The use of a Virtual Learning Environment (VLE) to embed library information services in a Blended Learning Environment (BLE): a University of Pretoria Engineering study

Mini-dissertation by

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ABSTRACT

The main objective of libraries in higher education institutions is to enable access to information that will meet the teaching, learning and research needs of the institutions' communities (Department of Arts and Culture, 2015:18). Technology makes it easier to accomplish this by allowing librarians to embed products and services directly into the teaching, learning and research environments used by the communities. Course Management Systems such as Blackboard, are used by higher learning institutions to provide blended learning experiences. Many face-to-face lectures rely on an online module, and students appear to be more comfortable using the various online tools than ever before. For librarians, the online component of such a hybrid learning model is an opportunity to extend the traditional face-to-face library training and information literacy sessions into the Virtual Learning Environment (VLE). Virtually embedded librarians enable students' access to library information online (Hoffman & Ramin, 2010:298) and libraries that have shifted towards embedding in online courses reach users at their point of need (Paganelli and Paganelli, 2017:55). If these statements are true, the question remains whether the end user is satisfied with the services rendered online or not.

Many surveys have been conducted to assess users' satisfaction with library resources and the quality of library services (Zhang, 2015:273). Some studies investigated library use patterns of different user groups but few studies focus on the needs of Engineering students (Zhang, 2015:273) and if these needs are being addressed by embedded library services and products. The objective of this research was to establish the role that Engineering students expect an Information Specialist to play in a VLE, to identify the products and services the Engineering students expect the Information Specialist to provide, and to what extent. This was done using a case study research design.

As was expected, this research confirmed that the Engineering students recognise the importance of librarians embedding in their online modules. It is anticipated that librarians who embed online will be able to meet the needs of the students and build strong relationships with the students. If that does become the case, it is feasible to expect that the students' use of library resources will increase. The next phase would be to build and launch a pilot project. Recommendations made for embedding in a VLE were (1) to consult with the faculty, library staff, and the instructional designer before the librarian attempts to launch embedded activities; (2) to identify the top in-demand products and services that can be embedded for each course as a matter of urgency; (3) to pilot the program with a few students and library staff and obtain feedback before the initiative is made publicly available to all students; and (4) to align the expectations or activities of the program with those of the course.

Keywords: Embedded librarians, Virtual Learning Environments, Blended learning, Information Literacy, Information Needs – Engineers, Library products, Library Services

DECLARATION

I declare that the mini-dissertation, *The use of a Virtual Learning Environment (VLE) to embed library information services in a Blended Learning Environment (BLE): a University of Pretoria Engineering study*, is my own original work and has not previously been submitted by me for a degree at this or any other tertiary institution. When secondary material is used, this has been acknowledged and referenced in accordance with the University of Pretoria's requirements.

31 October 2018

DEDICATION

This research is dedicated to the memory of my late grandfather Michael Malesela Makhafola. A wise and inspirational man who believed that I could do anything.

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LIST OF ABBREVIATIONS AND ACCRONYMS

BL	Blended Learning
BLE	Blended Learning Environment
CMS	Course Management System often used interchangeably with VLE
EBIT	Engineering, Built environment and Information Technology
IL	Information Literacy
IS	Information Specialist often used interchangeably with ‘librarian’
IT	Information Technology
LMS	Learning Management System
UP	University of Pretoria
UPDLS	University of Pretoria Department of Library Services
VLE	Virtual Learning Environment – used interchangeably with CMS

CLARIFICATION OF KEY TERMS

Blended learning

BL also referred to as hybrid learning, is a combination instruction method where traditional face-to-face instruction and online learning are combined (Olapiriyakul & Scher, 2006:288). BL is considered a complement for face-to-face classes where web-based materials are provided (López-Pérez, Pérez-López & Rodríguez-Ariza, 2011:818). For this research, BL will be referred to as the combination of traditional face-to-face instruction and web-based online learning.

BL courses

A hybrid/BL course is one where the participants meet for a reduced number of scheduled classes, face-to-face and online activities are designed to reinforce, complement, as well as support each other, and the best features of class-based as well as online course can be combined so students benefit from meeting with their instructor regularly and are still be able to enjoy online learning and its flexibility (Blackboard Inc., 2018a: online)

Content management systems (CMS)

CMSs can be described as software programs that are used in higher education for face-to-face, online and distance learning instruction (Paganelli & Paganelli, 2017:56).

Embedded

Dewey (2004:6) mentioned that embedding requires one to be more direct and purposeful in their interaction as opposed to acting in parallel with the given group. Shumaker (2009:240) mentioned that the concept of embedding is used to describe a librarian becoming a member of the customer community instead of just being a service provider that remains separate. For this research, embedded will be defined as making something a permanent and important part of something else.

Embedded librarian

From the multiple definitions of an embedded librarian that were explored in the literature overview by York and Vance (2009:199) and Kesselman and Watstein (2009:387), key elements can be picked up from each of the definitions, namely: integration and collaboration. For this research, an embedded librarian will be defined as a librarian who is integrated in, and actively participates and collaborates with a group of users in a VLE for the purpose of providing customised information services and products to suit the needs of the user group.

Online courses

An online course is one where the participants do not meet face-to-face but interact fully online, course materials are delivered in an online format, communication and interaction with students is done using online tools, and students' work is assessed online (Blackboard Inc., 2018a: online).

Virtual learning environment (VLE)

According to JISC (2016: online) a VLE is a means of structuring, managing and delivering learning activities and content, student tracking and the management of online assessments. Examples given were Blackboard or Moodle. VLEs allow for courses to be delivered to a large number of students and include communication tools such as email and discussion boards, as well as collaborative workspaces (JISC, 2016: online). The Oxford University Press (2016: online) defined a VLE as a system used to deliver learning materials to students using the web. VLEs are also known as Learning Management Systems (LMS) and Course Management Systems (CMS). For this research, a VLE is defined as a web-based platform used to structure, manage, communicate and deliver educational content and activities for a specific module to a defined group of students in order to enhance the students learning experience.

Web-enhanced courses

Web-enhanced courses are those that require participants to meet for scheduled classes for the course, but where some instructional activities and supplementary materials are added online, for example, study guides, homework assignments, and optional discussions (Blackboard Inc., 2018a: online). The online components are only meant to supplement, and not replace, the face-to-face work in the course.

CHAPTER 1: INTRODUCTION

1.1. Background to Embedded Librarianship

Originally, libraries resided in academic departments and they were often built by individual staff who 'loved books' (Dewey, 2004:6). In essence the library was embedded in the department (Dewey, 2004:6). This changed when departmental libraries became too big for the departments to manage or too complex for individual staff to run effectively and central library services were established. In modern-day libraries, rapid changes are taking place due to the impact of Information Technology (IT) where libraries now move from being passive to active, dull to lively, reactive to proactive, and singular to social (Dewey, 2004:6). Online learning is increasing, and so libraries must consider the role they will play in serving the increasing number of students online (Matthew & Schroeder, 2006:61). Library services are crucial in the academic success of students (Kearley & Philips, 2004:66). Providing services to students across geographic boarders will help them develop information literacy (IL) skills which will improve their lives (Kearley & Philips, 2004:66).

According to Paganelli and Paganelli (2017:54), technology is being used extensively in higher education; librarians should therefore continue to look for ways in which they can provide library services to students and staff with the use of technology. This is because library users have changed the way that they use the library (Paganelli & Paganelli, 2017:54). Students and staff seeking information are doing so by using a variety of electronic databases to find and retrieve information (Paganelli & Paganelli, 2017:54). This has forced academic libraries to rethink the physical spaces in the library (Dewey, 2004:6; Paganelli & Paganelli, 2017:54). Information Specialists (IS) (otherwise also referred to as librarians) are in constant contact with a sizable number of students. The consistent contact with the students can assist the librarians in being able to better integrate and understand the needs, wants and concerns of the students (Dewey, 2004:13).

Librarians are also breaking out of the physical barriers of the traditional library, building new relationships with users, and finding ways to deliver new kinds of services to users who need them (Shumaker, 2009:240). Librarians are finding ways to create new value for the libraries they work for by getting out of the physical library and meeting the users where they are — in the classroom, at the departments, even in the cloud. This change is influenced by technology, which has freed librarians from the physical boundaries of the library building (Shumaker, 2009:240). The phrase 'embedded librarianship' was coined to describe the notion of a librarian becoming a member of a user community instead of only providing a service while

remaining separate from the user community (Shumaker, 2009:240; Carlson & Kneale, 2011:167).

Embedding can occur in a physical or a virtual environment. For example, ISs could conduct a face-to-face lecture with a group of students or they could interact online with students in a computer-based learning environment, also known as a Virtual Learning Environment (VLE) (Shumaker, 2009:240). The embedded librarianship model was proposed as a way of enabling librarians to show their capabilities as ISs and applying these capabilities in such ways that there is a direct and profound impact on learning (Carlson & Kneale, 2011:167). Embedded librarianship allows librarians to move from a supporting role to a role where they can partner with their clients, which in turn allows for the development of stronger working relationships and connections with clients (Carlson & Kneale, 2011:167). According to Shumaker and Tyler (2007:21) embedded librarianship is comprised of three aspects: physical-, organizational-, and virtual embedding. Virtual embedding, which was the focus of the research, is the provision of library services in a virtual environment that is for the sole use of a specific group of people (i.e. students taking a specific module) (Shumaker & Tyler, 2007:21). It is also necessary to note that many residential universities, such as UP, make use of blended learning (BL) rather than true virtual learning. With BL the VLE modules augment the face-to-face lectures (refer to section 2.3 for a more detailed discussion). When referring to the environment where the IS wishes to embed, this researcher uses BLE and VRE interchangeably. It is understood that most of the embedding should take place in the VLE.

In thinking about the embedded services several research questions were identified.

1.2. Central Research Question and Sub Questions

Establishing the needs and opportunities at UP for Engineering students gave rise to the following research questions:

1.2.1. Central Research Question

The main research question that was answered by this research is:

What needs to be done to ensure that appropriate library products and information services, that are of value to both students and lecturers, are embedded into the evolving learning environment for Engineering students at the University of Pretoria?

A simple answer to the main research question is not an easy task. This gave rise to the researcher formulating research sub questions to help answer the main research question.

1.2.2. Research Sub Questions

In order to be able to answer the main research question, a number of issues related to the main research question first needed to be addressed. The following sub-questions were identified as being the most critical for the research:

1. What is meant by embeddedness?
    - What is an embedded librarian?
    - What are regarded as typical embedded services?
    - What products are typically embedded in learning environments?
    - What typical Engineering information products should be embedded?

2. What are the characteristics of an effective blended learning environment (BLE)?
    - What knowledge and skills do Information Specialists require to embed in a hybrid teaching and learning environment?
    - In what ways can an embedded librarian participate in a BLE?

3. Do the information needs for learners from the sub-disciplines in Engineering show any variation?
    - What services does the library at UP currently offer to its faculty of Engineering learners?
    - What is the current level of IL as indicated by the respondents?
    - What is the current information behaviour as reported by respondents?
    - What services can the library at UP add to their existing services to support a hybrid learning environment developed for Engineering (undergraduate) students?

A methodology for conducting the research had to be selected. The research methodology that was used to conduct the research, including the collection and analysis of data is briefly discussed in the next section.

1.3. Research Methodology

This research, adopted a qualitative approach was. The reason for the decision is that the views of participants regarding the library and its services, as well as the actual shift to blended learning (BL) needed to be analysed and understood in order to find ways to embed the library in the most appropriate and successful manner.

The research design that was adopted was case study research (Leedy and Ormond, 2014:143). Engineering students were the focus of the study. The case of study were three University Pretoria (UP) Engineering departments namely: Chemical-, Material Science and Metallurgical-, and Mining Engineering. They are regarded as the most complex case or group to have the library embedded due to the complexity of the learning processes within the discipline. According to Leedy & Ormrod (2014:143), a single case that is unique or has exceptional qualities can be studied in order to promote understanding for similar cases. On the other hand, a multiple or collective case study involves two or more cases that can be studied in order to compare, build a theory, or even propose generalisations (Leedy & Ormond, 2014:143; Creswell, 2018:96). Case study research is most suitable when little is known about the situation or it is poorly understood. The only negative aspect of the research design is that since one case was studied, the results may not be generalizable to other situations (cases) or disciplines.

The researcher collected data using an electronic questionnaire and conducted a small number of interviews making use of guidance from Flick (2011:169, 2015:140-144, 200) and Kumar (2011:144). The questionnaire was made available to the students while the interviews were conducted with staff members from the different Engineering departments. The focus of the research was on the behaviour of the students and therefore the interviews served as confirmation for data collected.

According to Flick (2011:170, 2015:201), electronic questionnaires are easy to disseminate, collect and analyse. The questionnaire was designed using Google Forms. It contained both close-ended and open-ended questions following the guidance of Flick (2011:108). The open-ended questions allowed each of the respondents to give their own perspective without limitations, leading to the researcher having a better understanding of the views of the students regarding the topic at hand. The close-ended questions provided general qualitative data that gave insight into how the participants' felt about the topic.

The target population was the undergraduate third to fourth year Engineering students from Chemical Engineering, Material Science & Metallurgical Engineering, and Mining Engineering at UP. The third and fourth year students were targeted as they are more experienced in the

use of ClickUP (UP VLE) as well as with making use of discussion boards and completing assignments and projects. They were deemed to be the best population that could provide insight into services and products to embed but also to identify possible gaps that may exist in the current library products and services.

The sampling method that was used for the questionnaire was purposive sampling, since it allowed the researcher to reach the population quickly in the limited time of the study. In order to have a sample size that was manageable, the Engineering departments where the researcher is currently responsible for providing library services, formed part of the sampling pool. The sample consisted of 30 Chemical Engineering, 15 Material Science and Metallurgical Engineering, and 15 Mining Engineering students. The link to the online questionnaire was shared with all the students from within their current online learning modules. The process is described in detail in Chapter 3.

The data was analysed using two qualitative methods. The questions from the questionnaire were analysed using the built-in data analysis feature in Google Forms. The free text responses were summarized and then analysed by sorting and categorising the responses using both content and thematic analysis. The researcher looked for recurring themes which were used in the results.

The interview recordings were transcribed. The researcher made use of thematic analysis to look for recurring themes in the responses given by respondents. The results of the transcription were reported in Chapter 4.

