.* (2011: 322) found that loss or damage of devices might have other implications. Shurtz *et al.* (2011: 322) explain that when devices (which contain resources tied to an individual licence) are lost, the effect on libraries may be loss of a device, but also the cost of the applications installed on the device, in comparison to Kindle e-books, which can be purchased but downloaded on different devices.

2.8.5. Physical spaces

Challenges for libraries may also be in terms of physical space. With regard to loaning mobile devices, there is concern that libraries will need to make signage available to indicate the availability of equipment, as well as configure service desks to house these devices (Lippincott, 2008: 3). In order to use these devices within the physical library space, libraries should make physical facilities such as electrical outlets and network connectivity available if users want to use the devices within the library. Dempsey (2009) states that within the physical library spaces, “there is a need for facilities for recharging, for synching with the ‘cloud’, for copying/sharing media”. Dempsey (2009) and Lippincott (2008: 3) both discuss how the needs of students (who are using mobile devices) are changing, specifically their needs for space in order to use their mobile devices.

Many challenges exist for libraries in connection with the implementation of mobile services, which may be physical (such as physical re-allocation of spaces and circulation policies needed for the new mobile devices). However, as mobile service delivery is fairly new and emerging within the library sector, libraries may learn from one another and develop plans to avoid or anticipate challenges that mobile services and mobile devices may pose for libraries.

2.9. Conclusion

The advancement within the mobile technology market has had an effect on education and in turn the library as a key information provider. Libraries are able to use these mobile technologies as an additional and supplementary channel for service delivery. The technologies are enabling libraries to enhance traditional services through their simplicity and flexibility. However, with the introduction of library mobile services, libraries may be faced with challenges such as workflows adaptations, reallocation of physical spaces, strategy adaptation in terms of circulation, cataloguing and reference services, marketing and reallocation of funds for purchasing equipment.

The available literature has shown that libraries throughout the world are already implementing various services to users via their mobile devices, such as reference, awareness, notification, access, and searching and information literacy and are already using mobile technologies as part of service delivery. Further evidence from literature found that libraries are also providing additional services such as tours, audio and video services to enhance their existing services, and are using mobile technologies to save both the user and the library time and space.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

The purpose of chapter 3 was to describe the research methodology and design used to investigate how mobile technologies can advance service delivery for library users at the University of Pretoria Library Services. The chapter firstly provides an overview and goal of the research study, which is followed by a discussion about the specific research approach chosen for the study. Furthermore, a discussion on the research design chosen for the study is presented, as well as the data collection methods and sampling used to collect data for the study. The chapter is concluded with an explanation of the applications of the study, the selection of the research location and a discussion about the data analysis and interpretation methods. Section 3.2 provides an overview of the study as a background to the research methodology.

3.2. Short overview and goal of study

The goal of the study was to determine whether mobile library services can enhance service delivery in an academic library. The study was aimed at answering the research questions (as provided in chapter 1) and to determine whether users of the University of Pretoria Library Services are using the mobile services that are provided by the library, as well as to investigate whether users' needs for mobile library services have changed since the implementation of the current mobile library website. This study is based on the current mobile library services that the University of Pretoria Library Services provide through the mobile library website, as well as the library services that are accessible through the University of Pretoria's mobile application.

In order to investigate whether mobile library services can advance service delivery at the University of Pretoria Library Services, the following questions need to be answered:

- I. Which mobile library services and products have been implemented at the University of Pretoria Library Services?
- II. How do the mobile library services meet the needs of the library services users?

- III. Which mobile devices do library users own?
- IV. Which mobile library services and products are used, and which mobile library services are users not using?
- V. What library information/services do library users want to be available from mobile devices?

To answer the research questions, a plan or design is needed. The following section provides a discussion about the research methodology and design chosen for the study.

3.3. Research methodology and design

The research methodology provides a general approach a researcher uses to conduct a research study (Leedy & Omrod: 2013: 7). The research methodology and design for the study are discussed in sections 3.3.1 and 3.3.2.

3.3.1. Research design approach and methodology

In general, a distinction can be made between qualitative research and quantitative research. Qualitative research is based on characteristics or qualities of individuals or groups in order to gain understanding and assign meaning to a problem (Creswell, 2009: 4; Leedy & Ormrod; 2013: 95-96). Through qualitative research many complexities of a phenomenon can be examined and understood in order to “understand complex situations” (Creswell, 2009: 4; Leedy & Ormrod, 2013; 95-96). In contrast, quantitative research involves amounts or quantities, and examines the variables in a numerical manner (Creswell, 2009: 4; Leedy & Ormrod, 2013: 95-96).

This study can be seen as a qualitative rather than a quantitative research study, as the research study aims to understand and explore students’ preference for library services from their mobile devices to determine whether mobile library services can advance service delivery by the library. A plan is needed to answer the research questions and solve the problem. The research design provides the researcher with an overall strategy to

collect and analyse data. The following section discusses the specific research design chosen for this study.

3.3.2. The embedded design

The research design is a plan, procedure or strategy used to conduct research in order to solve the research problem and provides a procedure for the collection and analysis of the data (Creswell, 2009: 5; Leedy & Omrod, 2013: 74). The research design used to conduct this study was the embedded design. An embedded design is a research design that combines both quantitative and qualitative collection and analysis in a quantitative or qualitative research design, during the same time frame (Creswell & Clark, 2011: 90-92; Leedy & Ormrod, 2013: 260).

In an embedded design one research approach is dominant while the other research approach plays a secondary/supplementary role in order to answer the research questions (Leedy & Ormrod, 2013: 260). Using the embedded design, a researcher is able to gather different types of data, depending on the research questions to be answered, examine an intervention that has been implemented in an experiment, and enhance a traditional research design (Creswell & Clark, 2011: 90-92). To be able to provide answers to the questions posed in chapter 1, the researcher plans to examine the intervention implemented at the University of Pretoria Library Services (the implementation of the mobile library website). In addition, the researcher aims to use qualitative methods as the dominant approach to answer questions about users' needs, the use of mobile devices and preference for services and a quantitative approach to answer questions on issues such as mobile ownership and the services and products used on the mobile library website.

In this study the following collection and analysis method/design will be used: experimental design (quasi-experimental), and a case study, as these can be regarded as the most appropriate methods to collect and analyse data to answer the research questions. The following section explains each design and method.

3.3.2.1. Experimental design

Through experimental design a researcher is able to determine the cause-and-effect relationship that may influence a phenomenon or condition and test the effect of an intervention or treatment (Creswell, 2009: 145; Dane, 1990: 102; Leedy & Omrod, 2013: 226). There are various experimental designs, such as pre-experimental designs, true experimental designs, quasi-experimental designs, ex post facto designs and factorial designs (Campbell & Stanley, 1963; Leedy & Omrod, 2013: 232). The following section provides an overview of the different experimental designs listed above.

- Pre-experimental designs are based on a single group being studied only once and an intervention is applied during the study (Campbell & Stanley, 1963: 7; Creswell, 2009: 158). There is no control group to which to compare the experimental group when using this design (Creswell, 2009: 158).
- True experimental designs are designs aimed at individuals who are randomly or systematically assigned to groups (Creswell, 2009:155; Leedy & Ormrod, 2013: 234). Using this design, the experimental group is observed over time (Creswell, 2009: 159; Leedy & Ormrod, 2013: 234)
- Quasi-experimental designs are based on experimental designs in which no systematic sampling is possible and a non-random sample is used, such as a convenient sample (Creswell, 2009: 158). When applying this design, the researcher uses both a control group and an experimental group (Creswell, 2009: 158).
- Factorial designs are designs based on studies where more than one independent variable is studied (Dane, 1990: 92; Leedy & Ormrod, 2013: 243).

A quasi-experiment was chosen for this study, as it is regarded as the best suitable design to answer the research questions. This design was chosen based on a previous study conducted with an experimental group (during August 2010) at the University of Pretoria Library Services, and the implementation of an intervention (mobile library website). The quasi-experimental design is discussed in the following section.

a) Quasi-experimental design

A quasi-experimental design is a type of experimental design used in situations where randomness in terms of selecting groups for the research study is impossible or impractical (Creswell, 2009: 158; Leedy & Omrod: 2013: 237). In terms of the time allocation for this research study and the previous study, the quasi-experimental design is relevant, as this study is a continuation of work that has previously been done at the University of Pretoria's library (which was described in chapter 2).

b) Quasi-experimental design type

The type of quasi-experimental design used in this study is the non-randomised control group pretest–posttest design. This type of design involves two groups of participants, an experimental group (Group A) and a control group (Group B) (depicted below). In this research study the experimental group consisted of individuals who participated in the August 2010 online survey. The control group was represented by individuals selected in a non-randomised manner from the Natural and Agricultural Sciences faculty.

In non-randomised control group pretest–posttest design, no participants are randomly assigned to groups; however, the experimental group (Group A) is observed prior to the intervention (Leedy & Omrod, 2013: 237).

The groups can be depicted as follows:

- I. Group A: Refers to the participants who responded to the web/online survey, who were all students and staff at the University of Pretoria during 2010 (see Appendix 1)
- II. Group B: Refers to the case study of this research study, which comprised students from the Natural and Agricultural Sciences faculty.

The following symbols are used:

O=Observation or measurement.

Observation or measurement refers to the web survey, which was conducted from 16 to 27 August 2010 (known as O1), before the intervention.

X= intervention

Intervention refers to a treatment and/intervention that takes place or is administered to an experiment. In this study the intervention or treatment refers to the mobile website and mobile library services implemented after the first observation (O1).

The design as described above can be depicted in tabular format as follows:

Group A = O1	X1
----- (Indicates timeline/series)	
Group B = X1	O2

Figure 11: Research Design

In addition to the experimental design used, a case study methodology was used and is described in the following section.

3.3.2.2. The case(s)/case study

The case study methodology specifically studies a small number of people in order to obtain understanding of a phenomenon and identify possible patterns (De Vos, 2011: 321). A case study, according to Leedy & Ormrod (2013: 100), is a method through which “data are gathered relative to a single individual program, or event for the purpose of learning more about an unknown or poorly understood situation”. In the case study method an individual, programme or event is studied in order to learn more about the programme

event or individual, and identify which features are common, not common or unique to the specific case (Leedy & Ormrod, 2013: 141; Struwig & Stead, 2001: 8 & 16).

Case study methodology assists with exploring and describing a case (such as an event or programme) and uses data collection methods such as interviews, documents, observations or archival records (De Vos, 2011: 321). In order to investigate how mobile library services can advance service delivery for library users at the University of Pretoria Library Services, the researcher used the case of the undergraduate and postgraduate Natural and Agricultural Sciences students on the main campus of the University of Pretoria. Because of the nature of the research study (mini-dissertation), time and cost, the entire population was not studied. However, a sample in the form of a case study was drawn from the population and used to understand the population from which the case study group was drawn (Strydom & De Vos, 1998: 191).

The sections above discussed the approach and strategy used for this research study. An overview of the research methodology was given, and a description of the design was provided. The following section provides a description of the tools that were used to collect the data for the study.

3.4. Data collection methods

The data collection methods chosen for the study are discussed below.

3.4.1. Data collection methods

A literature review was done prior to planning and collecting data, which provided an understanding of current literature available on mobile library services locally (South Africa) as well as internationally. By examining the literature, a benchmark was established to compare results found during the secondary data collection method with findings from literature (Creswell, 2009: 25).

The literature review provided a framework to examine the literature in order to gain an understanding of how library users are using mobile library services and how libraries are

implementing mobile services for library users, and to identify which mobile library services are being developed and implemented.

In addition, a review of South African libraries' approaches to mobile websites and application, services and products, was done to determine how South African university libraries are implementing mobile services, and which mobile library services and products are available in South African academic libraries. Universities included in the review were the University of Johannesburg, University of Stellenbosch, University of the Witwatersrand, University of the Free State, University of KwaZulu-Natal and University of South Africa. The reason for the selection of these university library websites was that these university libraries had implemented some type of mobile service (at the time of the start of this research project). University libraries excluded were those where no visible mobile services could be found on the library website accessed from a mobile device or searched from an internet browser.

In addition to the above, a second primary collection method was used. Through this method the researcher was able to conduct an evaluation of the mobile website that had been implemented at the University of Pretoria Library Services. The evaluation of the mobile library website of the University of Pretoria Library Services was conducted to determine which mobile services and products were available at the time of the study (refer to chapter 2). For the study, a secondary data collection method was used, which is described in the next section.