The reasons why the topic was chosen to investigate are discussed in the next section

1.4. Justification for the Research

UP currently makes use of Blackboard Learn as its VLE but has dubbed it ClickUP. Both students and lecturers refer to the application as ClickUP.

The UPDLS currently serves nine faculties, support services and external clients of the university. The library consists of the main library (which serves the Humanities, Economic and Management Sciences, Natural and Agricultural Sciences, and Engineering, Built Environment and IT faculties (EBIT)) which is located on the Hatfield campus, the Law and Music libraries which are also on the main campus in Hatfield, Health Sciences libraries (Basic Medicine and Dentistry, Medical, Witbank, Klikikala, and Weskoppies (spread across five different locations between Pretoria and Witbank), Jotello F Soga library for Veterinary

Sciences (located in Onderstepoort), the Education library (located in Groenkloof) and the Mamelodi branch library (University of Pretoria, 2017a: online).

The UPDLS is not only focused on the traditional library products and services, it also provides a wide variety of electronic products and services to its clients. Products include, among others: e-books, an institutional repository, e-journals, customized web pages, digitized full-text local collections, knowledge tools, and a digital reference service (University of Pretoria, 2017a: online). The presence of e-resources at the UPDLS is especially important in a BLE as it makes it much easier to link to selected e-resources from within the VLE (such as Blackboard Learn) which is discussed in section 2.7.1.

Currently the UPDLS hosts, within its own infrastructure, customized resource pages for each of the faculties of the university. The faculty page, in some instances also link to pages developed for specific departments. For example, the EBIT faculty page, allows a user to select a specific school or department, such as Chemical Engineering, and it then links to the resources specific to the department. Resources include: e-resources links (such as databases, institutional repository, e-books, subject-related website links, and referencing software), standards and patents, and subject guides, and IL training and training material (University of Pretoria, 2017b, c: online)

The UPDLS further offers the following services to its School of Engineering students: IS consultations and IL training (University of Pretoria, 2017b, c: online).

There are some similarities and differences that exist between the library resources available for the School of Engineering and other schools at UP. Still within the faculty of EBIT and looking at the School of Built Environment, an obvious difference is that the school makes use of special collections material (such as South African architecture and buildings drawings) as well as photographs, while Engineering does not (University of Pretoria, 2018a: online). A select number of departments within the schools of Engineering have a number of research guides and training material available on the faculty library web page while the schools of Built Environment and IT do not (University of Pretoria, 2018b, c: online). Some of the services not included on the faculty library web page, may however, be included on the subject guides. The similarities are that all three schools within the faculty all offer IS services, e-resources, and subject guides. It is anticipated that students would find the structure of the web pages difficult to navigate. It is also anticipated that relevant resources would not be known or used.

Finding ways that will cement the working relationship between an IS and the university's Engineering community is a challenge. It is not easy to identify where, when and how an IS can assist the end users (students) and at what phase of the Engineering learning process interventions are required. The main purpose of the study was therefore to investigate how

ISs can embed themselves and their services within a blended learning environment for engineers in training at a higher learning institution.

The research is of importance in establishing the role that Engineering students expect an IS to play in in their VLE and to what extent assistance and services should be provided. The research was also useful in establishing what products the Engineering students expect the IS to embed. It is anticipated that this knowledge will help with relationship-building between the library and its clients, as well as to ensure the actual use of library resources by the students. Ultimately this could lead to better academic performance due to readily available and subject-specific information.

The research had limitations which the researcher has to acknowledge. These are discussed briefly in the next section.

1.5. Scope and limitations of the Research

Due to the limited time and resources available to conduct the research, a smaller sample group had to be used than what the researcher would have liked to. Student contact information was not provided to the researcher when requested. The researcher had to rely on the subject guides as well as lecturers to share the link to the questionnaire with the students. The time available to collect data was consequently greatly reduced. The researcher would have liked to have received more responses from students. The interviews were conducted in English and the questionnaire was only available in English, which may have disadvantaged participants who may have preferred to use their mother-tongue languages. Participants were advised of the language limitation before the commencement of the research.

Nevertheless, the research results hold value for stakeholders involved in teaching and learning and will also be of value to librarians embarking on embedded service delivery. This value is discussed below.

1.6. Value of the Research

Perspectives from the identified groups in Engineering on embedding library services were provided. The research will contribute to the literature on embedded librarianship, more specifically in Engineering education in a hybrid higher learning institution. ISs, researchers, faculty staff and students will benefit from the research as it provides insight into the current

services as well as make recommendations for closing the gaps, in service delivery, that currently exist. As a result, the IS role could become an integral part of the departments rather than just an 'add-on' in times of need.

The dissertation was divided into five chapters. The content from each of the chapters is highlighted below.

1.7. Division of Chapters

Chapter 1 provided some background on the topic and introduced the research. It included the scope of the research as well as the methods used. It also included the objective of the study, the central research question and sub-questions. A description of the methodology used as well as a summary of findings of the research were included.

Chapter 2 provides detail regarding an extensive literature review on embedded librarianship, and provides insight into the current status of UP in terms of blended learning, VLEs and embedded librarianship.

Chapter 3 explores the methodology that was followed when conducting the research. The chapter explains the research design, target population, sampling, data collection techniques, data collection tools as well as methods used to analyse the data collected.

Chapter 4 provides an analysis of the results from the data collected.

Chapter 5 makes available recommendations and conclusion to the research.

1.8. Conclusion

Looking at the introduction to embedded librarianship and the potential gaps that were noted, it can be said that there is a wide range of opportunities available in the development and progression of embedded librarianship at UP. The objective to the study, central research question, sub questions, justification of the research as well as the value of the study, highlight the significance and contribution that the research will contribute to embedded librarianship, especially with regard to the use of VLEs. These all support and underpin the research to offer more relevant library and information products and services to Engineering students in order to improve their learning experience.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

According to the Department of Arts and Culture (2015:18), the main objective of libraries in higher education institutions is to enable access to information that will meet the teaching, learning and research needs of the institutions' communities. Technology makes it easier to accomplish this stated objective by allowing the librarian to embed products and services directly into the teaching, learning and research environments used by scholars and lecturers. However, embedded librarianship is still seen as an emerging practice (Hoffman & Ramin, 2010:293). It is only recently that publications on individual experiences around the phenomenon of embedded librarianship are materializing (Hoffman & Ramin, 2010:293; Moran & Mulvihill, 2017:13-14). Looking at what the authors said, it may be challenging to define the role of librarians that embed in courses in VLEs (Hoffman & Ramin, 2010:293; Tumbleson, 2016:225). This can be attributed to the different experiences that each embedded librarian has had. The interactions that the embedded librarians have with the course instructors as well as the differences in the disciplines that each librarian is embedded in may be factors that have an impact on the outcome of the "embedding experiment".

According to Paganelli and Paganelli (2017:54) and Tumbleson (2016:225) libraries have established several services by using technology to provide services to users who are technologically inclined. For example, most academic libraries have websites that contain links to numerous online services such as the online library catalogue and interlibrary loans service (Paganelli & Paganelli, 2017:54). The authors also mention that technological services play an important role in meeting the demands of library users while addressing the changes that occur in higher education. Despite this, library users still need library assistance (Paganelli & Paganelli, 2017:54; Tumbleson, 2016:225). Many surveys have been conducted in academia to assess users' satisfaction with library resources and the quality of service as well as to find library use patterns, or rather, information seeking patterns of different user groups (Hiller, 2002; Hemminger et al., 2007; Baer & Li, 2009; Niu et al., 2010; Engel, Robins, and Kulp, 2011; Tucci, 2011; Zhang, 2015:273). Very few studies however, have covered the Engineering field (Zhang, 2015:273). This is also evident at UP, where two studies on the topic of embedded librarianship have been completed (Ntuli, 2015; Kleinveldt, Schutte & Stilwell, 2016), but neither specifically investigated embedding in an Engineering context. Research into embedded librarianship in other disciplines such as Nursing, (part of a first-year writing program) (Allen, 2017, 255; Moran & Mulvihill, 2017:17-19), Alternative medicine,

Business/entrepreneurship. Construction Management, and general education (Bezet, 2013:187), and Library Science (Hoffman & Ramin, 2010:295), have also been undertaken.

Librarians seeking to collaborate with departments on their courses using a VLE, often question their role, how much they can get involved, and what they can do to embed themselves in the courses (Hoffman & Ramin, 2010:292; Tumbleson, 2016:225). As it stands, there appears to be no definitive guide on how to create an embedded librarian program for online courses except for a few articles giving individual librarian's experiences of embedding in online courses (Hoffman & Ramin, 2010:292; Bezet, 2013; Tumbleson & Burke, 2013; Allen, 2017; Paganelli & Paganelli, 2017:56). York and Vance (2009:202-207) explored some best practices for librarians who seek to provide services to students online through a course management system (CMS). Tumbleson and Burke (2013:70) recommended using the ADDIE process of instructional design to plan and implement an embedded librarianship program. The ADDIE process will be discussed briefly in section 2.5.5. It should be noted that librarians are usually not trained instructional designers and, therefore, may not be aware of the existence of the ADDIE process.

To answer the main research question, several issues related to the main research question first needed to be addressed as identified in section 1.2.2 in Chapter 1. The sub-questions have specific relevance to the literature review component of this dissertation. In the following section, an effective BLE will be discussed including the different types of online courses. The importance of librarians embedding in VLEs to augment the BLE will also be mentioned.

2.3. Online Learning

Online learning is considered a key component of any modern and sustainable institution of higher learning (Moran & Mulvill, 2017:14). Many face-to-face lectures also have an online module and students have been found to be more comfortable using the various online tools (Moran & Mulvill, 2017:14). Therefore, it is important that libraries become strategic about how they provide services and products to the online communities and how they will utilize their time for these services and products to have an impact on the students.

CMSs are primarily used for online or BL and they support the placement of course materials online, linking students with courses, tracking the performance of students, storing student submissions, as well as mediating communication between the students and the instructor

(Watson & Watson, 2007:29). There are different types of online courses: fully online, web-enhanced, and hybrid or blended, each of which were defined as key terms.

A blended teaching and learning model has the ability to improve distance education by supplementing online approaches with face-to-face interaction between students and their lecturers (Tabor, 2007:48).

The focus of this research is on embedding library products and services within BL courses, specifically for Engineering students. The next sections will expand on these two aspects.

2.4. Effective BLEs

In order to have a good understanding of what makes BL effective, the characteristics of such an environment, as found in the literature, will be discussed below.

Osguthorpe and Graham (2003:230-231) mentioned that BL courses should be designed with specific purposes in mind and those purposes may be different for each of the blended courses. There are six goals that need to be kept in mind when designing BL courses: pedagogical richness, access to knowledge, social interaction, personal agency, cost effectiveness, and ease of revision (Osguthorpe & Graham, 2003:231). Each of the identified goals were briefly described by Graham (2006:8) and Tabor (2007:48).

Pedagogical richness is described as the methods that are supported by theory.

Access to knowledge is described as taking advantage of materials that are media-rich.

Social interaction is described as students communicating with each other.

Personal agency is described as the control that students have over the learning process.

Cost effectiveness is described as investing wisely in the lecturer's time.

Ease of revision is said to be an important concern for constantly changing technical content (Graham, 2006:8; Tabor, 2007:48).

2.4.1. Characteristics of effective blended environments

CMSs such as Blackboard, are used by higher learning institutions in addition to the traditional face-to-face lectures. These kinds of lectures are referred to as hybrid — they exist in the lecture halls as well as online (Jackson, 2007:459 cited in York & Vance, 2009:198). UP is

one of the institutions that uses Blackboard. For librarians, the online component of the hybrid learning model is an opportunity to extend the traditional face-to-face library training and IL sessions into the VLE (also known as the online component of the BLE). With the lecturing staff providing information on the requirements for the course and assignments, librarians are afforded the opportunity to tailor information literacy (IL) sessions/content specifically for the course, as well as to integrate library resources such as databases, images, and electronic course reserves (Dewey, 2004:15; Paganelli & Paganelli, 2017:57).

As already mentioned in the introduction to this chapter, Hoffman and Ramin (2010:293) pointed out that defining the role of an embedded librarian in an online course can be challenging. The authors conducted a study which found evidence that suggested that as students and lectures became familiar with a particular librarian, they were able to create personal connections with the library and the students and lecturers were more likely to take advantage of the library services available to them (Hoffman & Ramin, 2010:298). Furthermore, interacting with librarians personally, builds stronger relationships between online students and the library, and to some extent, the institution as well. Virtually embedded librarians are considered to be crucial to students having access to library information online (Hoffman & Ramin, 2010:298).

The following are characteristics of an effective BLE:

- An online library module that is open to all the online students must be available in order to save time. The module should direct students and course instructors to library resources while also allowing them to access the resources within the CMS. However, it should be noted that the module does not replace personal interaction with an embedded librarian (Hoffman and Ramin, 2010:301).

- The contact details (email and work phone number) of the embedded librarian need to appear on the course page in various places such as the homepage, study guide and discussion boards as a way of encouraging students to ask questions in and outside the course (Hoffman and Ramin, 2010:301). Office hours for consulting can also be posted so that students can find out when the embedded librarian is available.

- Announcements or topics for discussion need to be posted in a single library-specific or assignment-specific discussion board in order to allow the students to locate all the information relating to the library in one location (Hoffman and Ramin, 2010:301). The authors also added that when a student asks a question via email, the librarian can repost and answer the question, while omitting the name of the

student, so that the rest of the students taking the specific module may also benefit from the information. Students need to be informed that their questions make an important contribution to the learning experience of the entire class and they should be encouraged to post questions in the discussion board available in the online course page (Hoffman and Ramin, 2010:301).

- Information needs to be posted proactively in the sense that the librarian needs to keep track of assignment deadlines so that they could post tutorials and tips at the student's point-of-need (just in time information). This is because they are more likely to read posts about relevant sources when an assignment deadline draws near rather than to look at the recommendations weeks in advance (Hoffman and Ramin, 2010:301). Delaying the relay of information to just the right time helps to minimize overwhelming the students.

Visual elements, such as screenshots, should be included in discussion board posts where possible. It aids, for example, the instruction when explaining a database and using screenshots or when embedding a link to a video tutorial in a post (Hoffman and Ramin, 2010:301-302). According to the authors, the golden rule of instruction is to provide information in multiple formats to assist learners with different learning needs.

In summary: Librarians are integral to the teaching and learning process (Bell & Shank, 2004:373). It is important for librarians to be visible both physically and online in a BLE as the researcher believes the librarian's contribution is fundamental to making the BLE more effective. Blended librarians can add to their traditional roles by collaborating with course instructors to improve student learning and assessment in the areas of information access and information retrieval as well as information integration (Bell & Shank, 2004:374).

The next section will discuss the importance of having a librarian embed in a VLE for BL.

2.4.2. The importance of embeddedness

According to Dewey (2004:14), along with the physical collaboration, it is equally important for librarians to embed in the virtual learning space of the university. Matthew and Schroeder (2006:61) mentioned that libraries need to find a way to serve the increasing number of online students, while Burke and Tumbleson (2016:5) noted that librarians have been seeking new ways of reaching out library users and support their research needs. VLEs can be used in BL to embed library services. Essentially, the library must always be highly visible and well-

integrated into the VLE of the university. Kearley and Philips (2004:70), Corrall and Keates (2010:1-2) and Burke and Tumbleson (2016: 5) mentioned that a VLE exists:

- Firstly, as a way of consolidating online information and learning resources by subject; and
- Secondly, as a channel for delivering important information skills and IL tutorials created for library users.

Section 2.5, below, explains the concept 'embedded librarianship' in detail. A brief overview of the embedded librarianship model will be given. The services that are typically offered by embedded librarians, as well as products that are typically embedded in learning environments will also be discussed.

2.5. Embedded Librarianship: An Overview

The table below briefly summarized the differences between traditional librarians and embedded librarians as explored by Shumaker (2012:13).

Traditional librarian	Embedded librarian
Responsive	Anticipatory
Individual customer	Team of collaborators
Standardised	Customized
Single transactions	Ongoing projects
Service	Partnership

Figure 1: Differences between Traditional and Embedded librarianship

Source: Shumaker (2012:13).

The five characteristics that Shumaker (2012:18-19) proposes and that differentiate an embedded librarian from a traditional librarian as highlighted in table 1 translate to an embedded librarian being able to:

- Not only be responsive but also be able to notably anticipate the information needs of users as the librarian closely communicates and deeply understands the work that a specific user group is doing;

- Interact with a community of information users and makes sure that information is flowing to everyone in the group who may be in need of it, instead of just serving one user at a time;
- Customize contributions in order to meet the user group's most important needs whereas a traditional librarian provides standardized library services;
- Focus on the value that the librarian adds to a project since tasks flow into each other instead of merely focusing on how much reference work has been put in, meaning the value added and the contributions made by the embedded librarian can be measured and quantified; and
- Place value on partnership and shared ownership of the goals and objectives of a team because the librarian's participatory role is not limited but rather, they are seen as an important member of the group and this is emphasized by the partnership

  (Shumaker, 2012:19).

In the next section, the concept of embedded librarianship will be defined. The working definition which is being used throughout the research, is drawn from the definitions mentioned in the ensuing section.

2.5.1. Defining embedded librarianship

Dewey (2004:6) states that for librarians to embed, their interactions need to be more direct and more purposeful than what was expected from the intermediary-librarian. Hoffman and Ramin (2010:293) and Tumbleson (2016:229) mention that that embedded librarians need to maintain the visibility of the library in a virtual campus. Dewey (2004:14) also mentions that, like physical collaborations, it is equally important to embed the library into the VLE of a university. Kesselman and Watstein (2009:387) confirm Dewey's (2004) statements by mentioning that embedded librarianship is associated with integration and collaboration. Shumaker (2009:240) mentions that embedding does not lead to the closing of the physical library or maintaining the library as 'place' as an afterthought. Rather, it is a means to explore beyond the library walls and to build working relationships while truly collaborating and partnering with clients.

So what is an embedded librarian? York and Vance (2009:199) defined an embedded librarian as a librarian that actively participates in a 'CMS classroom' regardless of it being fully online or blended. In this context a CMS could be seen as a VLE. Such a librarian is integrated into the surroundings that may be either traditional or non-traditional. The environment could be virtual where the librarian could collaborate with groups of clients, regardless of their physical location (Kesselman & Watstein, 2009:387; Burke & Tumbleson, 2016:5). Embedded librarians change the way in which library and information services are typically designed and delivered to library clients. Shumaker (2012:4) defines embedded librarianship as a "distinctive innovation that moves the librarians out of libraries and creates a new model of library and information work". This definition of embedded librarianship highlights the significance of librarians forging strong working relationships with a given group of people that needs expert information services being offered by the librarian.

This is indeed evident in what Shumaker (2009:240) mentions about being embedded: a librarian moves away from the physical confines of a library, builds relationships, becomes a member of a user community and does not stand apart from it. Virtual collaboration in the form of interacting with students in a computer-based learning environment serves as an example (Shumaker, 2009:240; Burke & Tumbleson, 2016:5).

For this research, an embedded librarian is defined as an Information Specialist (IS) / librarian who is integrated in and actively participates and collaborates with a group of users (undergraduate engineers and their lecturers) in a VLE for the purpose of providing customised information services and products to suit the needs of the user group.

The following section clarifies what the embedded librarian model is.

2.5.2. The Embedded Librarianship Model

Below is a proposed visual representation of the embedded librarianship model from the discussion offered by Shumaker and Tyler (2007) on embedded library services. Each of the aspects of the model will be discussed in this section:

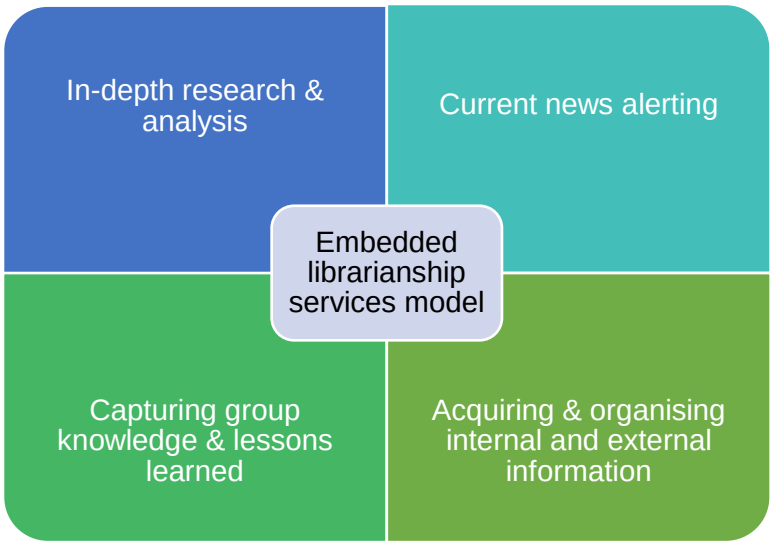


Figure 2: Embedded librarianship services model

Source: Shumaker and Tyler (2007:2-3).

In the embedded librarianship model that is proposed by Shumaker and Tyler (2007:2-3) which is depicted in Figure 2 above, the librarian's value is basically measured in terms of services that contribute useful and timely information to a user group, as well as anticipating needs that users may not realize they have or are not able to articulate (Shumaker & Tyler, 2007:2). The services may be one or all of the following:

- **In-depth research and analysis***:* the librarian solves problems by finding, obtaining, evaluating, analysing, as well as synthesizing information that is relevant, for example, an Engineering librarian locating scholarly literature to help a mining Engineering student to design an open pit mine (Shumaker & Tyler, 2007:2).
- **Current news alerting***:* the librarian monitors news sources and forwards the news items that are both relevant and important to the user group, for example, sending alerts on the latest published articles that are relevant to a topic that a student or group of students are currently working on (Shumaker & Tyler, 2007:2).
- **Capturing group knowledge and lessons learned***:* the librarian may be the only member of a project team that has extensive understanding of the work that the group is doing as well as having a responsibility to manage information in which case, the librarian may be the most logical person to capture results as well as information from meetings, important decisions and reflections at the end of the project (Shumaker & Tyler, 2007:2-3).
- **Acquiring and organizing internal and external information***:* the librarian plays a role in the maintenance of a well-organized, collaborative workspace that is information

rich, as well as the information resources of the user group (Shumaker & Tyler, 2007:3). The librarian will apply information organization principles in order to make information that is contained within the repository of the group easily accessible, as well as administering the virtual workspace of the group with other tools, for instance, calendar management, messaging and collaborative authoring (i.e. wikis) (Shumaker & Tyler, 2007:3).

There are activities which an embedded librarian engages in. Below is an illustration of the functions of an embedded librarian and the sequence in which they are most likely to take place within the School of Engineering at UP:

Figure 3: Activities of an embedded librarian

Adapted from: Shumaker and Tyler (2007:5).

With reference to the librarian embedding in a VLE, an embedded librarian may perform the following activities which have been depicted in figure 3 above:

- Firstly, the librarian will engage with a faculty to find out how they can support a particular class (Shumaker & Tyler, 2007:5; Berdish & Seeman, 2010:217);
- Secondly, the librarian may prepare tutorials, study guides, and/or assistance in finding research in the form of a user guide (Shumaker & Tyler, 2007:5);

- Thirdly, the librarian may monitor social networking sites in order to offer assistance to students as well as be involved as an active participant in the online classroom (Shumaker & Tyler, 2007:5; Shumaker & Talley, 2009:5);

- Fourthly, along with lecturers, the librarian can provide assignment descriptions and expectations for a particular course (Shumaker & Tyler, 2007:5; Shumaker & Talley 2009:5);

- Lastly, the librarian can suggest resources, organize training session on the use of resources that include the requirements for the class as well as push relevant information to the students taking the particular course (Shumaker & Tyler, 2007:5; Shumaker & Talley 2009:5).

Shumaker and Tyler (2007:12) mention that meeting the needs of the users at the point when they experience the need, is important to the embedded librarianship service model, whether it is in a physical or virtual space. The adaption to the model to create a loop in the functions of the embedded librarian instead of keeping it as a linear process, is necessary in helping the librarian to keep up to date with the developments within the VLE in terms of the student requirements and adapt the embedded services as the needs of the user group change. The librarian needs to communicate with the course instructor about any new developments in the library services, how to improve or adapt them for the user group, as well as to gauge if the embedded librarian program is beneficial to the users and what can be done to improve it. A good working relationship between the librarian and course instructor is a rather important aspect of embedding in any course.

In order for the librarian to be able to embed into a VLE successfully, he or she needs to possess some knowledge and a specific set of skills; these will be discussed in the next section.

2.5.3. Knowledge and Skills required by librarians to embed in a VLE

In their research findings, Shumaker and Tyler (2007:18) found that there are six critical success factors in terms of skills for embedded librarians. Carlson and Kneale (2011:168-169) offer some advice for embedded librarians which can be tied in to the six critical success factors for embedded librarians as discussed by Shumaker and Tyler (2007). Taking the skills identified by Shumaker and Tyler (2007) and the knowledge needed as identified by Carlson

and Kneale (2011), embedded librarians should possess the following knowledge and skills to be able to successfully embed in a VLE:

- **Interpersonal communication skills**

  The embedded librarians need to be **team players** since they will be part of a team and should be able to play well with others (in the team). The embedded librarians will also have to understand how the team they are working with functions and undertakes its duties; ideally the embedded librarian needs to know the role of each team member, know how to interact with, support and receive support from the team members (Carlson & Kneale, 2011:169).

  An embedded librarian needs to be able to **build trusted relationships** by talking and listening to the user group that the librarian serves with a special emphasis on the librarian and the user group teaching and learning from each other (Carlson & Kneale, 2011:169). Hoffman and Ramin (2010:298) mention that stronger relationships between students and the library, and possibly the university, can be built from personal interactions with librarians. This is done by first creating an understanding of the needs of the users and the capabilities of the librarian and secondly, to build trusted relationships. The authors mentioned that it is only when users know a librarian and what the librarian can do that they begin to trust the librarian and start to see the librarian as a valuable resource (Carlson & Kneale, 2011:169).

- The embedded librarian needs to obtain **support** from the institution as well as colleagues since it will be a change to work with clients outside the library walls. The success of the embedded librarian is dependent on the understanding and approval of the library management (who may adjust the librarian's responsibilities) as well as colleagues (may be affected by the librarian's new role as an embedded librarian). It is also essential to make all the parties involved from the library side that becoming an embedded librarian does not remove the librarian completely from their work but rather it redefines and expands the influence that the library has on its clients (Carlson & Kneale, 2011:169).

- **Library research, referencing, information organization and ICT skills**

  The embedded librarian should be able to translate library science (or information science) to other disciplines since librarians are skilful in doing so. When doing reference work, a librarian can discover the information needs of a library user and

then translate the needs into the language of the relevant information environment so that the user can be connected to information sources that are most appropriate (Carlson & Kneale, 2011:169). The authors add that it is vital for embedded librarians to be able to explain their knowledge, skills and expertise to others in a manner that is both relevant and meaningful to the users and their situation. This will obviously take some time, effort and repetition.

It is not only an academic solution to have librarians present in online courses, it is also a "powerful outreach tool" since information can be provided in multiple forms for different students (Hoffman & Ramin, 2010:298). This is understood to mean that having librarians present in an online course helps the librarians to reach more library users and provide information services regardless of location and to reach those students who would have otherwise been disadvantaged by the traditional text-only formats. Librarians can provide the same information in multiple formats so that even those who may be challenged in one or more ways can still receive the information (i.e. some users may learn better with visual information representations as opposed to text, or they are better at watching and learning than reading and learning.) The librarian and the lecturer combine to form a team that ensures that different learning styles benefit from the librarian's presence and ability to represent information in multiple formats.

Shumaker (2009:240) noted that reference librarians have in depth knowledge and skills that can potentially benefit a number of user communities, but the value can only be revealed once the librarians have established relationships that allow them to join in the conversations of the user group in order to identify the information needs that are not expressed since some of the users may have a difficult time expressing their needs. Continued working relationships, knowledge of and commitment to the goals and objectives of an information user group, along with contributions that are highly customized and value-added, are what define an embedded librarian (Shumaker, 2009:240; 2012:5).