To collect data for a qualitative research study, Creswell (2009: 179-180) and Leedy and Ormrod (2013: 141) suggest various data collection methods, such as observations, interviews, documents, past records and audio-visual materials. As discussed in a previous section of this chapter, the embedded research design was used, which is based on a combination of qualitative and quantitative approaches. As this study is predominantly qualitative, semi-structured interview and focus interview data collection methods were chosen. The following paragraphs describe the semi-structured and focus interviews, the interview schedule, advantages and disadvantages of interviews and an explanation on the pilot study conducted.

3.4.2. Semi-structured interviews

Semi-structured interviews are guided interviews through which the researcher is able to obtain comprehensive and comparable data from participants, by asking participants questions (De Vos *et al.*, 2005: 358). The researcher is able to use a standard set of questions with one or more individually tailored questions in order to obtain data and clarify answers if needed or probe participants for answers (Leedy & Ormrod, 2013: 190; Struwig & Stead, 2001: 86). The semi-structured interview uses an interview schedule and open-ended questions, comprising predetermined questions in the form of a questionnaire, to guide the interview and to engage with the participant (de Vos *et al.*, 2005: 186, 352).

The semi-structured interviews used an interview schedule (Appendix 2) that consisted of both open and closed-ended questions. The interview schedule consisted of six sections and approximately 24 questions, with additional questions depending on the answer to these questions. Section 3.4.2.2 discusses the themes and sections used in the interview schedule. In addition to the semi-structured interviews, a second data collection method, a focus interview, was chosen, which is discussed in the following section.

3.4.3. Focus interviews

Focus interviews are used as a qualitative data collection method. These types of interviews consist of questions asked face to face to participants to gain an understanding of how participants view topics (Creswell, 2009: 179-180; Struwig & Stead, 2001: 99). These types of interviews are conducted with groups of participants consisting of between four and eight people (Creswell, 2009: 179-180; Struwig & Stead, 2001: 99). Through focus interviews the researcher is able to interact with a group of participants to investigate their attitudes and opinions or views about topics. For this research study a conveniently selected focus group was chosen. The focus interview group consisted of postgraduate students from the Department of Food Science at the University of Pretoria.

3.4.4. Interview schedule (Appendix 2)

A semi-structured interview schedule was used which comprised both open and closed-ended questions. In open-ended questions, according to Babbie (2005: 254), participants are asked to provide their own answer to the question posed, in contrast to closed-ended questions where participants are asked to select an answer from a list provided. The interview schedule was both quantitative and qualitative in terms of the questions. The quantitative questions were included to obtain statistical information needed to make comparisons of issues such as age, gender, race, study field and year of study, as well as mobile device ownership. The qualitative questions included in the interview schedule provide insight and understanding of the needs library users have in terms of mobile services: the services users want. The following section provides an overview of how the interview schedules were categorised.

The interview schedule questions can be divided into the following themes, which address the research questions (Appendix 2)

- 1) Demographic information of population
 - 2) Educational/tertiary Information
 - 3) Mobile device ownership and use
 - 4) Use of mobile devices for academic purposes
 - 5) Library resource usage
 - 6) Use of the University of Pretoria mobile library services
 - 7) Comments
- Sections 1 and 2 investigated the demographics of the case study group in terms of the age, gender and study fields of the population in order to gain an understanding of the case study group.

- Section 3 investigated mobile ownership and use of mobile devices in the case study group to identify patterns and user preferences and views about their mobile devices.
- Section 4 investigated how the case study group accessed the internet, so that a background could be established to determine from which places and devices/hardware users preferred to access the internet.
- Section 5 investigated how users accessed the library resources, the devices used to access services as well as users' familiarity with resources.
- Section 6 investigated the respondents' participation in the first web survey (during 2010 [observation 1]) and their knowledge of the implemented mobile library website [intervention 1] and attempted to determine the usage of the mobile library website and to decide whether a second interview was needed.

3.4.4.1. Advantages and disadvantages of interviews

a) Advantages of semi-structured interviews

Some advantages of semi-structured interviews as described by Babbie (2005), de Vos *et al.* (2005), Leedy and Ormrod (2013) and Struwig and Stead (2001) are:

- Semi-structured interviews are more versatile and flexible for both the researcher and the participant.
- The researcher has more control over the response rate than with questionnaires.
- The researcher is able to follow up on interesting avenues presented by the participants.
- With the interview schedule the researcher is able to ask participants the same questions.
- The interview is guided by the interview schedule but not dictated to by the schedule.

In this research study, interviews were more appropriate for the study in terms of the flexibility and versatility of the study. The researcher was able explain unknown terminology to participants and prompt participants when interesting avenues were mentioned in order to obtain data necessary to answer the research questions. The interview schedule made it possible to ask the same questions to all respondents, since it guided the interviews, but was able to control discussions as well.

b) Disadvantages of semi-structured interviews

Some disadvantages of semi-structured interviews as described by Babbie (2005), de Vos *et al.* (2005), Leedy and Ormrod (2013) and Struwig and Stead (2001) are:

- Interviewing can be time-consuming.
- A researcher can only interview one participant at a time.
- Some participants may be reluctant to answer questions posed directly by the respondent, compared to online questionnaires.
- When using tape recordings, participants might withdraw.
- The researcher should have the ability to cope with unanticipated problems.

In this research study participants were informed and asked for permission to record the interviews beforehand. As interviews are time-consuming, the researcher conducted a pilot study to determine how long the interview might be and time was scheduled accordingly. In addition, the researcher made use of focus interviews to overcome time constraints.

3.4.5. The pilot study

A pilot study is a test or small-scale implementation of the main planned investigation to determine and test the feasibility of the research study, and to determine if any deficiencies exist (Babbie, 2005: 265; de Vos *et al.*, 2011: 73). A pilot study was conducted prior to the main investigation with a small group of students from the Natural and Agricultural Sciences faculty. The researcher selected students who were available in the

library, and tested the questions of the semi-structured interview to establish whether the questions were appropriate in relation to the research questions. It was found that the questions were appropriate; however, in some cases students pre-empted questions, or provided answers to questions that had not been asked yet. The questions were not changed, seeing that some library users needed to be prompted to answer questions compared to others who answered questions not mentioned yet. The pilot study assisted the researcher to determine the time needed to address all questions, which assisted in the management and scheduling of the interviews.

This section provided a discussion on the research data collection methods used in this study. The primary data collection methods were discussed, which described how the literature review was used to gain an understanding of existing practices of libraries in terms of mobile services and products, as well as a review of what South African libraries are implementing in terms of mobile library services. A secondary data collection method was used. This method comprised semi-structured interviews and focus interviews. This section described what these data collection method entailed and how they were used in the study. In addition, the interview schedule was described and the themes of the questions included in the interview schedule were given. The section concluded with a discussion on the advantages and disadvantages of semi-structured interviews and a description of the pilot study. The following section describes how the sample was selected from the population.

3.5. Sampling

The sampling technique used in this research study was convenience sampling, a non-probability sampling technique (Strydom & de Vos *et al.* 1998: 198; Thomas, 2003: 91-92). In non-probability sampling the probability of a population member being chosen for the sample is unknown; the researcher is unable to forecast that any member of the population will be included in the sample and that some members of the population may have a small or no chance of being included in the sample (Leedy & Ormrod, 2010: 211; Struwig & Stead, 2011: 111). The non-probability sampling technique that was used is called convenience sampling. Convenience sampling is based on the availability of members of the population as a result of accessibility (Leedy & Ormrod, 2010: 212;

Struwig & Stead, 2011: 111). In view of the time and nature of this research study, a case study group was used as the sample from which to collect data. The case study is described in section 3.2.2.2. above. The following paragraph describes how the research location was selected.

3.6. Selection of research location

The population or target group of the study were students of the University of Pretoria. The selection of the research location was based on the availability and accessibility of students. The research location was the Hatfield campus of the University of Pretoria, situated in Pretoria, Gauteng province of South Africa. This location was chosen as this campus “houses the majority of faculties” and is seen as the main campus of the university (University of Pretoria, 2012). This campus is home to the faculties of Humanities, Law, Theology, Economic and Management Sciences, Natural and Agricultural Sciences and Engineering, Built Environment and Information Technology. The data had to be analysed and interpreted after being collected. The following section describes how the data were analysed and interpreted.

3.7. Data analysis and interpretation

Data analysis reports on how the data collected are organised and analysed in order to present and interpret the findings of the study, and bring meaning to large amounts of data (Bloomberg & Volpe, 2012: 109; Struwig & Stead, 2011: 169). Chapter 4 details how the data collected were analysed and interpreted and how inferences were drawn from the data collected from both the qualitative data collection method (transcripts of the semi-structured interviews) and the quantitative questions included in the interview schedule. Data tabulation and investigation were used as a quantitative data analysis method to edit and encode the data collected. By using data tabulation, the researcher is enabled to eliminate errors and place data into categories (Struwig & Stead, 2011: 150). As the quantitative responses are on a smaller scale, the categorical variables approach was used for the demographic and educational information data collected. The qualitative data

analysis method used to analyse and interpret the data was data coding. Through data coding, information is grouped according to themes, which are assigned to codes or categories (Struwig & Stead, 2011: 169). Codes were assigned to the questions linked to the following research questions:

- How do the mobile library services meet the needs of the University of Pretoria Library Services users?
- What mobile library services and products are being used and what services are not being used by library users?
- How have users' library needs for mobile library services changed since the implementation of the mobile library services?

Chapter 4 describes the data analysis and interpretation of data further to establish the enhancement of mobile library services.

3.8. Conclusion

This chapter summarised the research design, approach and methodology, as well as the primary and secondary data collection methods, namely the literature review, semi-structured interviews and focus interviews. This chapter further discussed how the pilot study was used to test and evaluate the interview schedule in terms of the interview questions and time needed for the data collection. The selection of research location and selection of the sample were described and the sampling method was outlined. The chapter concluded with a description of the data analysis and interpretation used, which is explained in more detail in chapter 4.

CHAPTER 4: DATA ANALYSIS AND FINDINGS

4.1. Introduction

The purpose of this chapter is to describe the data collected during the semi-structured interviews so as to provide meaning and interpretation. The interviews were called observation 2 [O2] as described in the research design in chapter 3. The observation was done after the intervention [X1] had been implemented. This chapter aims to provide organisation and interpretation of the data in terms of the research questions posed (chapter 1). The data analysis was done by grouping data into themes or sections, as described in chapter 3. Subsequent paragraphs in this chapter describe the themes, analysis and interpretation of the themes, as well as a comparison to observation 1 [O1], an online survey conducted in 2010.

4.2. Background of the data collection and case study

The research study used convenience sampling, as discussed in chapter 3. Nine students were conveniently selected as participants for individual interviews for the study. A focus interview was conducted with six students. The following paragraphs describe the themes/sections that were used to group questions for data analysis.

4.3. Themes for application of data analysis

As discussed in chapter 3, themes/sections were used in order to group the interview questions. The sections were divided as follows:

- Sections 1 and 2 investigated the demographics of the case in terms of the age, gender and study fields of the population in order to gain understanding of the case study group.

- Section 3 investigated the mobile ownership and use of mobile devices of the case study group to identify patterns and user preferences and views about their mobile devices.
- Section 4 investigated how the case study group accessed the internet, so that a background could be established to determine from which places and hardware devices users preferred to access the internet from.
- Section 5 investigated how users accessed the library resources and the devices used to access services, as well as users' familiarity with library resources.
- Section 6 investigated the case study group's participation in the first web survey (during 2010 [observation 1]), their knowledge of the implemented mobile library website [intervention 1], as well as usage of the mobile library website. This was necessary to determine whether a second interview was needed.

The applications of these sections are described in the following paragraphs.

4.3.1. Demographic information of population and study fields

The demographic information section describes the case study group in terms of gender, age and degree studied to understand it.

4.3.1.1. Gender and age

At the University of Pretoria 6 115 students enrolled during 2012 for degrees in the Natural and Agricultural Sciences faculty (University of Pretoria Management Information, 2012). Of these 6 115 students, 2 791 were male and 3 324 female. The total number of enrolments in the entire University of Pretoria for 2012 was 20 554 males and 25 088 females. During this study, nine individual interviews were conducted, in which six males and three females participated (Figure 4.1.). The focus group interview involved of six students. The students were all postgraduate students from the department of Food Sciences, studying full-time at the University of Pretoria, the group consisting of three males and three females.

A study conducted during 2011 by Accenture indicated that young consumers aged between 18 to 35 years are the leading adopters of new technologies such as mobile devices (Accenture, 2012). This reports also found that this group of consumers owned more devices than e.g. the age group aged 35 to 55. The group of participants interviewed included mainly individuals aged 20 years and younger (Figure 4.2.). All participants were full-time students at the University of Pretoria. The participants in the focus group interviews were all aged between 20 and 30. For the purpose of this study the age group of participants was therefore appropriate in relation to the goals of the study.