All of the above require expertise and proficiency when it comes to the use of Information and Communication Technologies (ICTs) (Shumaker & Tyler, 2007:18). According to Allen (2017:252-253), an embedding IS should be able to: host online discussions in an online environment (web technology skills), record video tutorials (video software knowledge and use), host online workshops/ training sessions (collaboration and video conferencing tools use), create a library page

within the VLE (web design and basic coding skills), and market library services directly to students via email and links in the VLE (digital communication skills and tools use).

- **Knowledge of the subject area of users**

  The librarians need to combine their traditional library and/or information science skills and competencies with an advanced knowledge of their clients' discipline (Shumaker & Tyler, 2007:3). This means that the librarians' ability to retrieve and organise information is what separates their contribution to the group from those of the other members of the group (Shumaker & Tyler, 2007:3). In addition, the librarians are able to understand the goals and problems of their clients, which make the librarians' contributions valuable (Shumaker & Tyler, 2007:3).

- **Marketing, entrepreneurial & innovation skills**

  Marketing skills are important as they can be used to introduce faculty to a completely different view of library services and move away from what clients expect from a library (Allen, 2017:257). Additionally, misinformation that may be presented in the VLE can be repelled (Bezet, 2013:193). Information, that demonstrates the importance of the library training and the contribution it makes to the students' success, as well as the benefits that the embedded library activities have for the clients, can also be shared with clients (Bezet, 2013:195, 199).

  Accepting risk and putting yourself out there while working in new environments has a risk element for the embedded librarian as well as the institution they are working for (Carlson & Kneale, 2011:169). Taking risks is essential for change. The risks may not always payoff directly, but the librarian's involvement may have some indirect benefits, for instance, better working relationships with the faculty staff.

  The embedded librarian needs to have **an entrepreneurial mindset** (Carlson & Kneale, 2011:168), specifically knowledge entrepreneurship which is "the ability to recognize or create an opportunity and take action aimed at realizing the innovative knowledge practice or product" (Senges, 2007:5). According to the authors, the embedded librarian model's success is dependent on the librarians' ability to become entrepreneurial in their work as librarians and should have the following characteristics: be proactive in the identification and pursuing of opportunities, attend university talks with speakers and seminars, and also be able to sell

themselves and what they can contribute as librarians concerning new knowledge-based products or practices.

An embedded librarian should be able to **move outside his/her comfort zone** and venture into unfamiliar territory and ask for assistance when needed. Developing a network of trusted colleagues to consult with when uncertain about things is recommended. Embedded librarians must remember that they possess skills and a perspective that the users may likely not possess and that in itself is valuable (Carlson & Kneale, 2011:169).

An embedded librarian needs to be innovative and to **think and act outside the box** as the librarians may already recognize the need to re-look their role at the institution they work for and adapt their work to the current age of research and scholarship (in undergraduate education it would be in teaching and learning) (Carlson & Kneale, 2011:169). The challenge that the embedded librarian may encounter is going beyond just being recognized and moving forward with real change in the relationship with students. Planning the embedded librarian initiative counts much less than the actions taken by the librarian and the library in taking up opportunities for embedding in the student modules.

(Shumaker & Tyler, 2007:18; Senges, 2007:5; Shumaker, 2009:240, 2012:5; Carlson & Kneale, 2011:18).

Branch (2009:2) introduced the ADDIE (Analyse, Design, Develop, Implement and Evaluate) process of instructional design as an essential process for producing effective learning resources. Tumbleson and Burke (2013:70) mentioned that the ADDIE process should be adhered to when devising a plan for delivering online embedded librarian services so that they are able to achieve the outcomes they want to achieve. . A brief explanation of each phase of the process is given below):

- **Analyse:** the librarian can analyse the need for the embedded librarian program, the instructional goals and requirements (i.e. content), as well as the students themselves (Branch, 2009:8; Tumbleson, 2013:71). The librarian can also look at what resources are required as well as how the embedded librarian program will be introduced to the course instructors and students. (Branch, 2009:8, 21).

- **Design:** the librarian can validate the desired outcomes and methods for testing the embedded librarian program (Branch, 2009:21). A design brief can be produced by the librarian (Tumbleson, 2013:74).
- **Develop:** in the development part of the process, student learning resources can be generated and validated (Branch, 2009:21; Tumbleson, 2013:78). This is where the embedded librarian generates content, select or develop supporting media, step-by-step guides, as well as conduct a pilot test of the program (Branch, 2009:21; Tumbleson, 2013:78).
- **Implement:** during the implementation phase preparation of the learning environment (in this case a VLE) can take place as well as student engagement (Branch, 2009:21). The embedded librarian can prepare the course instructor and students on what to expect once the librarian embeds in the VLE (Branch, 2009:21). This is where an implementation strategy can be produced.
- **Evaluate:** the embedded librarian can assess the quality of the instructional processes and products, pre- and post implementation (Branch, 2009:21). This means that the embedded librarian would have to determine the criteria to use for evaluating the instructional processes and products. The librarian would also have to select the tools that will be used in the evaluation as well as conduct the actual evaluation (Branch, 2009:21). An evaluation plan would have to be created that encompasses all the above-mentioned evaluation procedures.

Librarians choosing to embed in a VLE can get involved at different levels, ranging from minimal to maximum embeddedness. In the next section, the different levels that an embedded librarian can get involved in a VLE are discussed and a depiction of the different levels is also provided.

2.5.4. Tiers of embedded librarian participation in a VLE

The depiction of the tiers of participation of an embedded librarian or levels of embeddedness was drawn from the ideas of York and Vance (2009), Bezet (2013) and Allen (2017).

The first tier of participation

Allen (2017:252) made the example of the study by Bezet (2013) mentioning that the librarians had administrative access to all online classes. This is deemed to be the first tier of

participation by an embedded librarian. York and Vance (2009) proposed seven best practices for embedded librarians. Providing library links in the CMS is linked to the first level of embeddedness (York & Vance, 2009:203). Bezet (2013) on the other hand compiled a list of ten recommendations from lessons learned while embedding online at the Everglades University. Of the ten recommendations, the author mentions personalizing content for a group of students and encouraging students to contact the librarian (Bezet, 2013:197). The embedded librarian could also provide links to journal articles (Bezet, 2013:203). This ties in with the first level of embeddedness.

The second tier of participation

The second tier of embeddedness stems from York and Vance (2009:203) who mention that an embedded librarian can get involved in individual courses as an instructor and providing assessments such as quizzes and also give IL courses. The authors also added that the embedded librarian can become an active participant in a course by posting contact information and taking part in discussions. Bezet (2013:200) noted that the embedded librarian can upload tutorials, a library quiz and a citation exercise into a course for students. This ties in with the second level of embeddedness as described by York and Vance (2009).

The third tier of participation

Allen (2017:253) identified the third tier of participation by noting that the highest tier of participation involves the embedded librarian collaborating with a course instructor in the design of a course that incorporates library resources as well as IL skills. York & Vance (2009: 206-207) mention that an embedded librarian can market the embedded librarian services by communicating with the course instructor as to what the librarian will be doing in in the course order for the course instructor to take interest. This is more about marketing the embedded librarian services to the course instructor; some may become open to including the embedded librarian in the creation of online courses by allowing them to have a say in the design of the course or take advice from the embedded librarian (York & Vance, 2009:206-207).

Below is a diagram depicting the levels of embeddedness which are measured in terms of the tiers of participation of an embedded librarian as drawn from the discussion above. Figure 4 was drawn specifically with a VLE in mind.

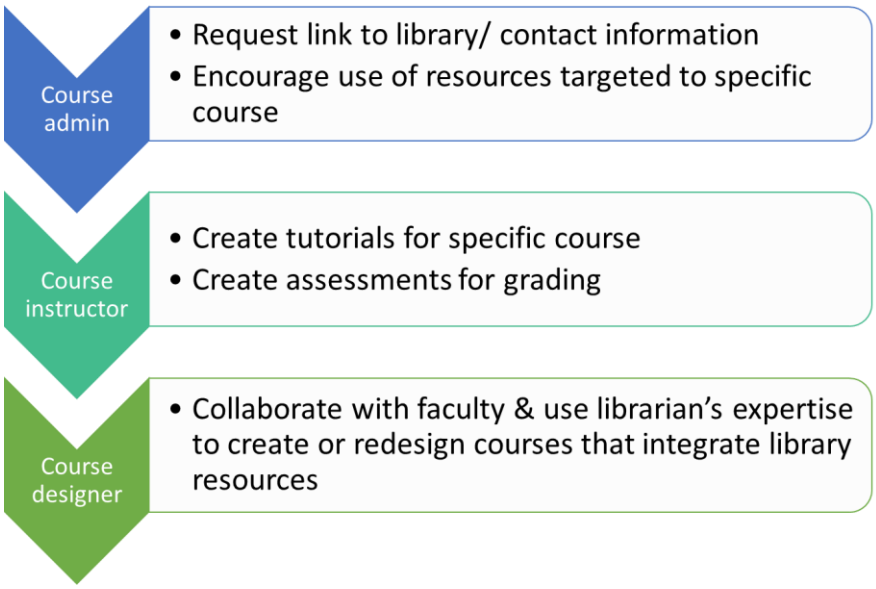


Figure 4: Tiers of participation of an embedded librarian (levels of embeddedness)

Adopted from: York & Vance (2009:202-207); Bezet (2013:197-203); Allen (2017:252-253).

The following section will address some of the challenges that librarians come across when attempting to embed in online courses as part of the BL movement.

2.5.5. Challenges to embedding online

According to Allen, (2017: 252) the implementation of an online embedded librarian program can prove to be a challenge because of the following reasons:

- Students and faculty staff frequently do not regard the library as being part of the foundation for online learning;
- Librarians are not actively involved in the process of developing the curriculum; and
- Librarians might find it quite challenging to influence the process of designing courses as the culture of faculty at many higher learning institutions stress the independence of the lecturer over collaborating with academic support departments such as the library.

Regardless of the challenges to implementing an online embedded librarian program mentioned above, many academic libraries have been able to implement embedded librarian services in online classes successfully (Allen, 2017:252). A number of typical embedded services have already been discussed in section 2.2.3 and section 2.2.4 highlighted some of the library products that are typically embedded in learning environments. In addition to discussion forums, video tutorials, creating a library page and hosting online workshops, it is also important to market the library services directly to students using communication channels such as email as well as posting links in the LMS used by the learning institution (Allen, 2017:253).

It is essential to identify those library services and products that can be embedded in a VLE or any other type of learning environment. In the following section, insight is shared to ensure that the VLE for Engineering students could be better understood. Examples of typical products and services required by this user group will also be discussed.

2.6. Embedding in the Engineering learning environment

According to Dewey (2004:13), it seems unrealistic for librarians to become embedded within the student learning environment, however, partnerships and opportunities for conversation can result in mutual respect and trust, as well as more productive use of library resources and expertise by user groups. By partnering with students, new innovative ways of reaching out to students can come into being (Dewey, 2004:13). When looking at a discipline such as Engineering, discipline-specific resources can be embedded in a VLE and these include among others: selected electronic resources, subject guides, and services specifically customized for Engineering (Dewey, 2004:15; Paganelli & Paganelli, 2017:54; Moran & Mulvihill, 2017:20). The links to the library services can include direct access to the IS for the specific course, interlibrary loans web page, and other services deemed appropriate (Dewey, 2004:15; Paganelli & Paganelli, 2017:54). By providing links, students can find discipline-specific resources and services easily (Dewey, 2004:15).

It is important for an embedded librarian to understand the information needs of Engineering students to be able to identify the most appropriate information products and services. It has been a challenge however, to find literature that discusses embedded librarianship in Engineering education at higher learning institutions. There have been numerous publications on traditional embedded librarianship, however from the literature search conducted, very little was found on VLEs, Engineering education and embedded librarianship. This supports what Zhang (2015:273) mentions, that very few studies that have been conducted to assess users'

satisfaction with library resources and quality of service, as well as looking for library use patterns, actually cover the Engineering field. With that in mind, a few instances exist in literature on how librarians can embed successfully in a VLE and some of which seem applicable to use to embed library products for Engineering and the University of Pretoria Department of Library Services (UPDLS) already has access to the products mentioned.

- *Screencast-o-Matic* which is a free screen capturing tool, can be used to create video tutorials and assessments for students taking a specific course in the VLE (Allen, 2017: 256). The librarian can capture live web demonstrations and desktop applications, for example, a live demonstration on how to search on Google Scholar and then save the video file in mp4 format and upload it to YouTube. The YouTube-link is then embedded for use at the point of need.
- *YouTube* is linked to a range of Google tools and a benefit of YouTube videos as they can be embedded in other platforms such as LibGuides and the library Website (Allen, 2017: 256).
- *Google Forms* can be used to create online quizzes for the video tutorials of which, YouTube videos can be embedded in Google Forms. This can especially be helpful in embedding the screencasts into the quiz itself (Allen, 2017: 256).

Once the tutorials and quizzes have been created for the targeted undergraduate course, the link to the video(s) and quiz can be given to the instructional designer or lecturer within the specific department and they can then give feedback on the tutorials which the librarian can use to improve the tutorials and/or quiz (Allen, 2017: 256). The author also mentioned that the instructional designer can take the final Google form containing the video tutorial and quiz into the online CMS. The use of multiple-choice questions in the quiz makes the embedded librarian program more scalable and sustainable as the quizzes could be marked automatically.

2.6.1 Information needs of Engineering students

It appears that different Engineering departments have different information needs. Kerins, Madden and Fulton (2004:4) in their study, mention that undergraduate Engineering students are required to complete projects which include research and development tasks. This is similar to what professional engineers do. While completing their projects, engineering students may be required to design, test, manufacture and construct a final product or device (Kerins, Madden & Fulton, 2004:4).

At the undergraduate level (the focus of this research) students are mostly expected to complete assignments and projects and, in most cases, there is an ideal way of getting to the end result. The IS can assist the students at different stages of the assignment or project completion process by training and equipping them with the necessary IL skills needed to acquire the required literature faster.

Before deciding what products and services to embed it is essential that the librarian understands the Engineering study process and workflow. This is necessary to identify the types of information that is typically used at the specific stage and level of study and in doing so, being able to assign the correct products and services that are best suited for the specific stage that the students may be in while working on a research project or assignment. In the next section the student self-study process is first discussed before the generic Engineering workflow is discussed in section 2.6.3.

2.6.2 The student self-study process

Figure 4 below illustrates how students should typically undertake effective assignment writing at undergraduate level:

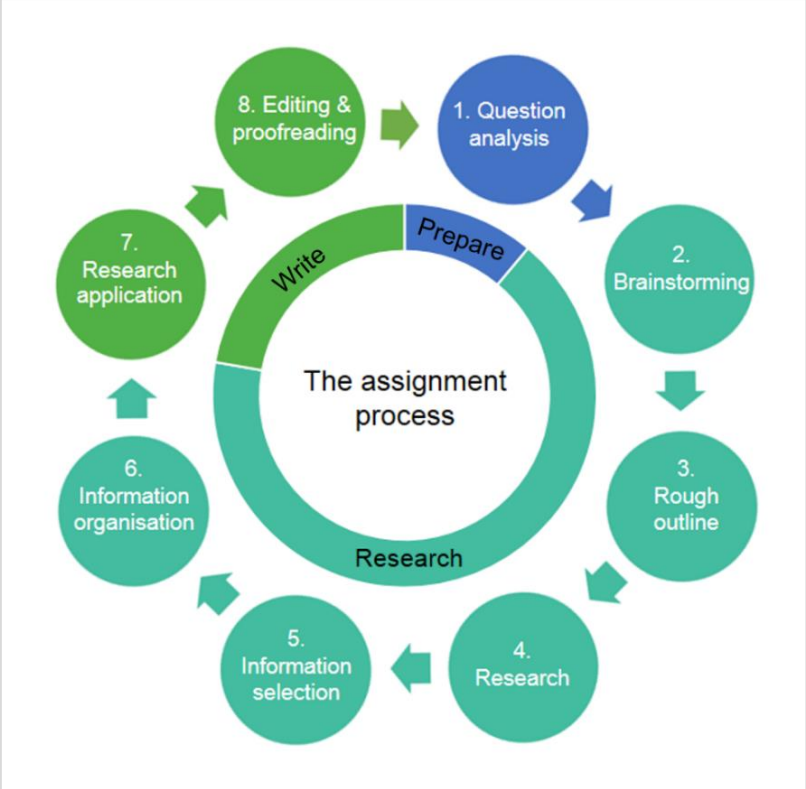


Figure 5: A generic assignment process

Adopted from: Macquarie University (2017: online); University of Technology Sydney (2017: online).

- In the first stage which is to prepare, the student needs to analyse the assignment topic for keywords which identify the topic and then try to rephrase the assignment question in order to ensure that they understand the question fully (University of Technology Sydney, 2017: online). If unsure of what is required the student can also seek clarification from fellow classmates, the lecturer or a tutor. This will help the student understand exactly what content is required so that an informed choice could be made when gathering the material they may need to read about or research (University of Technology Sydney, 2017: online).

- In the second stage which is research, reading is done broadly in order to get an overall picture of the topic in the question given by starting with lecture notes, the study guide, introductory as well general readings (University of Technology Sydney, 2017: online). It is advised that the assignment question should be kept in mind when reading. Once an understanding of the topic has been reached, the student can then formulate their own perspective on the assignment question and then focus on more detailed texts (sources) as well as the student's possible line of argument (University of Technology Sydney, 2017: online). By focusing their reading, a student can help to validate their adopted perspective and a search for texts detailing the identified issues should be conducted using the library catalogue, databases, introductory texts and journal articles. A clear view of the argument is necessary in order to keep the writing focused, logical and coherent (University of Technology Sydney, 2017: online).

- The third and final stage is writing. The argument and evidence need to be organized and connections between the points made should be established (University of Technology Sydney, 2017: online). To do that, three things need to take place: plan, draft and redraft, and edit. The planning phase includes organizing one's argument and evidence as well as establishing connections between the points. A draft ensures that a student has an overview of what the assignment will cover, provides guidance as well as ensure that nothing is left uncovered (University of Technology Sydney, 2017: online). Once a plan is in place, the first draft can then be written, during the drafting and redrafting, more research or reading may need to be done in order to strengthen one's argument or evidence in an assignment. Once the final draft has been completed, it should be left for at least a day before the final editing is done which includes the structure, grammar and technical aspects of the assignment (University of Technology Sydney, 2017: online). It is also useful to get a fresh set of eyes to read over the

assignment, so it is advisable to also ask a friend to read the assignment before submitting it.

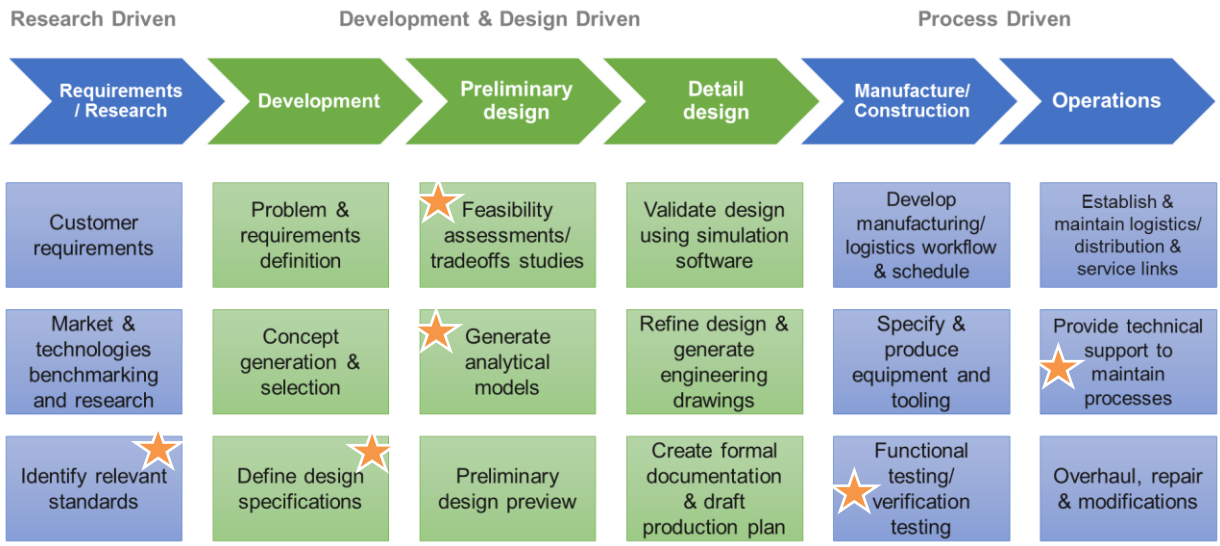
From the discussion above it can be deduced that any assistance with the writing process could enhance the quality of the end product.

For further clues regarding information needs the following section highlights the generic Engineering workflow.

2.6.3 The Engineering workflow

Figure 6 below shows a typical Engineering workflow which can inherently be grouped into three parts: Research, development and design, and process.

According to Helmy (2017:27), the development and design stages of the Engineering workflow (marked in green in Figure 6) have the biggest demand for technical information. The requirements or research phase (marked in blue in figure 6) mentions the identification of relevant standards which an embedded librarian can provide to the students. It would also be possible to assist with benchmarking information. This is where the embedded librarian can come in and offer information services to the Engineering undergraduate students.



Source: Helmy (2017:27).

Figure 6: Engineering workflow.

Obviously, all of the stages do not require external information. However, decision making needs to be traced back to reputable sources, students can acquire this information

(supporting facts) using the information resources available through the library such as articles from journals, books, audio-visual material and databases. It is therefore anticipated that areas marked with an orange star should find value in relevant information either provided on demand or proactively. New insights for exploring solutions and improving approaches can also be obtained through the library since the library has the most up to date information sources and journal subscriptions. Students can also obtain the best practice information needed to enhance information and models by consulting resources such as local and international standards (i.e. ISO, ASTM, IEEE and SABS standards) for testing, maintenance and production.

From the two sections above it is possible to make an educated guess as to the information product and service needs of the Engineering students. With that understanding and in the absence of clear guidance from literature it was decided to at least look at the generic items that are usually embedded. In the following section, the products that are typically embedded in learning environments will be discussed. The generic services will be addressed in section 2.6.5.

2.6.4 Products typically Embedded in Learning Environments

According to Paganelli and Paganelli (2017:55) libraries have shifted towards embedding in online courses in order to reach users at their point of need. This is made possible by innovations in technology and new library service models. Technically it is easy to embed the library into the teaching and learning activities of a university. For example, it could be done by posting links on a virtual learning system like Blackboard. However, for that to happen, librarians must collaborate with the teaching staff to integrate library resources such as e-course reserves, databases, images and any other materials that are relevant directly into ClickUP pages (Dewey, 2004:15; Kearley & Philips, 2004:71).

An interlibrary loan form to request material that the library does not already have, style guides and writing resources, as well as book and article searching functions, can also be included in the course as part of the library component to the module (Kearley & Philips, 2004:71; Matthew & Schroeder, 2006:61).

Kerins, Madden & Fulton, (2004:6,8,11) and Jeffryes & Lafferty, (2012: online) identified the following products as important for Engineering students:

- Print books;
- Technical handbooks and reports;

- Journals;
- Online databases;
- Standards;
- Patents;
- Vapor-Liquid Equilibrium data (for Chemical Engineering students);
- Material property data;
- Subject guides; and
- Previous student projects

(Kerins, Madden & Fulton, 2004:6,8; Jeffryes & Lafferty, 2012: online).

In addition to the library products already mentioned, librarians can embed their expertise into courses by including links to online tutorials created by the librarians to address the needs of the students taking the specific modules that relate to seeking information and conducting research (Dewey, 2004:15; Kearley & Philips, 2004:71; Kearley & Philips, 2004:71; Shumaker & Tyler, 2007:5; Paganelli & Paganelli, 2017:54). Providing access to online books is another way of embedding library products online.

Relating to what Hoffman and Ramin (2010:301) mention about the use of discussion boards, they also mention uploading screenshots in discussion boards to enrich the students' learning as it is easier to explain a database search in pictures than actually outlining the steps in words. Video tutorials can also be embedded by providing a link to the tutorial in a post on the discussion board (Matthew and Schroeder, 2006:61; Hoffman & Ramin, 2010:302; Paganelli & Paganelli, 2017:54; Allen, 2017:253).

In the following section, the services that are typically embedded in learning environments will be discussed.

2.6.5 Services typically Embedded in Learning Environments

Librarians who embed in online courses aim to keep the library visible in the online learning environment. However, librarians need to also look at how students can benefit from having

the librarian present in the online campus and if such a service is wanted (Hoffman & Ramin, 2010:293). The question remains: What services would be relevant?

Jeffryes and Lafferty (2012: online) conducted a survey involving 42 Engineering students taking part in a co-operative education program at the University of Minnesota. The students were from the following departments: Aerospace & Mechanics, Civil Engineering, Computer Science, Electrical Engineering, Mechanical Engineering, Chemical Engineering, and Material Science. They expressed the need to gain access to the following services:

- Access to the library at times that suit them;
- Information sources which are within arms' reach such as the internet (or electronic resources);
- Information searching strategies/ information retrieval and evaluation skills training;
- Personal consultation with a librarian (librarian is seen as an intermediary and not as an important source of information);
- Inter-lending of material; and
- Referencing

(Kerins, Madden & Fulton, 2004:6,8,11; Jeffryes & Lafferty, 2012: online).

In addition, the services being offered by the embedded librarians may span from providing general links to web pages to the provision of mass communication, content that is exceedingly interactive, as well as personal interaction (Matthew & Schroeder, 2006:61; York & Vance, 2009:199; Allen, 2017: 253). Hoffman and Ramin (2010:298) state that embedded services frequently commence as an experiment by a single librarian. Students are more likely to notice information that is provided at the point when they need it, in which case, it may prompt the students to ask additional questions (Hoffman & Ramin, 2010:294; Paganelli & Paganelli, 2017:54). By creating and posting in a library-specific discussion board in a VLE such as Blackboard (referred to as ClickUP at UP), librarians can interact with students and learn more about their needs. Librarians can also become proactive by posting information relating to the students' studies in the VLE and also include visual material when posting on the discussion board, for example, a screenshot of what a specific reference book, they need for their studies, looks like (Hoffman & Ramin, 2010:299; Allen, 2017:253).

By posting in one discussion board, the students, along with the librarian, are able to find all the library information that is related to their studies in one location. By keeping track of when students' assignments are due, the embedded librarian can create and post tips and tutorials at the exact time that students need them (point of need) (Hoffman & Ramin, 2010:301). Hoffman and Ramin (2010:301) are also of the opinion that it is likely that students would rather read postings about sources that may be relevant to their assignments one to two weeks before the deadline as opposed to the first few weeks of the lecture. By understanding this dimension of student information behaviour, the librarian can avoid overwhelming the students with information when they start a course and only make the information available when they are most likely to use it (Hoffman & Ramin, 2010:301).

According to Kearley and Philips (2004:71) and Shumaker and Tyler (2007:5) suggesting resources, setting up training sessions on the use of library resources that integrate the information requirements of the students, as well as sharing information that is relevant to the students in the course is another way of embedding library services online. FAQs can also be used (Matthew & Schroeder, 2006:61). An email or chat-to-a-librarian feature can be also integrated into the module so students know who to contact in the library (Kearley & Philips, 2004:71; Matthew & Schroeder, 2006:61).

In the following section, the current status of the library services being offered by the UPDLS will be discussed, including the differences and similarities that may exist in the service offerings of the different schools within the EBIT faculty.

2.7. Blackboard as a VLE at UP

2.7.1. Blackboard Learn: An Overview

Blackboard learn is explained to be "an application for online teaching, learning, community building, and knowledge sharing" (Blackboard Inc., 2018a: online). Blackboard Learn is flexible and focused on the achievements of students, and any theory or teaching model can be used for online courses (Blackboard Inc., 2018a: online). Blackboard Learn is considered to be similar to face-to-face teaching in a classroom. Learning online can therefore take place in a synchronous (instant, real-time interaction) session or material could be uploaded for asynchronous (delayed interaction) access. Blackboard Collaborate can be used for synchronous learning where students and instructors can meet in a 'Collaborate' session to present a lecture, study sessions, discussions, host guest speakers and even hold office hours

(Blackboard Inc., 2018a: online). In an asynchronous environment, interactions take place over an extended period of time. Both lecturers and students can take the time to create communication that is more reflective.