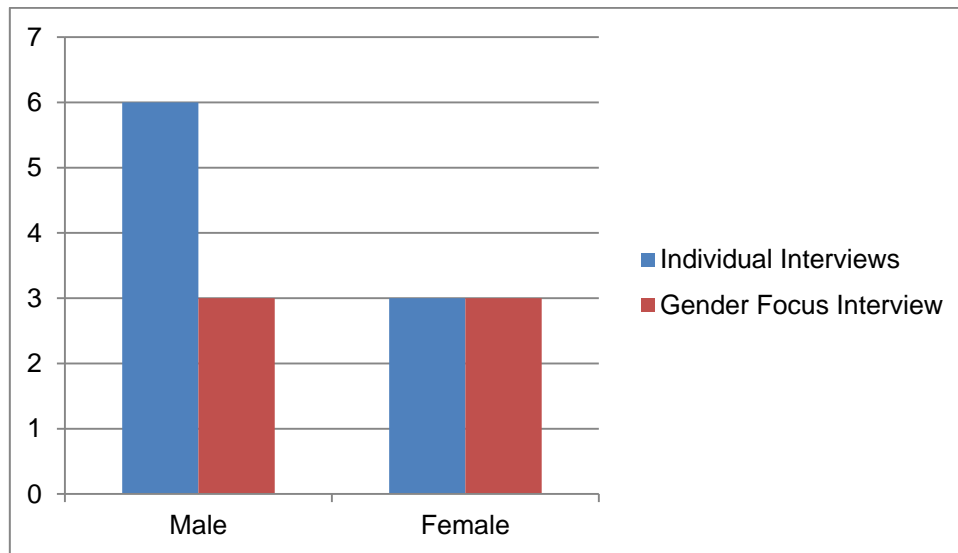


Figure 4.1.: Gender of interview participants

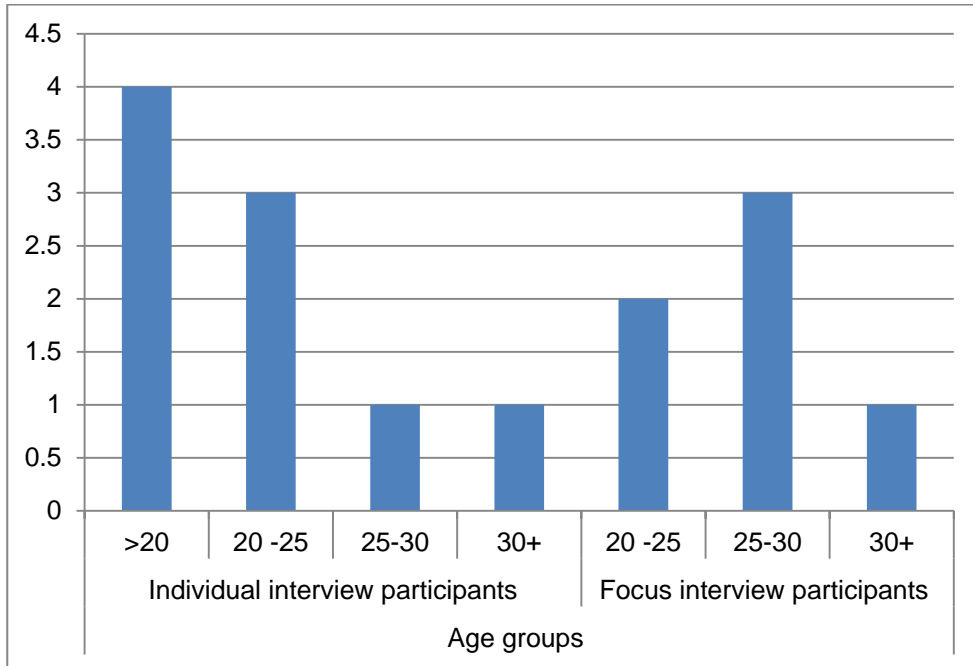


Figure 4.2.: Age distribution of interview participants

4.3.1.2. Educational/tertiary Information

Figure 4.3 indicates the degree studied by the interviewed participants. The case study is based on Natural and Agricultural Science students.

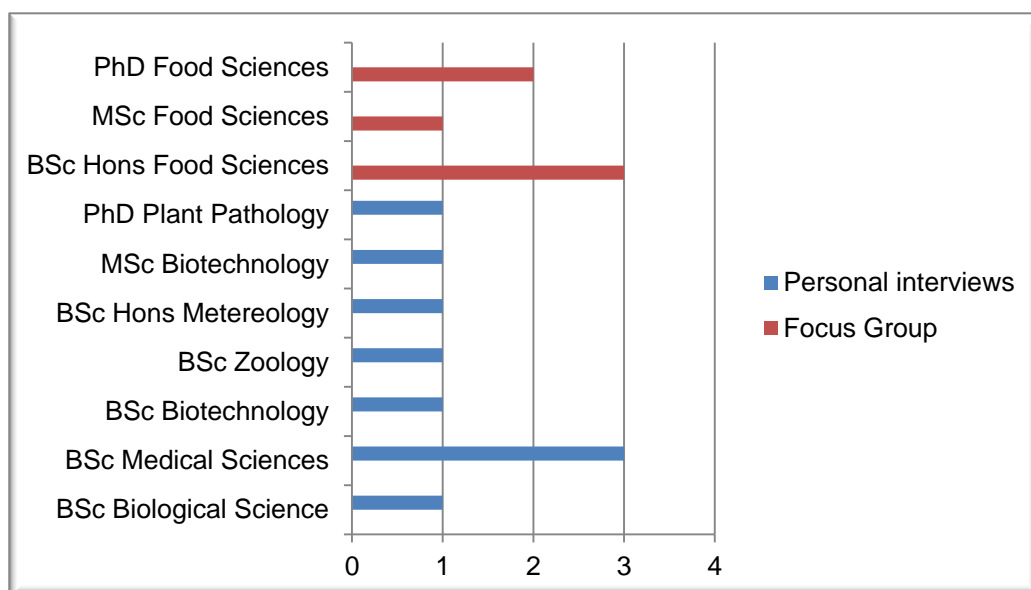


Figure 4.3.: Degree studied by interview participants

From Figure 4.3 it can be seen that more postgraduate students participated in the research study compared to the participants of the 2010 online survey, when 18% of the respondents were postgraduates and 58% were undergraduates (Appendix 2). This may have been a result of the researcher using a convenient sampling method compared to an online survey conducted in 2010. The following section reports on the data collected with regard to the mobile ownership and use of mobile devices of the Natural and Agricultural Sciences students.

4.3.2. Mobile device ownership and use

Section 3 of the interview schedule was designed to determine which mobile devices students owned, whether they were on contract or prepaid data and/or call services, and to determine how they used their mobile devices. In addition, students were asked about their future plans in terms of mobile device ownership to determine if they would change and acquire other mobile devices within the next year. The aim of this section is to identify possible patterns and compare data with observation 1 (see Appendix 2)

4.3.2.1. Mobile ownership

According to a number of statistical reports, such as those of Accenture, (2012), Brenner, (2013) and Stats SA (2012) in South Africa, 75% of households have access to a cell phone and 75% of South African consumers own a smartphone; ownership increased to 89% of citizens purchasing a smartphone in 2011.

It was found that all 15 participants interviewed owned a cell phone and two of the participants owned more than one cell phone. All of the participants owned some model of cell phone that is able to access the internet or can be used to download mobile applications. Only two of the participants (who owned more than one cell phone) indicated that the second cell phone they owned was not able to access the internet or able to download mobile applications. These findings are aligned with the statistical reports mentioned above in terms of ownership of cell phones by South Africans and the age group 18 to 29.

Figure 4.4. depict participants' ownership of more Blackberry and Samsung model cell phones compared to iPhone, Nokia and Motorola cell phones. In addition, students were asked which other types of mobile devices they owned. Figure 4.5 indicates that students owned more cell phones and laptops than other mobile devices such as media tablets, iPods or e-readers. It was found that most students owned a cell phone and laptop; however, only two of the students owned a mobile tablet device.

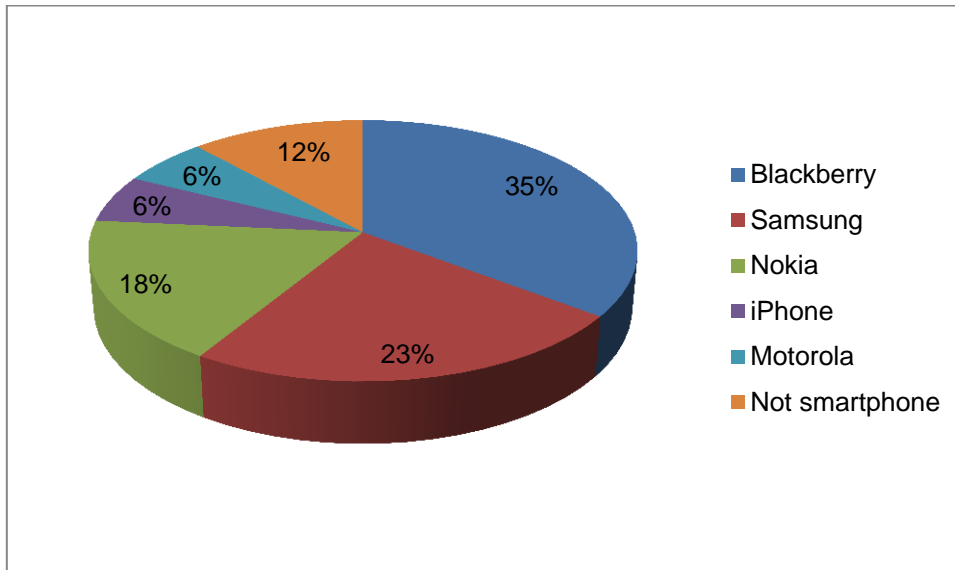


Figure 4.4.: Cellular ownership of interview participants

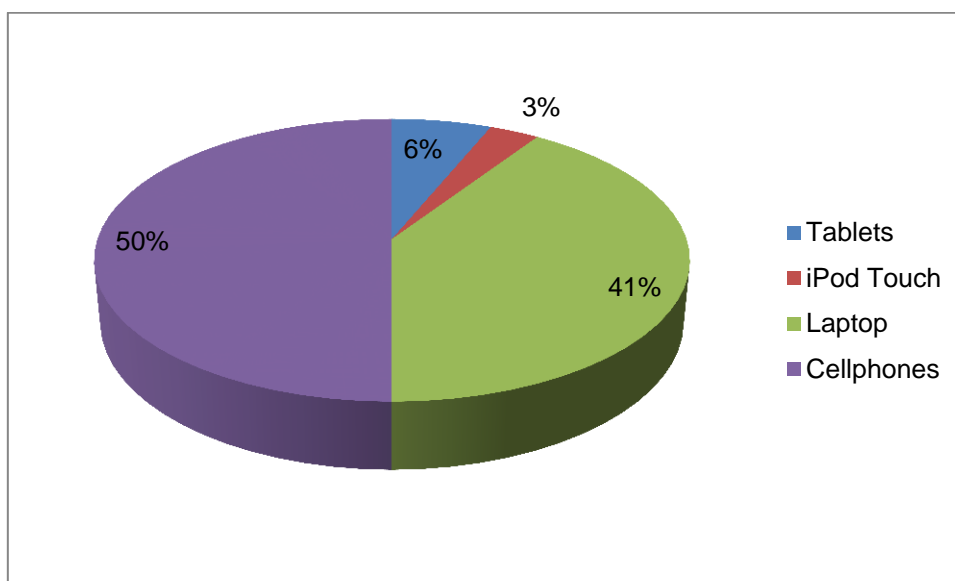


Figure 12: Mobile ownership of interview participants

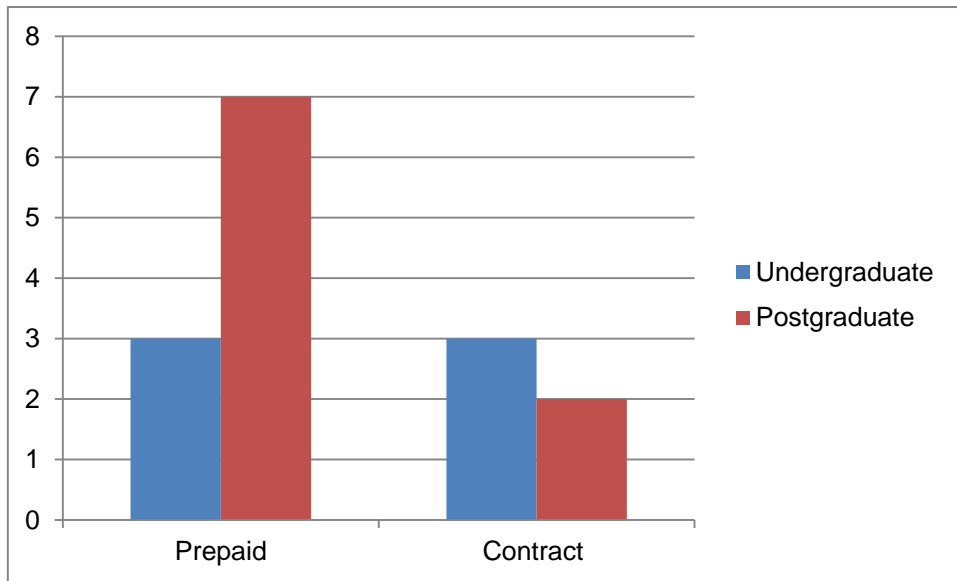


Figure 4.6.: Mobile prepaid or contract funding of mobile devices

Students were further asked how they funded their mobile devices (in terms of airtime), whether they used prepaid (loading airtime on the go) or contract services (Figure 4.6). For the undergraduates it was found that they used prepaid and contract service equally; however, the Blackberry device owners were found to use contract services . It was found that postgraduates used more prepaid services compared to contract services and contract services were found to be used mainly by the Blackberry owners. This may be due to the fact established by Unicef (2012) that South African mobile users prefer prepaid services rather than contract services because of the low cost and the irregular income of consumers. Unicef (2012) also found that consumers preferred prepaid services, as contract services require documentation for subscription.

In 2010 (Appendix 2) most participants owned Nokia cell phones, followed by Blackberry and Samsung devices. There has been an increase in Blackberry device ownership (at 35% in 2012 compared to 12% in 2010), followed by Samsung and Nokia, in 2012. The ownership of iPhone (6% in 2012) is still very small and did not show growth compared to 6% in 2010 (Appendix 2).

4.3.2.2. Mobile use

Most students indicated that they use their cell phone more than other mobile devices (such as their laptop or tablet). Students indicated that they use cell phones more for personal reasons compared to using laptops for more academic purposes. The use of cell phones is as follows:

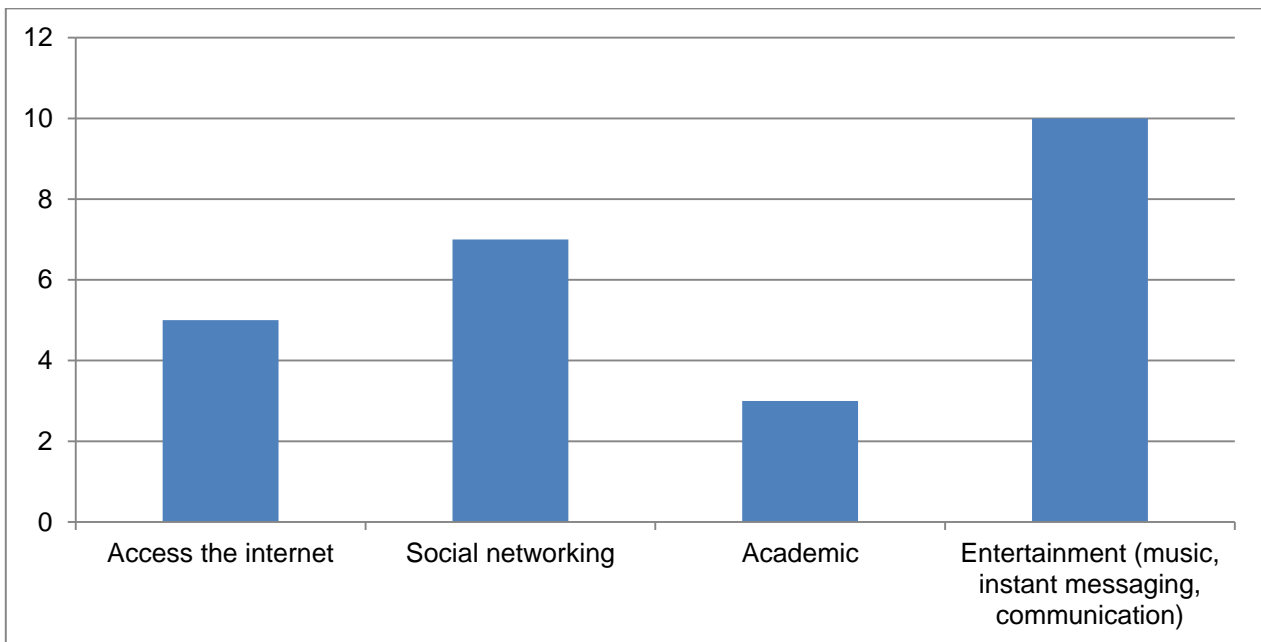


Figure 4.7.: Use of mobile devices

- Students mainly use their cell phones for entertainment, e.g. music, and for instant messaging, social networking and connecting with friends.
- Students use cell phones for access to the internet less than for entertainment; however, they also commented that internet searching is limited to simple web searching rather than for academic purposes.
- Most students indicated that they used laptops for academic purposes, such as for assignments, lecture notes and accessing books; however, most postgraduates indicated that their use of laptops is higher than their use of cell phones for academic purposes.

In an American survey (Duggan & Rianie, 2012) it was found that consumers' activities on cell phones was higher for texting and SMS services than for internet searching or

academic activities. The findings from this study were therefore aligned to international trends such as those identified by Duggan and Rianie (2012).

4.3.2.3. Future ownership

Students were asked which mobile devices they were planning to acquire in the next 12 months. Most students indicated that they would be acquiring the Apple iPhone 4 or Apple iPhone 5, compared to Blackberry and Samsung phones (Figure 4.7). Only two students indicated that they would be acquiring a mobile tablet (Apple iPad) in future. Participants gave the following reasons for acquiring new mobile devices:

- Some students were replacing their existing cell phones with Apple products (iPhone, iPad) as they regarded the Apple technology as better than the Blackberry technology;
- Students were finding the Blackberry not to be compatible with their needs;
- Students who indicated that they would be acquiring tablets indicated that the current screen sizes of the cell phones were too small to read documents;
- The focus interview students indicated that their device ownership over the next 12 months was dependent on their professional and financial situation over the period.

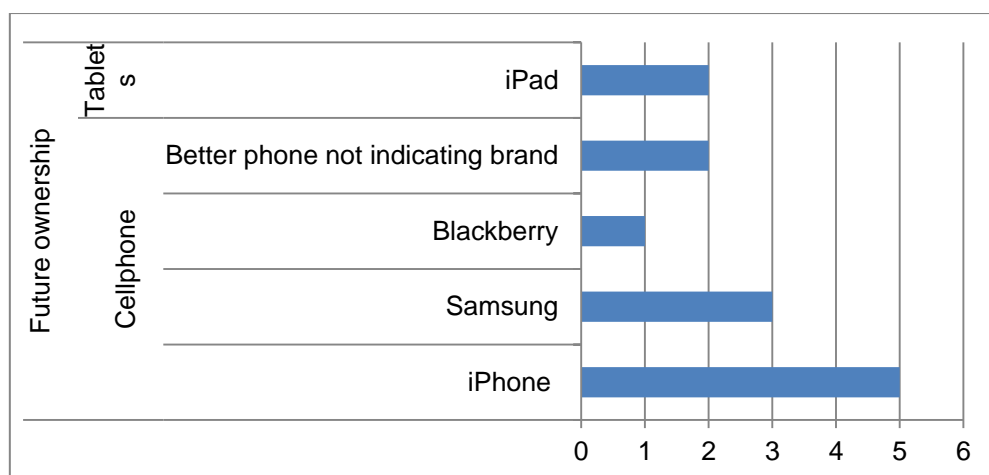


Figure 4.8.: Future mobile ownership

A pattern can be seen when comparing observations 1 & 2 (2010 online survey and the current 2012 study). During the 2010 online survey only 34% of respondents owned smart phones. In 2012, more than 53% of the students owned cell phones that were able to download applications (which can be seen as smartphones). In future (which was defined as the next 12 months) five of the 15 students (33%) said that they would be upgrading their existing cell phones to Apple iPhones and Blackberry and Samsung phones. However, the acquisition of media tablets is very low and students did not want to acquire e-readers at the time when this study was conducted. This pattern is in alignment with statistical information from Accenture (2012) that found that tablet ownership in 2011 was only 12% compared to smartphone ownership and e-book reader ownership less than 10%; however, future ownership is predicted to increase for both smartphones and tablets (Accenture, 2012).

This section provided insight into the types of devices that students owned, and the devices which students planned to acquire in the following 12 months. The following section reports on which devices students use to access the internet (in general and not specific to academic or personal use) and also discusses the devices and the main locations from where students access the internet.

4.3.3. Use of mobile devices for academic purposes

4.3.3.1. Devices mainly used to access the internet

Approximately 93% of the students indicated that they preferred to access the internet either from a laptop or from campus computers, 26% preferred to access the internet from a cell phone and 20% from home (Figure 4.9). It was found that postgraduate students mostly accessed the internet from their campus, laboratory or departmental computers and they supplied the following reasons for this:

- Free internet is available to postgraduate students at the University of Pretoria'
- It is cheaper to download big files from campus than from home.
- The internet connections are faster on campus compared to internet speed at home or from a cell phone.

- Screens on the laboratory computers are bigger than the cell phone screen, which makes it easier to read literature.
- Most postgraduate students are on campus most of the day, therefore it is convenient to use campus computers and internet access from campus.

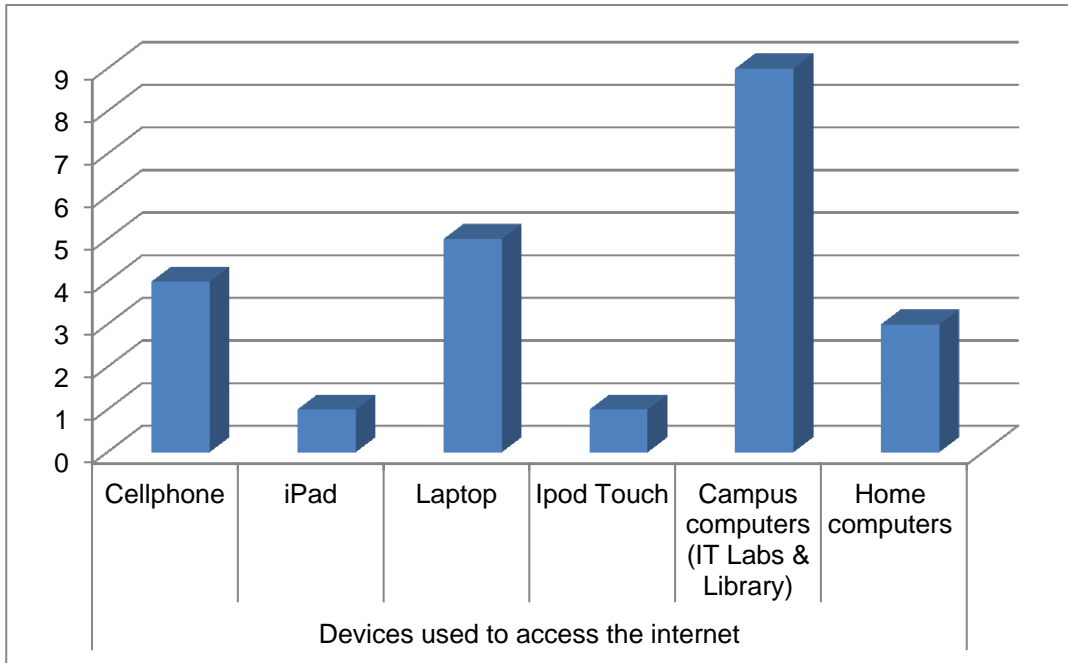


Figure 4.9: Devices used to access the internet

Undergraduate students use their mobile devices more often to access the internet than postgraduate students do. All the postgraduate students who participated in the interviews are full-time students who are on campus most of the day and therefore have access to dedicated computer facilities in either their laboratories or departments and as mentioned, internet usage for post-graduate students at the University of Pretoria is free. Therefore, as mentioned above, the cost of internet usage may be a reason for postgraduate low use of internet on mobile devices compared to internet use on campus and laboratory computers.