It is crucial for the instructor to let students know how frequent the communication tools will be checked, as well as how often the students will hear from the instructor, and when the instructor is available to answer questions and students' concerns (Blackboard Inc., 2018a: online). Many of the tools in Blackboard Learn can be used to accomplish tasks that are also done in a face-to-face setting such as the following:

- In a traditional face-to-face classroom setting, students can be reminded of upcoming events by the instructor while in Blackboard Learn the instructor can post announcements in the discussion board to accomplish the same task.
- In a traditional face-to-face classroom setting the instructor asks questions to gauge the students' understanding of the class material and in Blackboard Learn the questions can be asked using the discussion board, holding collaborate sessions or asking the students to take a quiz which is usually not graded for marks.
- Learners need to be clear on what is expected of them; due dates, instructions and grading guidelines must be easy to find and understand.
- The instructors need to show the students that they care; students want interactions that are both meaningful and personal

(Blackboard Inc., 2018a: online).

Courses can be enhanced by adding library content since the library posts course reserves, electronic articles and other information resources (Blackboard Inc., 2018b: online). Seamless integration with Blackboard Learn can take place which makes it a great way of sharing and disseminating materials from the library. Two main areas exist within the Blackboard Learn library function which are library content and eReserves, however, it is possible for an institution to add more areas to the library in order to meet more user needs (Blackboard Inc., 2018b: online).

The following section will discuss the use of Blackboard Learn at UP

2.7.2. Blackboard Learn functionalities in use at UP

As was indicated in section 1.4, UP has over the years adopted Blackboard Learn as its LMS but has called it ClickUP. The Blackboard Learn system comprises five groupings of learning management functionalities: content, management, information, collaborate, and assessment (Blackboard Inc., n.d.: online). Each of the groups' descriptions and components are outlined below:

i. Content

Any or a combination of any of the following options are available to upload in the content group: Item, File, Web link, Mashups, Course link, Folder, Learning module, Lesson plan, and Module page. The embedded librarian, in collaboration with the instructor for the specific module, can get involved here to develop the course content. If a decision is made to develop a separate but embedded module these options would all be of use.

ii. Management

The management component of Blackboard Learn includes: Retention centre, Adaptive release, My grades, Course reports, the Performance dashboard, and the Grade centre. It is unlikely that the librarian could embed either products or services in this component.

iii. Information

The information part of Blackboard Learn includes: Tasks, Roster, Survey, Announcements, Contacts, and Calendar. These could also be of importance to the embedded librarian.

iv. Collaborate

The purpose of the 'Collaborate' group of functions in Blackboard Learn is for students to collaborate with each other while enrolled in a particular course in the VLE. The functions are a Journal, BB Collaborate, Messages, Send email, Discussion board, a Blog, Groups, and a Wiki. The embedded librarian would be able to make use of these functions to collaborate with students and lecturers.

v. Assessment

This group of functions includes the following options: Turnitin, Test, Graded wiki, Graded blog, Assignment, Graded discussion board, Rubric, and Graded journal.

Training regarding the use and usefulness of Turnitin could be developed and embedded by the librarian. Obviously, if an online module is developed the embedded librarian would be able to make use of all of these options.

2.8. Conclusion

Regardless of whether it's in a physical or an online learning environment, it is critical that librarians meet the needs of users at the point when they most need assistance. As Carlson and Kneale (2011:170) noted, embedded librarianship is an influential way of showing the current and potential impact that librarians have beyond the traditional roles associated with the library. Blackboard Learn has a diverse and substantial number of functionalities that are of use to instructors/lecturers, but that could also enable the librarian, wishing to embed relevant products and services, to do so. Embedding library products and services would allow both the lecturer and the student to gain access to learning content when and where they need to.

CHAPTER 3: METHODOLOGY

3.1. Introduction

The purpose of this chapter is to introduce and discuss the methodology used to conduct research on how an IS (librarian) who provides assistance to Engineering students could embed library products and information services, suitable for undergraduates, into the evolving e-learning environment at UP. In this chapter, the research paradigm, research design, target population and sampling, data collection methods and instruments are described in detail. The data analysis method and tools, as well as the validity and reliability of the research, the limitations of the methodology selected and any ethical considerations that need to take place are also provided.

3.2. Research Overview

The main research question that was answered by this research is:

What needed to be done to ensure that appropriate library products and information services, that are of value to both students and lecturers, are embedded into the evolving learning environment for Engineering students at UP?

To be able to answer the main research question, several issues related to the main research question needed to be addressed. The following set of sub-questions had specific relevance to the empirical research component of this dissertation:

Do the information needs for learners from the sub-disciplines in Engineering show any variances?

- What is the current level of IL as indicated by the respondents?
- What is the current information behaviour as reported by respondents?
- What services can the library at UP add to their existing services to support a hybrid learning environment developed for Engineering (undergraduate) students?

To answer the questions posed, the researcher had to consider numerous ways of conducting the research. In this chapter the research methodology is described in more detail. The research paradigm selected for the research will be discussed next.

3.2.1. Research Approach

There are two broad research approaches, quantitative and qualitative. Quantitative research is about quantities, it is used to test a theory and it attempts to measure variables using statistical methods, for example, the number of people of a specific gender in a class or school (Creswell, 2014b:4; Leedy & Ormond, 2014:97-98; Flick, 2015:13). In quantitative research, the data that is generated is numerical or can be changed into usable statistics and the results can be generalized to a larger known population from the original sample (Creswell, 2014b:4; Leedy & Ormond, 2014:98; Flick, 2015:13; Byrne, 2017a: online). The sample would therefore need to be rather large (Leedy & Ormond, 2014:98). The methods of collecting data in quantitative research are usually standardized (Leedy & Ormond, 2014:98; Flick, 2015:13; Byrne, 2017a: online).

Qualitative research, on the other hand, looks at the characteristics or qualities that usually cannot be measured numerically. For instance, people's perspectives on a given topic cannot be fully expressed in numbers (Creswell, 2014b:4; Leedy & Ormond, 2014:97; Flick, 2015:14,16). Qualitative research is used when attempting to gain an understanding of opinions, reasons and motivations (Flick, 2015:16; Byrne, 2017a: online; Creswell, 2018:42). In addition to what has already been mentioned, qualitative research is used to get a better understanding of situations that may require an in-depth understanding of complex relationships (Leedy & Ormond, 2014:98; Flick, 2015:15; Creswell, 2018:43-44). The sample size required for qualitative research is relatively small when compared to that required for quantitative research. Data collection is commonly done using semi-structured or unstructured data collection techniques such as focus group discussions, ethnographic fieldwork, and individual interviews (Byrne, 2017a: online).

When undertaking research, a combination of qualitative and quantitative research methods is possible, and it is referred to as mixed methods research (Creswell, 2014b:4; Byrne, 2017b: online). Mixed methods research can be defined as the intentional collection of both qualitative and quantitative data as well as the combination of the strengths of each, in order to answer research questions (Klassen, Creswell, Clark, Smith and Meissner, 2012:379 Creswell, 2014b:4). A more descriptive definition by Creswell (2014a:2) states that mixed methods research is an approach that is used to conduct research in the social, behavioural, and health sciences where the researcher collects both qualitative (open-ended) and quantitative (close-ended) data from participants, integrates the two types of data, and interprets the data based

on the strengths of both types of data in order to understand the research questions that are posed by the researcher.

Mixed methods research is best undertaken when neither qualitative nor quantitative research is solely adequate to give multiple perspectives to the research being undertaken and when each alone would be unable to fully answer a research question or research problem.

For this research, qualitative research was conducted. The reason for the decision is that the views of participants regarding the library and its services, as well as the actual shift to BL needed to be analysed and understood before the library's products and services could be embedded in a manner that is the most appropriate and most successful for the clients.

3.2.2. Research Design

Research design, in its simplest form, is a general strategy that provides the overall structure for the procedures that a researcher follows, the collection of data by the researcher, and the data analysis that is conducted by the researcher to solve a research problem (Creswell, 2014b:12; Leedy & Ormond, 2014:76).

There are five types of qualitative research designs: case study, ethnography, phenomenological study, grounded theory, and content analysis (Creswell, 2014b:13-14, 2018:67; Leedy & Ormond, 2014:143-152). Each of the research designs is described below:

i. **Case study:** is used to study a specific person, program, or event in depth over a definite period of time. This appears to be a suitable design for the current study.

ii. **Ethnography:** is used to look at an entire group that shares a common culture in depth as opposed to a specific case. It requires the researcher to study the group in their natural setting over a long period of time (which can be months to years). This design would therefore not be suitable for the current research.

iii. **Phenomenological study:** attempts to understand the perceptions, perspectives, as well as understanding that people hold towards a particular situation. In some cases, the researcher has had a personal experience that relates to the phenomenon and wants to gain a better understanding of the experiences of other people which can then be generalised. This design is not suitable as the candidates have no experience in using embedded library services yet.

iv. **Grounded theory:** is an unlikely design as the research would have to originate from a particular theoretical framework which is then used to develop a new theory.

Grounded theory has its roots in sociology and is currently used in the humanities and social sciences. This research is much more practical than theoretical.

v. **Content analysis:** is a detailed and systematic study of the contents of a certain body of material in order to identify patterns, themes or biases that may exist.

(Creswell, 2014b:13-14, 2018:67; Leedy & Ormond, 2014:143-152).

The qualitative research design that the researcher found to be the best fit for the research is **case study** research as it allowed the researcher to conduct in-depth research over a definite period of time. This fit into the research schedule of the researcher and allowed for an in-depth investigation into the needs of the specific group of participants. The chosen research design is discussed in more detail below.

Case study research

As described above, Creswell (2018:67, 2014b:14) and Leedy and Ormond (2014:143) mentioned that case study research, is also referred to as idiographic research, and is used to study a specific person, program, or event in depth over a definite period of time. A single case that is unique or has exceptional qualities can be studied in order to promote understanding of similar cases. On the other hand, a multiple or collective case study involves two or more cases that can be studied to compare, build a theory or even propose generalisations (Leedy & Ormond, 2014:143; Creswell, 2018:96). Case study research is most suitable for studying situations where little is known about the situation or situations which are poorly understood. In case study research, data is collected through observations, interviews, past records, documents, as well as audio-visual materials (Leedy & Ormond, 2014:143; Creswell, 2018:96).

There are three types of case studies:

i. **Intrinsic case studies:** attempt to develop a practical understanding of a particular case (Flick, 2015:98). In this instance the focus is on the particular case and its internal structure.

ii. **Instrumental case studies:** use a single case to better understand a situation bigger than the single case being studied (Flick, 2015:98).

iii. **Collective case studies:** study several cases in order to understand a specific phenomenon (Flick, 2015:98).

The research design that was adopted is case study research. Specifically, intrinsic case study research as only the experiences of undergraduate Engineering students and their lecturers were studied.

3.2.3. Research Sites

The interviews were conducted at the UP's main campus in Hatfield. The online questionnaire could have been answered from anywhere, but it was anticipated that most students were based in Pretoria at the time when they completed the questionnaires.

3.2.4. Target Population and Sampling

According to Flick (2015:269) a population is the average of all the study objects (or people) about which a specific statement is intended. A target population or research population is also described as the complete set of individuals about whom deductions will be made (Pickard, 2013:60). A sample is a portion that is drawn from the research population.

The target population was the undergraduate, third and final year, Material Science and Metallurgical Engineering, Mining Engineering, and Chemical Engineering students at UP and their lecturers. The undergraduate students were targeted since they are the ones that mostly use ClickUP. They are expected to complete assignments and projects. The size of the full target population is 447 individuals.

Sampling can be described as the process that a researcher uses to select entities for analysis (Leedy & Ormond, 2014:154). A sample is the entities that are selected by the researcher to be analysed. There are a number of sampling techniques that can be considered both in qualitative and quantitative research. For qualitative research, the two sampling methods are theoretical sampling and purposive sampling. Each of the sampling methods available within each group are discussed:

i. Theoretical sampling

Theoretical sampling is the process by which data is collected to generate a theory. The researcher is responsible for collecting, coding and analysing the data as well as deciding which of the data to collect next and where to find it in order to develop a theory as it emerges

(Flick, 2009:118, 2015:104). This type of sampling is used when the entire population cannot be determined in advance and the features of the population are not known in advance (Flick, 2009:119).

ii. Purposive sampling

In purposive sampling, information-rich cases, which are those cases (or individuals) that the researcher can learn a lot about the issues that are central to the research, are selected to be studied in depth (Pickard, 2013:64). Case study research usually makes use of purposive sampling (Flick, 2009:122 and Pickard, 2013:104).

The sampling method that was used is purposeful sampling, more specifically cluster sampling (Flick, 2015:106). The sampling method allowed the researcher to analyse the data in the sample separately for specific groups, i.e. Engineering as a faculty and then each Engineering discipline that was represented in the research, from third and fourth year undergraduates. To have a manageable sized sample, three of the Engineering departments that the researcher is currently responsible for were targeted. Chemical Engineering, Material Science & Metallurgical Engineering, and Mining Engineering, formed part of the sampling pool for the interviews.

A sample of 30 Chemical Engineering, 15 Material Science and Metallurgical Engineering, and 15 Mining Engineering students could self-select. The link to the online questionnaire was shared with all the third- and fourth-year students from the identified Engineering departments. Each student had an equal chance to participate but the questionnaire was closed when the desired number of participants had completed it.

3.2.5. Data Collection Techniques

This section discusses the data collection techniques that the researcher used to conduct the research. Since a qualitative research design was used, the data collection techniques were also qualitative. Each data collection technique is discussed in this section.

Interviews

The interview is one of the most common methods for collecting data from individuals (Kumar, 2011:144). According to Brinkmann and Kvale (2015:3) qualitative research interviews endeavour to understand the world from the point of view of the subjects, to describe what

their experiences mean, as well as to uncover the world they lived in before it was explained scientifically. Creswell (2018:163) defines interviewing as a social interaction that is based on a conversation. Brinkmann and Kvale (2015:5) defined an interview as a conversation that has a structure and a purpose. Leedy and Ormrod (2014:156) mentioned that interviews that are conducted in qualitative studies are rarely structured; they are either unstructured or semi-structured.

There are three types of interviews: unstructured, semi-structured and structured interviews (Leedy & Ormrod, 2014:156; Flick, 2015:140-144). Structured interviews are rigid – the same questions are asked in the same order to all participants. Semi-structured interviews have a set of central questions but make provision for prompting and probing questions where needed, while unstructured interviews are totally flexible (Leedy & Ormrod, 2014:156). This means that a researcher who opts for an unstructured interview is more likely to obtain information that was not initially planned for and the outcome is often different for each participant (Leedy & Ormrod, 2014:156).

The advantages of interviews as a data collection method are that:

- complex questions can be explained to an interviewee if necessary;
- in-depth information can be collected by probing;
- information could be supplemented to enhance understanding;
- the depth and personal context of the interviewee can be drawn;
- words carrying ambiguous meanings can be clarified; and
- the application of interviews is wider than what is possible with a questionnaire.

(Kumar, 2011:150; Leedy & Ormrod, 2014:156; Flick, 2015:10-141).

The disadvantages of interviews as a data collection method are:

- interviews can be time consuming and expensive to carry out;
- the quality of the collected data is dependent upon the quality of the interaction;
- the quality of the collected data is dependent on the quality of the interviewer in terms of experience, skills and commitment;
- the quality of the collected data may differ when multiple interviewers are used;

- researcher bias may be introduced by framing questions and interpretation of responses;
- having set questions may omit the chance to gain important insight from the interviewees; and
- too much flexibility may make it difficult to compare the results

(Kumar, 2011:150; Leedy & Ormrod, 2014:156; Flick, 2015:214).

The researcher chose to use semi-structured interviews to collect data from lecturing staff.

The next data collection technique that will be discussed is the questionnaire.

Questionnaires

A questionnaire is one of the most popular data collection tools used in research involving people as research participants (Pickard, 2013:207). Kumar (2014:178) describes a questionnaire as a written set of questions that are given to respondents and the respondents in turn read the questions, interpret what is expected of each question and then record their answers. The difference between a questionnaire and an interview schedule is that, in an interview, the interviewer asks the questions and records the answers to the questions and may, when necessary, explain the questions to the respondent to provide clarity. With a questionnaire, there is no-one present to explain what the questions mean (Pickard, 2013:207 and Kumar, 2014:178).

Questionnaires can be made available in a number of ways. The questionnaire can either be mailed in paper format, it can be collectively administered in a classroom or similar setting by the researcher, it can be made available online in electronic format, or it can be administered in a public place (Pickard, 2013:222 and Kumar, 2014:180). An electronic questionnaire can be posted on a website or a link to the questionnaire can be emailed to potential respondents to access and respond to (Pickard, 2013:222 and Kumar, 2014:180). An appropriate online program can be used to analyse the results of the online questionnaire.

The advantages of a questionnaire as a data collection instrument are:

- it is convenient and less expensive compared to interviewing respondents and it also saves the researcher time, as well as human and financial resources;
- mass distribution can take place, especially if respondents are not in one location;
- electronic questionnaires are easy to disseminate, collect and analyse;

- greater anonymity is offered by questionnaires when compared to other data collection techniques such as interviews; and
- in cases where sensitive questions are asked, respondents are able to give accurate information since there is no face-to-face interaction between the respondents and the researcher

(Flick, 2011:170, 2015:201; Kumar, 2014:181).

The disadvantages of a questionnaire as a data collection technique are:

- application is often limited to a target population that is literate and able to read and write;
- the response rate may be low and sample size may be reduced;
- self-selecting bias may be created due to a low response rate and the findings may not be representative of the entire target population;
- there may be a lack of opportunity to clarify issues, such as the intended meaning when words carry double meaning;
- there are no opportunities for respondents to give spontaneous answers as they have time to look over the entire questionnaire before answering;
- the response to some questions may be influenced by responses to other questions; and
- respondents may consult other people before answering which may influence the answers given

(Kumar, 2014:181-182).

The researcher opted to make use of an online questionnaire as the primary data collection technique for the study because of the following advantages that were mentioned above: they could be distributed to more participants that are not necessarily located in the same geographical area, anonymity was guaranteed as the researcher did not meet the respondents to obtain the answers to the questions, and the respondents were able to be as honest as they want to be because they were not influenced by the researcher in any way, thus removing any bias in terms of the responses favouring what they think the researcher wanted.

3.3. Data Collection procedures

The researcher, a qualified junior Information Specialist, collected data through personal interviews with lecturers using a semi-structured interview schedule (see Appendix A) and an online questionnaire for students (see Appendix B).

Appointments were scheduled with selected staff members. They were provided with the purpose of the interview when the appointment was made. The interviewer arranged a venue that was convenient for the interviewees. The interviews, with the permission of the interviewees, were recorded using a voice recorder. A list of predefined questions had to be answered by each respondent. Depending on the course of the individual interviews, the researcher asked additional questions in order to understand some of the responses that the interviewees gave and also to dig deeper for better insight into their thought processes. The staff interviews had only eight questions and depending on the responses given, additional follow-up questions were asked. Clarity to the questions asked was given in the staff interviews. A transcription was created and shared with the participant after the interview.

The questionnaire was created using Google forms. It was shared on ClickUP with all the third- and fourth-year students from the identified departments. The questionnaire was made available for two weeks with weekly reminders. Once the desired number of responses had been obtained, the questionnaire link was removed from ClickUP and no additional responses were accepted.

The questionnaire was sub-divided into six sections collecting the following information: introduction into the study and the purpose of the questionnaire, consent to participate in the research, student IL, the role of the IS, student information behaviour, and general comments and volunteering to participate in the focus group. Beside the introduction, consent and general section where students could comment, all the other sections are important in answering the research sub questions which will ultimately answer the main research question. The role of the IS also ties in to Chapter 2 (literature review) where it was noted that the role of the IS in a VLE is not clear (section 2.1), more specifically, the fact that there have not been many studies in linking embedded librarianship to Engineering (section 2.1).

The questionnaire contained both close-ended and open-ended questions. Open-ended questions give the perspectives of each respondent without limiting them and this led to a better understanding of the views of the participants with regard to the topic at hand (Flick,

2011:108; Pickard, 2013:218-219; Kumar, 2014:184). This meant that possible responses were not provided in the questionnaire and the respondents wrote answers in their own words. The respondents were able to provide more detailed and personal responses to the questions.

Close-ended questions offer a general idea of how the participants felt about the topic of research (Flick, 2011:108). The possible answers are provided in the questionnaire and the answer that was most descriptive of the respondents' answer are ticked (Pickard, 2013:211 and Kumar, 2014:184). A category of "Other/Please specify" is usually included because the researcher should accommodate any responses that might not have been listed (Kumar, 2014:184).

3.4. Data Analysis

Seeing that the data were collected using interviews and questionnaires, the data had to be analysed differently. A transcript of what was said in the interviews was compiled. The interview recordings were analysed through the process of reviewing the transcriptions where thematic analysis was used to look for recurring themes in the responses given by the respondents. The researcher therefore used the transcript to make deductions and to draw qualitative meaning from it.

Questionnaire data were collected using an online questionnaire (which was created using Google Forms). The Google form captured and stored the responses given. The researcher was then able to access the original form as well as the responses to the original form. Google forms allows the researcher to access the data collected in a number of different formats including web-based view through Google Forms or as an Excel spreadsheet in the associated Google Drive, and as a PDF document. The response to each question can be viewed either separately for each respondent or as a summary for all the respondents. The analysis feature is able to create graphs with numerical results as well as a list containing any textual responses. The researcher analysed the text responses by sorting and categorising them using content and thematic analysis, in order to find recurring themes.

3.5. Validity & Reliability

In qualitative research, validity means checking for the accuracy or credibility of research findings using certain procedures (Silverman, 2013:285; Creswell, 2014a:201; Flick, 2015:483). It is used to develop arguments that convince the reader that the study is well

conceptualised and that it will be carried out in a thorough and an ethical manner (Creswell, 2014a:201).

Reliability can be described as the stability or consistency of research findings over time as well as across locations (Pickard, 2013:22; Silverman, 2013:284; Creswell, 2014a:201). It is used to assess qualitative research against a specific theory about an issue that is under study as well as the methods being used (check dependability of data and procedures that may be grounded in specific qualitative methods) (Flick, 2015:481-482). The reliability of research can be checked using the test, retest method where the research is conducted more than once and by other researchers. Reliability is accepted when the results are found to be similar (Pickard, 2013:23).

Both validity and reliability are difficult to prove for this research. The research was however, carried out in a controlled environment which is UP. Participants were not influenced in anyway and participation was completely voluntary. While it is true that different respondents could contribute slightly different results it was not anticipated that results would vary to a large extent as much alignment was found in the responses. The research will therefore remain valid for UP until such time that a different target group is used, different research questions are proposed, or a different methodology is used to conduct similar research. The results cannot be generalised as the research has a specific focus with identified needs (based on the experiences and observation of the IS at the time of conducting the research using the identified undergraduate Engineering student groups). However, ISs in similar roles, could use the results as a point of departure in their own research in the same discipline, same type of learning environment or similar embedded librarian programs.

3.6. Limitations of the methodology

Due to the limited time and resources available to conduct the research, a smaller sample group had to be used than what the researcher would have liked to. The questionnaire was available in English only which may have disadvantaged respondents who may have preferred to use their mother-tongue languages. The interviews were also conducted in English.

3.7. Ethical considerations

The ethical issues that the researcher may possibly face during the course of conducting the research is the issue of privacy when it comes to the participant's personal information. The researcher did not collect any personal information from the participants. No email addresses,

contact numbers, age, complete student numbers, addresses or any other information that can be used to identify the participants, were recorded. Only a partial student number was obtained to stop a participant from completing the questionnaire more than once. Participation in the research was voluntary. Participants were able to make an informed decision before they participated in the research. It was explained what the study entails as well as what was expected of them. Very simple language terms (no jargon) were used and where necessary a definition or description was provided. Participants were also informed regarding their right to withdraw from participation at any given point should they want to do so. Participants had to acknowledge having read the informed consent form (see Appendix C), and having understood its contents before the data collection commenced. Interviewees completed a similar informed consent form. The form will be kept on record should it be required at any point.

3.8. Conclusion

The research paradigm that was identified as being best for the research is qualitative research. The research design selected was a case study as this was identified as best for answering the main research question as well as the sub research questions. The sample was drawn from the three Engineering departments identified in section 3.2.4 using the sampling method identified in the same section. Data were collected using qualitative data collection techniques namely interviews and questionnaires. The interview data was recorded through a process of transcription. Thematic analysis was chosen to interpret the data collected. The built-in feature in Google Forms was used to analyse the questionnaire responses and the researcher also used thematic analysis to objectively interpret the individual answers to open-ended questions that were included in the online questionnaires. Elements that might have posed ethical issues were eliminated and data were anonymised, where necessary, before the data analysis phase commenced.

CHAPTER 4: RESULTS & DATA ANALYSIS

4.1. Introduction

In Chapter 3, the research methodology used to conduct the research was discussed. This chapter will present the findings from the data collected during the course of the research. In the ensuing section, those research sub-questions not addressed by the literature review (Chapter 2) are highlighted. The questions addressed are the following:

Do the information needs for learners from the sub-disciplines in Engineering show any variances?

- What services does the library at UP currently offer to its faculty of Engineering learners?
- What is the current level of IL as indicated by the respondents?
- What is the current information behaviour as reported by respondents?
- What services can the library at UP add to their existing services to support a hybrid learning environment developed for Engineering (undergraduate) students?

The process followed to collect the data is briefly as follows: The researcher sent out the questionnaire link to lecturers and instructional designers within the various identified Engineering departments at the start of the second semester of 2018. They were requested to send the link to the students, as well as to post the link on their various ClickUP modules. A reminder was sent to the lecturers on the 23rd of July again asking for the link to be shared with students as previously discussed. The questionnaire link was available and active until the 3rd of August, when the questionnaire was closed off from accepting additional responses. It was decided to gain feedback from a sample of 60 students and four (4) lecturers. The student sample was self-selected. The lecturers were identified using purposive sampling. The total number of responses received for the questionnaire was 43 (forty-three) providing a response rate of 71.6%. The response rate for Chemical Engineering was 100% (30/30), for Material Science and Metallurgical Engineering it was 26.6% (4/15) and for Mining Engineering it was 60% (9/15).

4.2. Findings from Data Collected

The data that were collected through staff interviews and online student questionnaires is reported on in section 4.3 and 4.4 respectively. The two data sets were reported on separately and then compared for similarities and variations.

Themes identified for data analysis

The findings from the data that was collected were analysed and categorized into six (6) themes namely:

- Level of information literacy
- Usage of library products
- Usage of library services
- IS role
- Engineering students' information behaviour
- Challenges to assignment completion

Some demographic information such as the year of study and department that students are currently enrolled in were collected in the questionnaire. The results pertaining to the section on demographic information of students are presented in section 4.4. All percentages were rounded off to the nearest whole number where possible. The questionnaire was analysed using the above-mentioned themes (refer to section 4.5).

4.3. Staff Interviews

The results of the interviews with the lecturers are reported in this section. Refer to Appendix A for a copy of the questionnaire. The interview schedule consisted of eight (8) questions with the interviewer being able to ask follow-up or additional questions when necessary. Four (4) interviews were conducted: Chemical Engineering (1), Material Science and Metallurgical Engineering (2), and Mining Engineering (1). The questions along with the responses given by the participants are recorded below:

4.3.1. Information/ library material consulted by students

Lecturers were asked to explain what information/library material they require the students to consult for the course(s) that they are taught. The library material may not necessarily be used

by the students when completing assignments. The students may however, consult the material to better understand the content that the lecturer shares with the students.

The participant from Chemical Engineering, (Participant A) noted that "*whatever the library makes available, we would want to be linked".* Participant A also noted that students in both third and fourth year are required to consult their prescribed textbooks (available in both print and electronic formats), a copy is available in the library, as well as extracts from textbooks that are no longer in print. Students are also required to consult journal articles. Links to the resources the students need are made available on their ClickUP modules.

Participant B was a lecturer from Material Science and Metallurgical Engineering responsible for teaching students in their third year of study. The participant responded that the prescribed textbook as well as electronic copies of the book must be available in the library so that students have access to the books. Students are required to do literature searches and find books and articles for their 'practicals'. In the final year, however, there is no prescribed textbook, so students are required to use library resources to find relevant information they need for their studies. Participant C, from the same department as Participant B, focused on students in their fourth year of study. The participant mentioned that students are required to consult a mix of sources such as the ASM handbook and a number of journal articles.