4.3.4. Library resource usage

4.3.4.1. Use of mobile devices for academic purposes

Six (40%) of the 15 participants indicated that they preferred using their laptop for academic purposes four (26%) indicated that they would use their cell phones for academic purposes and two students (13%) indicated that they would not use a cell phone for academic purposes (Figure 4.10). Both of these students were postgraduates. One (6%) other participant claimed to be using an iPod to record lectures and access the university learning system.

During the focus interview postgraduate students indicated that using cell phones for academic purposes was problematic for the following reasons:

- Screen sizes are too small for reading cell phones are used to do quick reference searching or viewing but files are transferred from cell phones to devices with bigger screens (such as laptops).
- A cell phone is too expensive to use for accessing the internet compared to free internet access in the laboratories.

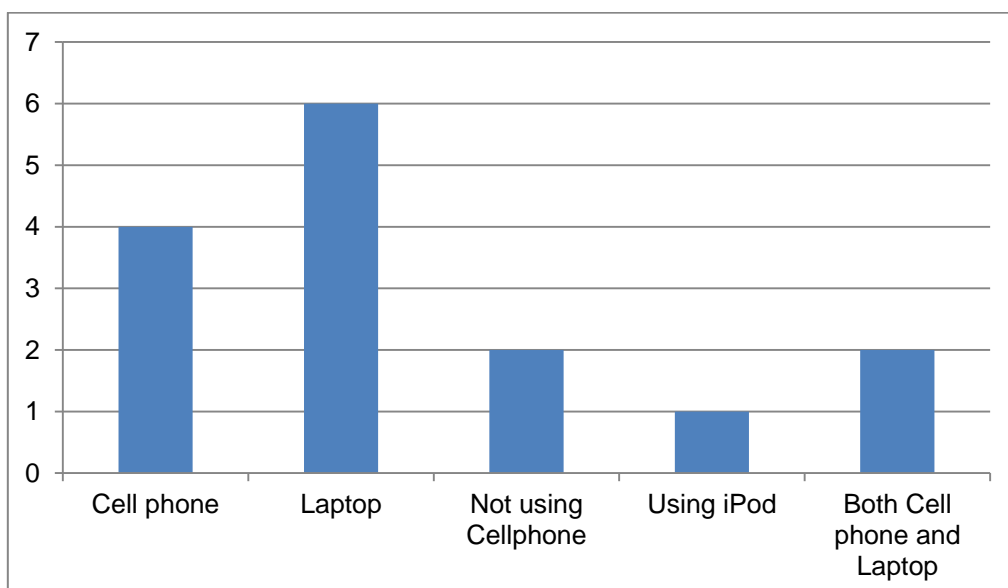


Figure 4.10: Use of mobile device for academic purposes

4.3.5. Use of the University of Pretoria Library Services

This section was focused on how students use the library, in terms of the physical building, reasons for visiting the library, and which library services and resources students use.

4.3.5.1. Visiting the physical library

Visits to the physical library building by students in the Natural and Agricultural Sciences faculty are depicted in Figure 4. 11below. Figure 4.11 illustrates that eight postgraduate students (53%) seldom visit the physical library. Undergraduate students visit the physical library on a more regular basis (at least three to four times a week), compared to postgraduate students. Undergraduate students stated that visits to the library were mainly for studying (42%), compared to other visits for fetching books from the shelves (17%) and access to computers (17%). Although postgraduate students seldom visit the library, the main purpose of such visits would be to collect books (postgraduate), whereas undergraduates use the library for studying and accessing the learning system (Figure 4.12(a) and Figure 4.12(b)).

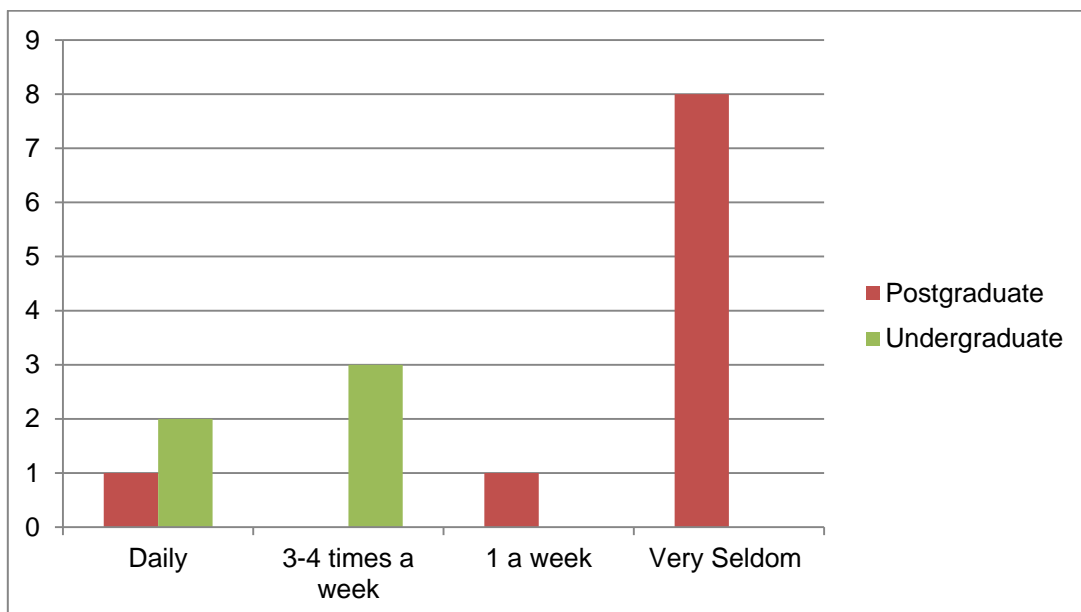


Figure 13: Student visits to the physical library

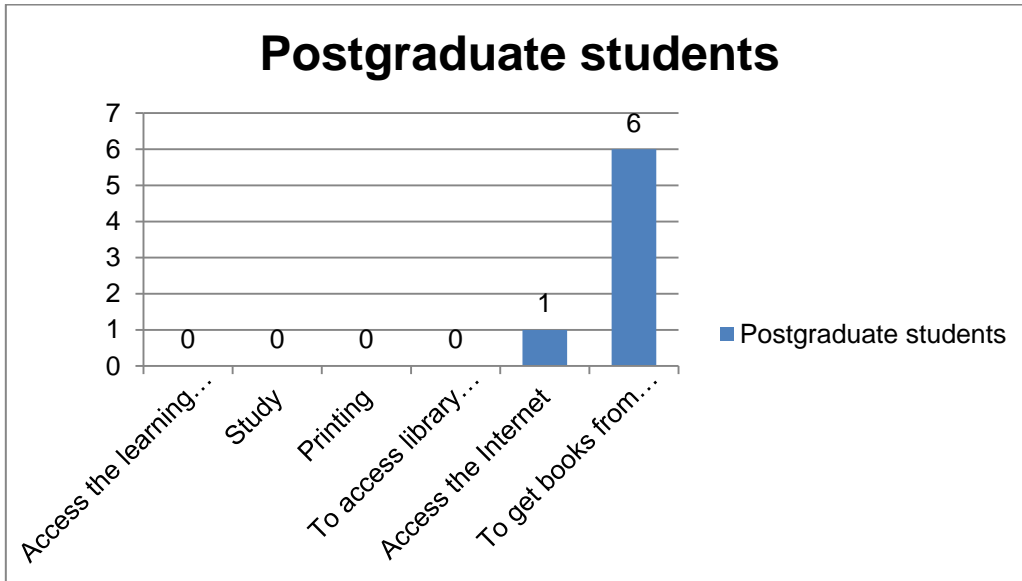


Figure 4.12 (a) Postgraduate students' reasons for visiting the physical library

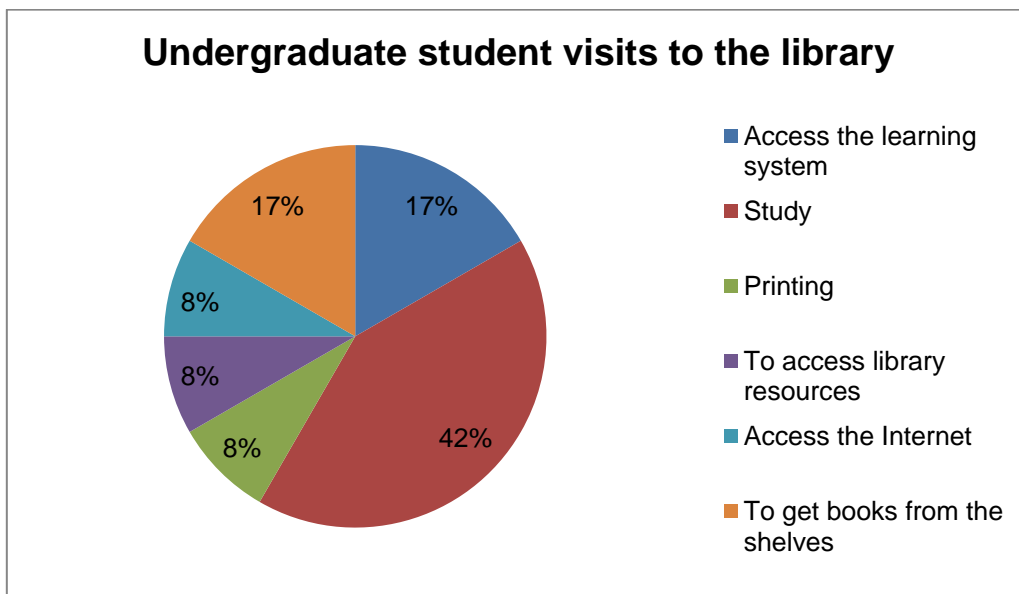


Figure 4.12 (b) Undergraduate students' reasons for visiting the physical library

4.3.5.2. Use of library online resources

Students were asked about their use of online library resources. Thirteen (86%) of the participants indicated that they were familiar with the library’s online resources and 11 (73%), the larger proportion, are comfortable using the resources. Thirteen students (86%) indicated that they accessed online resources more often from the library computers, campus computers or laboratory computers, one (6%) student indicated accessing the online resources from home and one student indicated using both laboratory computers and a computer at home. Only two (13%) students (undergraduate students) indicated that they seldom used their cell phone or iPod to access library online resources.

No students indicated using mobile tablets to access library resources. The reason for this low use may be that only two (13%) students participating in the study owned tablets and these two students indicated that the tablets were only for personal use, such as watching movies or listening to music or sending and receiving emails.

Figure 4.13 indicates the library resources that students use most often. Databases (36%), e-journals (29%) and the library catalogue (18) are used more than services and resources such as examination papers (11%), interlibrary loans (3%) and e-books (3%).

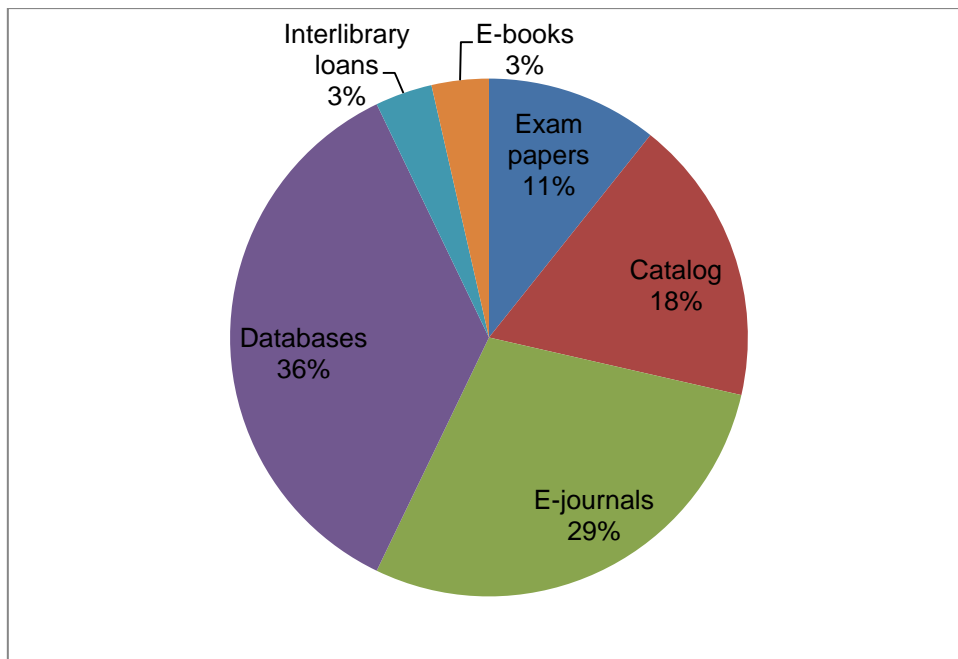


Figure 4.13 Online resources used for academic purposes

In addition to the above-mentioned library resources and services, participants were asked whether they made use of other online resources to which the library does not have subscriptions. Figure 4.14 indicates that 43% of participants used Google and Google scholar (38%) in addition to the resources and services described in Figure 4.13.

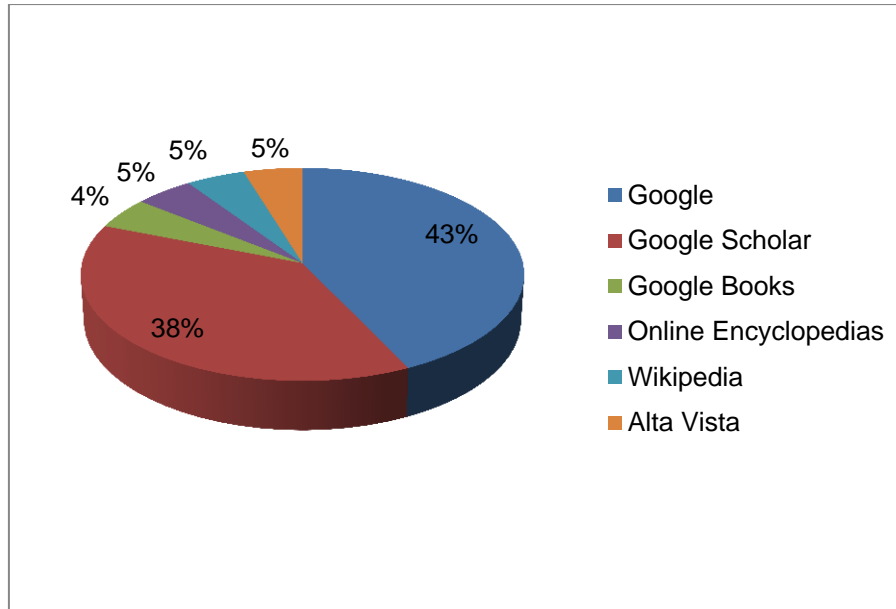


Figure 4.14. Other online resources, not offered by the library

Although undergraduate students visit the library, it is not primarily for accessing online resources, but rather for collecting of books and other studying purposes. Postgraduate students seldom visit the physical library; however, they do use the online library resources. It can be concluded that both undergraduate and postgraduate students are familiar with online library resources, but use these resources from locations and/ or devices other than the physical library.

As discussed in section 4, postgraduate students use mostly computers in laboratories and laptops to access library resources, compared to undergraduate students who use their personal devices, as well as campus computers, to access library resources. In order to assess the students' needs for library resources, the following section discusses data collected on students' needs for library resources from mobile devices and to ascertain the use of the mobile library website, as well as to compare students' needs for mobile library services and resources.

4.3.6. Use of the University of Pretoria Library Services mobile website

It was necessary to establish how many students had participated in the previous survey, which was conducted in 2010 (observation 1 [O1] as discussed in chapter 3). This section was included to establish the use of the intervention [X1] (the mobile library website) implemented after the online survey. In addition, this section was intended to establish whether the student's needs for mobile library services had changed over time and to determine present and future needs in terms of mobile library resources and services.

4.3.6.1. Participation in 2010 online survey

Of the 15 students who participated in the interviews, only one student had participated in the 2010 online survey. The reasons for this are:

- The 2010 online survey was an anonymous survey and participants could therefore not be included in the 2012 study intentionally.
- Most undergraduate and postgraduate students who participated in the interviews were only enrolled as students at the university from 2011 to 2012.
- The study focused on students in Natural and Agricultural Sciences only and excluded other participants, such as academic staff (who participated during the 2010 online survey).

4.3.6.2. Awareness and use of the mobile library website

Students were asked whether they were aware that the library had implemented a mobile library website. Of the 15 students, nine (60%) indicated that they were aware of the mobile library website and six (40%) indicated that they were not aware that such a service was available. Of the nine students (60%) who were aware of the mobile library website, only two (13%) indicated that they had used the mobile library website.

4.3.6.3. Use of the mobile library website

Two students (13%) who had used the mobile library website are undergraduate students aged >20 in their second year of study. One student reported downloading the University

of Pretoria mobile application (discussed in chapter 2) from the Android app store onto a cell phone and accessing the library catalogue and examination papers through the mobile application. The second student reported accessing the mobile library website through the cell phone's browser and using the databases and dictionary links. Both students indicated that they did not require any other resources, services or enhancements to the current mobile library website or content of the mobile library website. Both students also indicated that the navigation and layout needed no enhancements. The students found the website very simple to use, in terms of the layout and design as well as the navigation.

4.3.6.4. Students who had not used the mobile library website

Of the 15 participants 13 (87%) indicated that they had not used the mobile library website before. Table 4.1 below illustrates findings from students who had not used the library mobile website. The table includes reasons students gave for not using the mobile website, which can be divided into two categories: (a) students knowing about the library mobile website and not using the mobile website and (b) students being unaware of the library mobile website.

Table 4.1 Reasons for not using the library mobile website

Non-use category	Reasons for not using the mobile website
(a) Students who know about the mobile library website	<ul style="list-style-type: none"> • The current cell phone owned causes problems or has insufficient capabilities • Students have not got around to testing or accessing the mobile library website • Students have had no need to access the mobile library website • Students are not on contract and internet access from cell phones is expensive • Students do not know how to go about accessing the mobile library website
(b) Students who are not aware of the mobile library website	<ul style="list-style-type: none"> • Students indicated that they did not know about the website

Table 1: Reasons for not using the library mobile website

4.3.6.5. Use of mobile library website in future

The 87% of participants who had not used the mobile library website prior to this study all indicated that they would like to access library resources and services via their mobile devices in future. Future use would occur more often from media tablets (63%) compared

to access from a mobile phone (37%) because of the bigger screen capability of the media tablets compared to cell phones (Figure 4.15).

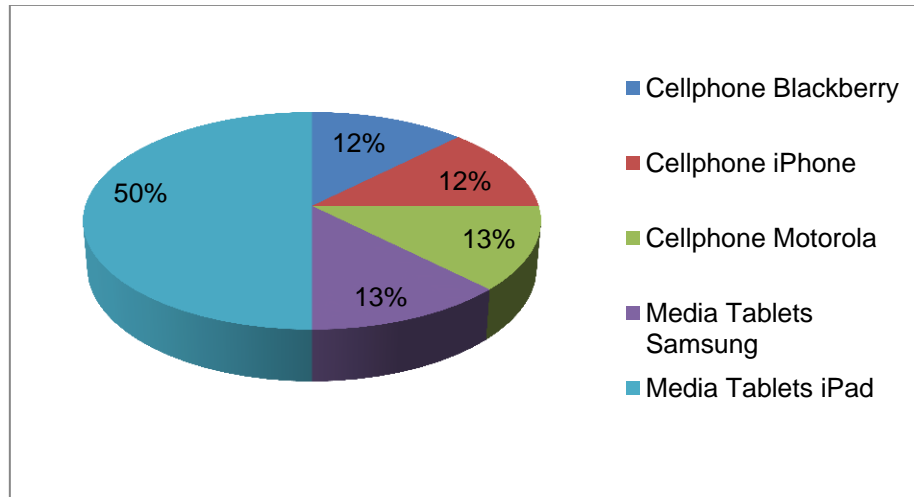


Figure 4. 15. Devices to be used to access the library mobile website

4.3.6.6. Library resources on the mobile library website

The following section describes which library resources and services participants indicated they would like to access from a mobile device.

4.3.6.7. Library resources to be accessed from mobile devices

Students who had not used the library mobile website indicated that they would like the resources mentioned below to be available from a mobile device (depicted in Figure 4.15.). Undergraduate students indicated a greater need for catalogue searching and access, e-journals and e-books rather than examination papers, reference works and databases. Postgraduate students' need for access to databases and searching functionalities is higher than for catalogue searching and other resources such as examination papers and reference works.

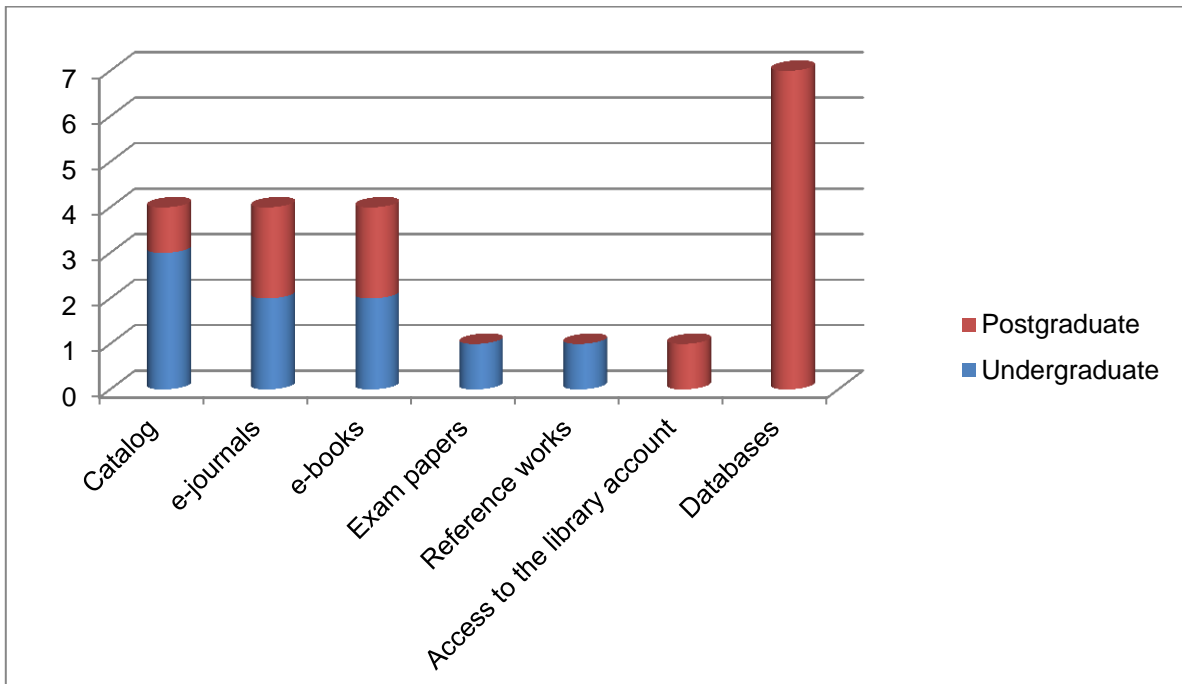


Figure 4.15. Library resources students would want from a mobile library website

During the 2010 online survey [observation1] the respondents stated that the following top five library resources were needed from a mobile device (Appendix 2):

1. Library account
2. Library catalogue
3. e-books
4. Journal articles
5. e-Examination papers.

During the 2012 research study it was found that the top five library resources needed from a mobile device were the following (Figure 4.15):

1. Databases
2. Library catalogue
3. E-journals
4. e-books

5. Examination papers, reference works, access to the library account

It can be concluded that students' needs for mobile library resources over two years have not shown significant change. The most noteworthy change in students' needs was that most students indicated the need for databases to be available from a mobile device, compared to access to the library account being the most needed resource on mobile during the 2010 online survey. All resources identified in Figure 4.15 are already available on the library mobile website (as discussed in chapter 2). A survey of mobile library services identified in chapter 2, in studies such as those by Barnhart & Pierce (2011), Lippincott (2009) and Vila *et al.* (2010), shows that the University of Pretoria Library Services are providing similar mobile services as international university libraries.

In addition to library resources and products accessible from mobile devices, students were asked to identify which additional services they would like the library to implement. These services are discussed in the following section.

4.3.6.8. Additional library services needed from mobile devices

Students were asked which services they would need in addition to services or resources currently available on the library mobile website. As discussed in chapter 2, academic libraries both nationally and internationally have created additional services via mobile websites and mobile applications. Such services range from reference, SMS, information literacy, ask-a-librarian, library tours, lending of mobile devices, facility booking and other services such as hours, location and contact details (chapter 2). Students who participated in the interviews indicated that the following additional library services should be available from a mobile device or as a mobile service:

- Lending devices such as media tablets for circulation from the library;
- Training materials of resources available from the library mobile website;
- Access to plagiarism and referencing techniques information from the library mobile website;

- Booking training from the mobile library website;
- Access to a mobile library helpline to call with queries concerning the mobile library services;
- Visible posters or information in the library on the mobile library websites, with instructions;
- Personal communication with librarians such as chat and email from the library mobile website;
- Training materials on how to use the mobile library website;
 - How to use the mobile website and mobile library resources
 - Hands-on training sessions on using the mobile library website (individual training and group sessions).

4.4. Conclusion

The data collected reflects that the mobile library services are used by only 13% of participants. Participants in the study indicated that although use of the mobile service is low, they would like to make use of the service in future. It was found that users' preference for mobile services have not changed significantly over the two years since the implementation of the mobile library website. Participants indicated that additional services are required, which are not available on the current mobile library website.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSION

5.1. Introduction

The purpose of this chapter is to reflect on the research questions and objectives of the study as stated in chapter 1, in terms of the literature review (chapter 2) and the research findings presented in chapter 4. This chapter further provides a discussion on the findings and recommendations flowing from the data collected and analysed, as well as the literature review, and provides a conclusion to the research study.

5.2. Findings

The objective of this research study was to investigate whether the development and implementation of mobile library services can advance service delivery for library users at the University of Pretoria Library Services. The following research sub-questions were formulated to provide answers to this research question:

Research sub-questions:

- I. Which mobile library services and products have been implemented at the University of Pretoria Library Services?
- II. How do the mobile library services meet the needs of University of Pretoria Library Services users?
- III. Which mobile devices do students own and how are these devices used, in terms of personal and academic use?
- IV. How have the user's library needs for mobile library services changed since the implementation of the mobile library services?

The following paragraphs report on the answers to the research sub-questions' that were reached and the literature that was reviewed.

5.2.1. Which mobile library services and products have been implemented at the University of Pretoria Library Services?

As discussed in chapter 2 (section 2.7.2), the University of Pretoria Library Services have implemented a mobile library website, which is accessible from mobile devices through the device's web browser. It was found that the library mobile website and mobile services are also available through the University of Pretoria mobile application, available for Android, Blackberry and Apple mobile devices.

In the literature review (chapter 2.6) it was found that many libraries are using the option of providing access through a mobile library website, or providing access through a downloadable mobile library application or using a combination of the two methods. This can be seen in the case of the University of Pretoria Library Services' mobile library service website and services.

The mobile library website was implemented after an online survey conducted during August 2010. Chapter 2 (section 2.7.2) discusses the various mobile library services available from the University of Pretoria Library Services' mobile website. As was found in the literature review, various mobile services and resources are made available through mobile library websites and applications; such as mobile OPACS, mobile databases and e-journals, reference services, special collections, borrowing and circulation of mobile devices and feedback services (chapter 2.3.4). The University of Pretoria Library Services render similar mobile services from the mobile website, such as:

- Mobile OPAC
- Contact information
- Hours of operation
- Maps and directions
- Access to databases and e-journals
- Mobile encyclopaedias
- Mobile dictionaries.

The following sections discuss how the mobile library services meet the needs of the University of Pretoria students in terms of mobile ownership (present and future) and the mobile library needs of students.

5.2.2. How do the mobile library services meet the needs of the University of Pretoria Library Services users?

The 2010 online survey results (Appendix 2) indicated that library users needed library services that were accessible from their mobile devices; 90% of the respondents in this survey indicated that they would like to access library services from a mobile device. During the 2012 research study 87% of the participants who had not used the mobile library website prior to the study all indicated that they needed library services from a mobile device and that most were already using mobile devices owned for academic purposes. University of Pretoria students therefore need mobile services; however, in the 2012 study it was found that most students were not aware of the existence of the mobile website.

The 2012 research study found that the library user needs a mobile website for quick reference, should a student not be near a laptop or computer, and that it is used as a secondary service, not a primary or main source of library access as indicated by some postgraduate students.

Students are already using their mobile devices for academic purposes, as shown in chapter 4.3.4.1. Although mobile devices are used students, especially postgraduate students, indicated that they preferred using a laptop or computer to access library resources rather than using library resources from a mobile screen [46% preferred using a laptop or campus computer, 26% preferred a cell phone, 6% preferred an iPod and 13% preferred using both a cell phone and a laptop]. In addition, students indicated that they would use a bigger screen device, such as a media tablet, more often than a mobile phone to access library resources.

There is thus a need for library services from mobile devices; however, the need is secondary to access to online library resources from a laptop or computer. In chapter 4 it was found that 93% of students preferred to use a computer or laptop as a primary access

point to library services and viewed the mobile library website as a secondary or supplementary access point when library services are needed. The following section discusses students' mobile ownership and use of mobile devices for personal and academic purposes.

5.2.3. Which mobile devices do students own and how are these devices used, in terms of personal and academic use?

5.2.3.1. Mobile device ownership

During the 2010 online survey it was found that students owned more Nokia and Samsung cell phones compared to Blackberry, iPhone, HTC and Motorola products. The report of the online survey did not indicate any ownership of other mobile devices such as media tablets or e-readers. The 2012 study showed that student's mobile device ownership had changed since 2010 in terms of the specific models of cell phones. According to the 2012 study, Blackberry and Samsung cell phones accounted for 58% of cell phone ownership of students; other products such as Nokia, Motorola and iPhone were less often owned by students. The 2012 study also found that no students owned any e-readers and only 6% of students owned media tablets. Students' planning for future ownership in terms of mobile devices indicates that more students will be acquiring new and additional mobile devices in future. More students will be acquiring iPhones compared to other mobile phones such as Blackberry and Samsung and 13% plan to acquire a media tablet. Therefore, more students are planning to replace or acquire new cell phones rather than other devices; no students are planning to acquire e-readers.

It can be concluded from the study that students are replacing and acquiring new mobile devices, which can be seen from mobile device ownership from 2010 to 2012.

5.2.3.2. Mobile device use for personal versus academic purposes

Most students were found to be satisfied with using their mobile devices for academic purposes, only two (13%) indicating that they did not have this preference. Students are already using mobile devices for different types of academic tasks, including searching for library-related information and learning system enquiries. However, the use of the library's mobile services is still limited because awareness of the mobile library site is still low.

Nevertheless, students have the devices to access the mobile library website and are positive about using the mobile library website. The following section describes how the students' needs have changed since the 2010 online survey.

5.2.4. How have the user's library needs' for mobile library services changed since the implementation of the mobile library services?

5.2.4.1. Needs for mobile library services

It can be concluded that students' needs for library services have not changed significantly over the past two years. The needs for library resources determined in 2010 compared to data collected in 2012 showed no significant change in the use of mobile library services from the mobile library website. However, a need for additional mobile services was identified. The 2010 results compared to the 2012 results showed that students' needs remained the same in terms of access to a library account, access to the library catalogue to search for resources, access to e-journals and e-books, access to examination papers and e-reference works. Students indicated in addition that although their needs were similar to those mentioned in the previous study, additional services were needed on the mobile website, as well as mobile services within the library.

5.2.4.2. Additional mobile library services

Students identified additional mobile library services they need. These additions are categorised as follows:

Additions on the mobile library website:

- I. Students indicated a need for access to training materials about library resources.
- II. They need access to plagiarism and referencing techniques information from the library mobile website.
- III. Students need to be able to book training from the mobile library website.

- IV. They require personal communication with librarians, such as chat and email from the library mobile website

Students also indicated a need for the following mobile services in the library:

- I. Circulation of mobile devices - lending devices such as media tablets for circulation from the library
- I. Access to a mobile library helpline to call with queries concerning the mobile library services
- II. Visible posters or information in the library on the mobile library website, with instructions
- III. Training materials on how to use the mobile library website
 - a. How to use the mobile website and mobile library resources
 - b. Hands-on training sessions on using the mobile library website (individual training and group sessions)

From the data collected it can be seen that students' needs for resources on the mobile website have stayed constant, with no significant change. However, a need for additional services as discussed in the literature (chapter 2) indicates that students require additional services, which are linked not only to changes on the website but also within the library and internal operations in the library.

5.3. Evaluation of the research methodology used

The primary research methodology used (as described in Chapter 3) was that of an experimental design. The specific design chosen was a quasi-experimental design in order to determine whether a cause-and-effect relationship which might influence the phenomenon or condition studied. Evaluating this design after the study found that it may not have been the best methodology chosen. The main reason is:

- Only 1 of the interview participants participated in the first study during 2010.
- The researcher was not able to identify the experimental Group (Group A) as the previous 2010 study was anonymous.
- The control group could not be evaluated prior to this study to determine participation in the previous (2010) study.

This methodology and data collection method was useful however it is suggested that other research methodologies be evaluated for similar studies.

5.4. Recommendations

The following paragraphs summarise recommendations made on the basis of the sections above.

- The University of Pretoria Library Services should market the mobile library website with emphasis on the mobile services and resources that are available to improve user awareness of the service.
- The University of Pretoria Library Services could add a chat functionality to the mobile website.
- The contact information could be updated by adding email contact information to the existing mobile library website.
- The library could conduct training sessions on mobile library services on an on-going basis to raise awareness of the mobile products and services and train users on how to use mobile resources.
- The University of Pretoria Library Services could conduct a feasibility study to determine the probability of lending/circulating mobile devices to students.
- Physical spaces are required to display or make available informational materials to raise awareness, and market mobile products and services.
- Dedicated support for mobile library service should be provided through a helpline.

- Similar research studies should be conducted at intervals to ensure user needs are identified and appropriate services are implemented, as users' mobile device ownership and needs for library services change.

5.5. Recommendations for further study

The following recommendations in terms of future studies could be implemented:

- Similar studies may be done in the other eight faculties of the university to determine whether all students' needs are similar or whether the needs of students differ between faculties.
- A study focusing on distance students may be done to determine whether the needs and usage of mobile library services differ between full-time students and part-time or distance students.
- A study to determine usage of the overall mobile library services could be conducted to determine how the mobile services are used, from which devices and if additional services are needed.

5.6. Conclusion

A Horizon report dated 2010 already showed that mobile technologies would affect the educational sector significantly. Reports as discussed in earlier chapters reported on the effects that mobile technologies have on libraries that service academic institutions and various studies throughout the report showed how libraries have created new services, such as mobile websites, mobile OPACS, mobile library applications and other mobile services and products to adapt to these changes.

As seen in chapter 2, South African libraries are already adapting to this change by introducing similar services to library users. At the University of Pretoria similar services have been implemented. Through this study it was found that students need mobile library services; however, such services are secondary or an additional service that library users

would like to have, but traditional library services through the internet are still on the whole preferred. This study found that users' needs will be changing in terms of mobile devices owned and preferred during the next 12 months. This study suggests that mobile library services are able to enhance the service delivery for libraries users.

References

- ACRL (Association of College & Research Libraries). 2011. Environmental scan 2010. [Online] Available <http://www.ala.org/acrl/sites/ala.org.acrl/files/content/publications/whitepapers/EnvironmentalScan20.pdf> [Accessed February 10, 2012].
- Accenture. 2012. Always on, always connected: finding growth opportunities in an era of hypermobile consumers. [Online]. Available http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_EHT_Research_2012_Consumer_Technology_Report.pdf [Accessed 2 February 2013].
- Anderson, L. & Andrews, J. 2011. Portable devices - libraries trying to meet the demands of the iPhone generation. *Library and Information Research*, 35 (111): 20-32.
- Ashcroft, L. 2011. Ebooks in libraries: an overview of the current situation. *Library Management*, 32 (6): 398 – 407.
- Ashford, R. 2010. QR codes and academic libraries: reaching mobile users. *College & Research Libraries News*, 71 (10) 526 – 530.
- Babbie, E. 2005. *The basics of social research*. 3rd ed. Thomson/Wadsworth: Belmont, CA.
- Barile, L. 2011. Mobile technologies for libraries. *College & Research Libraries News*, 72 (4): 222-228.
- Barker, K.R. *et al.* 2012. The implementation of embedded quick response codes into library resources to improve service delivery. *Journal of the Medical Library Association* 100 (1): 68 – 71.
- Barnhart, F.D. & Pierce, J.E. 2011. Becoming mobile: reference in the ubiquitous library. *Journal of Library Administration*, 51 (3): 279-290.
- Bloomberg, L.D. & Volpe, M. 2012. *Completing your qualitative dissertation: a road map from beginning to end*. Sage Publications: USA.

- Bornman, E. 2012. *The mobile phone in Africa: has it become a highway to the information society or not?* International Conference on Communication, Media, Technology and Design ICCMTD 09-11 May 2012 Istanbul – Turkey [Online] Available: <http://www.cmdconf.net/2012/makale/91.pdf> [Accessed July 24, 2012].
- Buczynski, J. A. 2008. Libraries begin to engage their menacing mobile phone hordes without shhhhh! *Internet Reference Services Quarterly*, 13(2-3): 261-269.
- Brenner, J. 2013. Pew internet mobile: Commentary. [Online] Available <http://pewinternet.org/Commentary/2012/February/Pew-Internet-Mobile.aspx> [Accessed 2 February 2013].
- Campbell, D.T. & Stanley, J.C. 1963. *Experimental and quasi-experimental designs for research*. Houghton Mifflin Company: Boston.
- Canuel, R. & Crichton, C. 2011. Canadian academic libraries and the mobile web. *New Library World*, 112(3):107 – 120.
- Choy, F.C. 2010. *Digital library services: Towards mobile learning. Seminar on E-books as learning resources in Chinese libraries in Asia (13 Jan 2010 : Kaohsiung, Taiwan: National Kaohsiung University of Applied Science)* [Online] Available <http://dr.ntu.edu.sg/handle/10220/6286> [Accessed February 19, 2012].
- Creswell, J.W. 2009. *Research design: Qualitative, quantitative and mixed methods approaches*. 3rd ed. Sage Publications: Thousand Oaks, Calif.
- Creswell, J.W. & Plano Clark, V.L.K. 2011. *Designing and conducting mixed methods research*. 2nd ed. Sage Publications: Thousand Oaks, Calif.
- Cummings, J, *et al.* 2010. The use of handheld mobile devices: their impact and implications for library services. *Library Hi Tech* 28 (1): 22-40.
- Dempsey, L. 2009. Always on: Libraries in a world of permanent connectivity. *First Monday*, 14 (1-5) [Online] Available: <http://0-frodo.lib.uic.edu.innopac.up.ac.za/ojsjournals/index.php/fm/article/view/2291/2070> (Accessed February 10, 2012).

- De Vos, A.S., *et al.* 2011. *Research at grass roots*. 4th ed. van Schaik Publishers: Hatfield, Pretoria.
- Ebsco Publishing. 2012. *Mobile access*. Ebsco Industries Inc. [Online] Available: <http://www.ebscohost.com/academic/mobile-access> [Accessed May 23, 2012].
- Etzo, S & Collender, G. 2010. The mobile phone 'revolution' in Africa: Rhetoric or reality? *African Affairs*, 109 (437): 659-668.
- Fling, B. 2009. *Mobile design and development*. O'Reilly Media, Inc.: Sebastopol, Calif. [Online] Available: <http://0-proquestcombo.safaribooksonline.com.innopac.up.ac.za/book/programming/mobile/9780596806231> [Accessed March 1, 2012] .
- Goodwin, S., Shurtz, S, Gonzalez, A. & Clark, D. 2012. Assessing an e-reader lending program: From pilot to mainstream service. *Library Review*, 61(1): 8 – 17.
- Hahn, J. 2008. Mobile learning for the twenty-first century librarian. *Reference Services Review*, 36(3): 272-288.
- Havelka, S. & Verbovetskaya, A. 2012. Mobile information literacy: let's use an app for that! *C & RL News*, 73 (1): 22-23.
- Herther, K.N. 2011. From cloud to mobile: drawing down big info into little apps. *Computers in Libraries*, 31(7): 6-12.
- ITU (International Telecommunications Union). 2012. *The little data book on information and communication technology*. [Online] Available: http://www.itu.int/ITU-D/ict/publications/material/LDB_ICT_2012.pdf [Accessed July 24, 2012].
- ITU (International Telecommunications Union). 2011. The world in 2011. ICT facts and figures [Online] Available: <http://www.itu.int/ITU-D/ict/facts/2011/material/ICTFactsFigures2011.pdf> [Accessed July 24, 2012].
- ITU (International Telecommunications Union). 2011. Mobile cellular subscriptions. [Online] Available <http://www.itu.int/ITU-D/ict/statistics/> [Accessed February 10, 2012].

- Johnson, L. *et al.* (2012). *The NMC Horizon Report: 2012 Higher Education Edition*. Austin, Texas: The New Media Consortium. [Online] <http://www.nmc.org/publications/horizon-report-2012-higher-ed-edition> [Accessed April 17, 2012].
- Johnson, L. *et al.* 2010. *The 2011 Horizon Report*. Austin, Texas: The New Media Consortium. [Online] Available <http://net.educause.edu/ir/library/pdf/HR2011.pdf> [Accessed May 2011].
- Kataria, S. & Anbu, J.P.K. 2011. Reference library in the pocket: Mobile reference services for Libraries. *Journal of Library & Information Science*, 1(2): 114-120.
- Karim, S.A., Darus, S.H. & Hussin, R. 2006. Mobile phone applications in academic library services: A students' feedback survey. *Campus-Wide Information Systems*, 23 (1): 35-51.
- Kim, B.& Ball, M. 2010. Mobile use in medicine: taking a cue from specialized resources and devices. *The Reference Librarian*, 52(1-2): 57-67.
- Kosturski, K & Skornia, F. 2011. Handheld libraries 101: Using mobile technologies in the academic library. *Infotoday*, Jul/Aug, pp. 11-13.
- Kroski, E. 2008. On the move with the mobile web: Libraries and mobile technologies. *Library Technology Reports*. [Online] Available: <http://eprints.rclis.org/15024/> [Accessed 16 May, 2012].
- Kumar, R. 2005. *Research methodology: a step by step guide for beginners*. 2nd ed. Sage Publications Ltd: London.
- Leedy, P.D. & Ormrod, J.E. 2013. 10th ed. *Practical research: Planning and design*. Pearson Education, Inc.: USA.
- Leedy, P. D. & Ormrod, J.E. 2010. *Practical research: Planning and design*. 9th ed. Pearson: Education International: Boston.
- Leung, Y-C. 2011. Library web/online information services to the needs and behaviour of students. In: Cohen, E.B. (ed.) *Navigating Information Challenges*. Information Science Press: Santa Rosa, CA. [Online] Available:

http://books.google.co.za/books?hl=en&lr=&id=cwR3W7mGR1MC&oi=fnd&pg=PA293&dq=Library+Web/Online+Information+Services+to+the+Needs+and+Behavior+of+Students&ots=pgTH7XdD_d&sig=MbpPV51aTfMeAe0CFGEpc3xHjKg

[Accessed February 10, 2012].

- Little. G. 2011. Keeping moving: Smart phone and mobile technologies in the academic library. *The Journal of Academic Librarianship*, 37(3): 267-269.
- Lippincott, J.K. 2010. A mobile future for academic libraries. *Reference Services Review*, 38(2): 205-213.
- Lippincott, J.K. 2009. Mobile reference: What are the questions? *The Reference Librarian*, 51(1):1-11.
- Lippincott, J. K., 2008. Mobile technologies, mobile users: Implications for academic libraries. ARL, 261 [Online] Available: <http://www.arl.org/bm~doc/arl-br-261-mobile.pdf> [Accessed February 12, 2012].
- Mbambo-Thata, B.2010. Assessing the impact of new technology on internal operations: With special reference to the introduction of mobile phone services at UNISA library. *Library Management*, 31(6): 466-475.
- McEwen, R., & Scheaffer, K. (2012). Orality in the library: How mobile phones challenge our understandings of collaboration in hybridized information centres. *Library & Information Science Research*, 34 (2), 92-98.
- Overdrive Inc. 2012. Overdrive. Available: <http://www.overdrive.com/About/Default.aspx> [Accessed 12 November, 2012].
- Parsons, G. 2010. Information provision for HE distance learners using mobile devices. *The Electronic Library*, 28 (2): 231-244.
- Paterson, L. & Low, B. 2011. Student attitudes towards mobile library services for smartphones. *Library Hi Tech*, 29(3): 412-423.
- Prytherch, R. 2005. *Harrod's librarians' glossary and reference book: A directory of over 10,200 terms, organizations, projects and acronyms in the areas of information management, library science, publishing and archive management*. 10th ed. Ashgate Publishing Group: Farnham, Surrey. [Online] Available

- <http://site.ebrary.com/lib/pretoria/Doc?id=10343276&ppg=440> [Accessed March 2, 2012].
- Ragon, B. 2009. Designing for the mobile web. *Journal of Electronic Resources in Medical Libraries*, 6(4): 355-361.
 - Sciverse. 2012. Mobile apps gallery. Elsevier Inc. [Online] Available: <http://www.info.sciverse.com/sciverse-mobile-applications/overview> [Accessed 23 May, 2012].
 - Shurtz, S., Halling, T.D. & McKay, B. 2011. Assessing user preferences to circulate iPads in an academic medical library. *Journal of Electronic Resources in Medical Libraries*, 8 (4): 311-324.
 - Smith, A. 2010. Mobile access 2010. Pew Internet & American Life Project. [Online] Available: <http://pewinternet.org/Reports/2010/Mobile-Access-2010.aspx>[Accessed February 10, 2012].
 - Struwig, F. W. & Stead, G.B. 2001. *Planning, designing and reporting research*. Pearson Education: Cape Town, South Africa.
 - Strydom, H. & De Vos, A.S. 1998. *Sampling and sampling methods*. In: De Vos, A.S. (ed.) *Research at grass roots: A primer for the caring professions*. van Schaik: Pretoria:189-201
 - Smith, A. 2012. The Best (and Worst) of Mobile Connectivity. Pew Research Center's Internet & American Life Project. [Online] Available from: http://pewinternet.org/~media/Files/Reports/2012/PIP_Best_Worst_Mobile_113012.pdf
 - Thomas, R. M. 2003. *Blending qualitative and quantitative research methods in theses and dissertations*. Corwin Press, Inc.: Thousand Oaks, CA.
 - University of Pretoria. Fact Finder 2012. [Online] Available: http://web.up.ac.za/sitefiles/file/2011%202012%20Faculty%20Brochures/Fact_Finder_2012.pdf[Accessed 14 November 2012].
 - Unicef, 2012. Internet Going Mobile: Internet access and usage in 11 African countries. *RIA Policy Brief No 2*. [Online] Available:

<http://www.researchictafrica.net/docs/Internet%20going%20mobile%20policy%20brief%20Final.pdf>[Accessed April 17, 2012].

- Vila, M. C., Gálvez, A.P. & Campos, J.C. 2010. Mobile services in the Rector Gabriel Ferraté Library Technical University of Catalonia. *Reference Services Review*, 38 (2): 321 – 334.
- Vollmer, T. 2010. There's an App for that! Libraries and mobile technology: An introduction to public policy considerations. Policy Brief No. 3
<http://www.ala.org/offices/sites/ala.org.offices/files/content/oitp/publications/policybriefs/mobiledevices.pdf> [Accessed April 17, 2012].
- Walsh, A. 2011. Blurring the boundaries between our physical and electronic libraries: Location-aware technologies, QR codes and RFID tags. *The Electronic Library*, 29 (4): 429-437.
- Web of Knowledge (WOK). 2012. Anywhere anytime access. Thomson Reuters. [Online] Available: <http://wokinfo.com/about/mobile/>[Accessed May 23, 2012].
- Webb, W. 2010. *Being mobile: Future wireless technologies and applications*. Cambridge University Press: UK.
- Willis, K. 2008. Mobile and wireless technologies: Spatial presence. In: Furht, B. *Encyclopaedia of Wireless and Mobile Communications*. Volume II. Taylor & Francis: New York: 613-633.
- Wilson, S. & McCarthy, G. 2010. The mobile university: From the library to the campus. *Reference Services Review*, 38 (2): 214 – 232.
- Wong, S.H. R. 2012. Which platform do our users prefer: Website or mobile app? *Reference Services Review*, 40 (1): 103 – 115.
- World Wide Web Consortium (W3C). 2008. Mobile web best practices 1.0. [Online] Available: <http://www.w3.org/TR/mobile-bp/>[Accessed April 26, 2012].
- Yee, A. 2012. Mobile technology: Academic libraries in Australia and beyond. *VALA2012 Proceedings*, Melbourne, Australia, 6 - 9 February 2012, pp. 1-18. [Online] Available: <http://0->

researchbank.rmit.edu.au/innopac.up.ac.za/view/rmit:15297[Accessed May 16, 2012].

- Zhou, Y., Broussard, R. & Lease, M. 2011. Mobile options for online public access catalogs. In *Proceedings of the 2011 iConference* (iConference '11). ACM, New York, NY, USA, 598-605. [online] Available: <http://o-dl.acm.org/innopac.up.ac.za/citation.cfm?id=1940842>[Accessed April 25, 2012].
- Zimmerman, M. 2011. E-readers in an academic library setting. *Library Hi Tech*, 29 (1): 91-108.

Appendix 1:

Groenewald, M.E. & Steyn. C. 2010. Results of the University of Pretoria Library Services mobile survey.

Appendix 2:

De Wee, J.A. 2012. Interview Schedule.