Participant D from Mining Engineering mentioned that very limited 'library information' is prescribed for the third-year students. Lecturers may, from time to time, refer students to journal articles that the library subscribes to. The participant also mentioned that students need to consult textbooks as well and that some prescribed material and documents are issued by an institute within the Mining Engineering field, which the library may not necessarily have in its collections.

In summary it is possible to say that, although requirements may differ, the sources consulted are limited to textbooks, prescribed articles and a very limited number of items selected by students themselves. Lecturers are aware of paper and electronic document formats but did not refer to the use of repository content or to formats other than traditional library material (for example no video material, graphics, data sets or source code sources were mentioned). This was confirmed by the responses to the next question (see 4.3.2) below.

4.3.2. Library material used by students for assignments

Participants had to identify the types of material used by students when completing assignments.

Types of materials are the different forms/ mediums that information is packaged in, for example, newspapers, books and journals. Participant A mentioned that that it would be difficult to give an exact answer, but students are required to use textbooks, extracts from out-of-print books, journal articles and sometimes YouTube videos. Participant B mentioned that the students are required to use the textbook and journal articles, as well as Google. Participant C noted that students must use journal articles and to some extent, reference works (such as the ASM handbook). Participant D mentioned that students are required to use journal articles and conference papers.

It appears that lecturers may not associate non-text resources (for example YouTube videos) with the library and that the librarians may therefore not be aware that these resources exist or how they are selected.

4.3.3. Library products available to students on ClickUP

Participant A noted that the link to the Kirk-Orthmer Dictionary is made available on ClickUP. The Chemical Engineering students also have access to the IL training presentations created by their IS as well as a general link to the library. Participant A alsoremarked that *"the task of the university is for the lecturer to point out what is important and what is less important, but we must have some room to stick everything together and that remains the textbook".* Participant B responded that there are no library products available on ClickUP because *"my personal knowledge is not so good…I can put up an announcement and upload a file…that's the extent of my skills*". Participant C also noted not having any library products available on ClickUP, but does refer the students to journal articles in their assignment specifications. Participant D mentioned only having a link to the library and not having any library products on ClickUP because *"I think because I don't know".*

It appears that the inclusion of library products by lecturers on ClickUP is limited because some lecturers lack awareness and knowledge of what products and services are available. This creates an opportunity for the IS to inform the lectures of library products that are available for their respective disciplines. This will have to be done regularly as lecturers change.

4.3.4. Presence of a link to the library's web site present in ClickUP module

Participant A from Chemical Engineering responded that a link to the library is available by means of a link to Google Scholar, databases that students are required to use, as well as the Chemical Engineering subject guide (which will ultimately link the students to the library as a

link is available). Participant B answered 'No' to the question and mentioned needing to attend the ClickUP training course as her knowledge of it is limited but that finding the time to do so is challenging. Participant C mentioned not having considered adding a link to the library but thought that it would be simple to arrange for some library products to be added to the fourth year ClickUP module. Participant D answered that there is a link to the library on ClickUP, as well as in the study guide.

In summary it is possible to say that the lecturers are aware of the library and its resources and they recognise the value that the library has for their students. The lecturers that indicated that there is no link on ClickUP, either lack the technical know-how (for example, how to add links on ClickUP) or have not considered it but are willing to add the link on their module. If, as is noted above, the IS keeps in close contact with lecturers it will be possible to timeously establish if a lecturer needs assistance to enable them to build the necessary links.

4.3.5. Aspects of assignment writing that students struggle with

Participant A noted that students are able to do a literature study and is happy with how the students do it, however, the students' biggest struggle is the programming component that the Chemical Engineering students must comply with in their assignments which are not take-home assignments but rather done in a computer laboratory under the supervision of the lecturers. The Chemical Engineering students are said to be able to find and use relevant information. Participant B mentioned that the third-year students struggle to write. The participant mentioned that the students are able to find the right technical content but struggle with basic writing skills. There is also a problem with plagiarism as the students copy and paste directly from sources as they cannot paraphrase the information.

Participant C answered that the challenge for the fourth-year students is to be able to read and understand the information contained in the sources. The students also struggle to put together their arguments in a concise manner as they tend to write too much and hope that it covers everything that is required of them. The students are provided with prescribed sources so they are not required to evaluate and select sources to use but they do have a problem with referencing. Participant D did not identify any challenges as the students in Mining Engineering have to do 'application and design' assignments (practical rather than knowledge and comprehension-based assignments).

Several opportunities could be identified from the responses given by the lecturers about the assignment writing-aspects that the students struggle with. Programming specifically appears to be a struggle for students within one of the Engineering disciplines. This provides an

opportunity for the library's MakerSpace, as well as the IS, to organise programming sessions with experienced programmers. The IS could also, in collaboration with the lecturer, identify standard YouTube videos that the students could use to improve their skills. Regarding the writing skills and plagiarism, the IS can conduct writing, referencing and plagiarism training and workshops with the students in the form of videos, exercises and group or individual sessions. A short referencing guide can also be created for the students to access and use when they need to do so. Similarly, training on the use of referencing software such as EndNote, which the library subscribes to, could be made available online.

4.3.6. Informing the librarian when an assignment is due

Participant A from Chemical Engineering noted that informing the librarian is not done in an organised way because lecturers try to delay the submission of assignments so that students have time but instead find that all the assignments are required to be handed in at the same time and that causes a logistics problem. The participant posed a rhetorical question asking if the library should provide a list of resources or enable the students to be able to find information on their own. Participant B answered not always because the students are expected to do the assignments on their own. The participant mentioned that the librarian is invited on the first day to give a lecture to the students and from that point on they are expected to work on their own. Participant C answered 'No' to the question. Participant D answered *"I did not think it was necessary.... I just never thought about it"*.

In summary, it is possible to say that, the lecturers prefer to have the students do their assignments independently and to not involve the IS. The IS however, has an opportunity to aid the students by creating training material on how to use information resources to find information they need to complete their assignments. A link to the material could be made available to the lecturer so that the embedded link could then lead to the material when the assignment is given to the students.

4.3.7. Students' attendance of IL sessions

Participant A from Chemical Engineering mentioned that it would be best if students attend the IL sessions at the beginning of the third year of study as whatever happens after the first semester would fall into place as the students need to have the required information skills in the second semester because that is when they are going to really need them. Participant A also noted that the IL training in third year is integrated with what is required of the students in the module and it prepares them to see exactly what the library offers in terms of access to

information they may require. Participant B answered *"I make use of the librarian in the third year to make sure that they [students] are up to speed'.* Participant C mentioned that students should get the training early in the first semester of the fourth year. Participant D mentioned that there is no expectation for the students to attend an IL session, however, the training that takes place in the first-year training at orientation week was mentioned as an option for the students.

The researcher observed that there is a miss-match between the lecturers' expectations regarding when the training should take place and the students' actual need for training. The lecturers prefer that the training takes place in the later years of the students' academic careers (for example, in the third or fourth year but in a different semester to when the task is due). Each lecturer seems to have a specific purpose in mind with regard to the need that the IL training will be addressing. A mismatch like this calls for 'on demand training'.

4.3.8. Embedding IL training within Engineering module(s) in ClickUP

Lecturers were asked: *If the library staff were to develop specific course material to assist Engineering students with IL what would be your viewpoint if you were asked to embed the course within your Engineering module(s) in ClickUP*?

Participant A from Chemical Engineering commented that *"… it would be wonderful if you could do that…you really want to connect it to part of what they have to pass in order to proceed and I would say for us, they would be much more receptive to understand the value of what we expect of them as part of that module so somehow what you propose should be connected in some way to that"*. Participant B answered *"definitely. If there is something like that I will make use of it and add it to ClickUP and work with that".* Participant C commented that it would be a very good idea and that it should be turned into an evaluation of some sorts in order to force the students to look at it. Participant D mentioned that it would be greatly beneficial as a way of getting newer information, newer designs, newer applications and finding newer methods. The overall response from the lecturers was very positive.

When the participants were asked if they had any additional remarks or comments, Participant A mentioned that generally, reading is a problem and that is why students' comprehension of what the lecturers expect, falls short and that is something that would need to be addressed. Participant B mentioned being happy with the work being done by the librarian and that requests for information are responded to promptly. Participant C had nothing to add. Participant D also had nothing additional to add.

It is important to note that the question posed has created an expectation for the library to create and deliver course-specific material that will assist students with IL. Should the library fail to deliver on the lecturers' expectations, the lecturers may withdraw their current trust in the library and its promise to deliver on expectations and this may lead to even more students becoming information illiterate. The reading problem is worth exploring by the IS in collaboration with the Unit for Academic Literacy to also provide access to their training and exercises for the students to do to improve their reading skills.

4.4. Findings from the questionnaire

The results of the online student questionnaire are reported in this section. Refer to Appendix B for a copy of the questionnaire.

4.4.1. Demographic information

Section C of the questionnaire (question 2 and 3) requested the demographic information of respondents and it included the year of study and the department that students are enrolled in. The details are provided below but are also summarized in Table 1 on the next page.

a. Year of study and enrolment within a department

The majority of the respondents (18/43; 42%) were in their third year of study, 40% (17/43) of the students were in their fourth year of study, 9% (4/43) responded that they are between third and fourth year, and the last 9% (4/43) did not wish to respond to the question. Most of the respondents who answered the questionnaire are enrolled in Chemical Engineering (30/43; 70%), followed by Mining Engineering (9/43; 21%) and the minority came from Material Science and Metallurgical Engineering (4/43; 9%).

Per year of study	Number of responses (43)	Percentage (100)
Third year	18	42%
Fourth year	17	40%
Between third and forth	4	9%
I do not wish to respond	4	9%
Total	**43**	**100%**
Engineering department		
Chemical Engineering	30	70%
Material Science and Metallurgical Engineering	4	21%
Mining Engineering	9	9%
Total	**43**	**100%**

Table 1: Demographic information of respondents

The Chemical Engineering respondents totalled 30 and included 14 (47%) third year students, 10 (33%) fourth year students, 2 (7%) between third- and fourth-year students, and 4 (13%) who were not prepared to say. The Material Science and Metallurgical Engineering responses included a majority of fourth year students (75%; 3/4) and 25% (1/4) between third and fourth year. The Mining Engineering responses were spread equally between third and fourth year (4/9) and one respondent (1/9) indicated being between third and fourth year. A table showing the breakdown of the total responses to show the individual departments' representation can be found below:

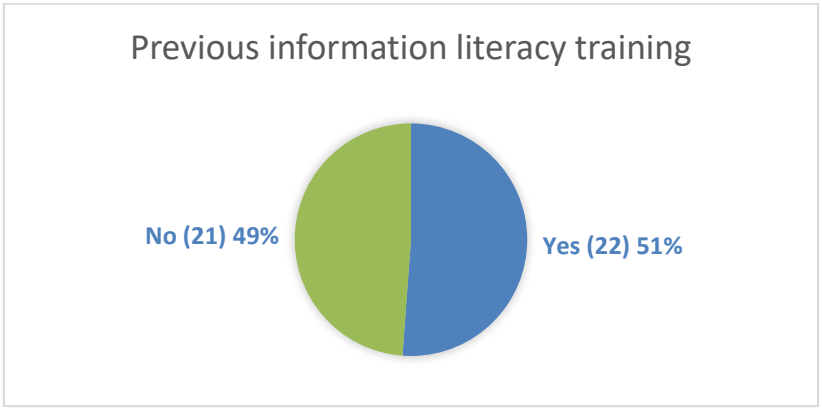
Department	Third year (18)	Fourth year (17)	Between third and fourth year (4)	Not prepared to say (4)	Total number of students
Chemical Engineering	47% (14)	33% (10)	7% (2)	13% (4)	**30**
Material Science and Metallurgical Engineering	-	75% (3)	25% (1)	-	**4**
Mining Engineering	45% (4)	44% (4)	11% (1)	-	**9**

Table 2: Individual department's responses

4.4.2. Level of information literacy among Engineering students

a. Previous IL training

Section D of the questionnaire was focused on the Engineering student's IL. One question was asked which also included two sub-questions (discussed below in b. and c.). The respondents were asked if they had IL training before. Fifty-one percent (22/43) of the respondents responded 'Yes' and 49% (21/43) responded 'No'. The Mining Engineering respondents all responded 'No' to receiving training before. Respondents in Chemical Engineering had 53% 'Yes' and 47% 'No' responses, while in Material Science and Metallurgical Engineering there was 75% 'Yes' and 25% 'No' responses. A graph summarising the findings is shown below.



Graph 1: Information literacy training of Engineering students

It appears that an opportunity exists for the IS to provide IL training to the students. The VLE can be used as a platform for conducting the training as well as for providing the students with training material in interactive formats such as games step-by-step guides as well as tutorials. Video material could also be created or where video training already exists – linked.

b. Knowledge and skills gained from IL training

The first follow-up to question 4 which was question 4.1., asked what part of the training the respondents remember. 20 respondents answered the question. The most commonly recurring words in the responses recorded were:

"How to use the library..."

"Access to information…"

"Plagiarism"

"How to reference"

"Writing reports"

"Excel and MS office"

Most of the students that specified what they remember responded that they remember how to use the library and its online services (9 occurrences) followed by how to access information from library resources including journals and databases (7 occurrences). How to reference to prevent plagiarising and plagiarism in its general form were also mentioned at least three (3) times each. The minority mentioned how to use Excel and Microsoft office (2 occurrences), as well as the writing of reports (2 occurrences).

The researcher observed that the students' perception of using the library and its online services, may be limited since the lecturers noted that the students are required to consult only textbooks, prescribed articles and a limited number of sources of their own. The students link to information sources using links posted by the lecturers on the VLE. That is not true IL.

c. Students' use of knowledge and skills gained

The second follow-up question to question 4, question 4.2, asked what is it that students learned that they actually use. The most common responses ranged with the majority being

"*finding resources"* followed by *"accessing information for research",* and *"how to reference"*. The least occurring responses included: *how to write a report, Microsoft Office, plagiarism,* and *how to use Boolean operators when searching for information.*

d. Library products' usage by Engineering students

Question 5 in section D was meant to gauge the respondents' use of the products available in the library. The respondents had to choose whether they use the products on a 'Daily basis', 'Weekly', 'Once a month', 'Never' or 'I am not familiar with the product'. Results are summarised in Graph 2 and discussed below.

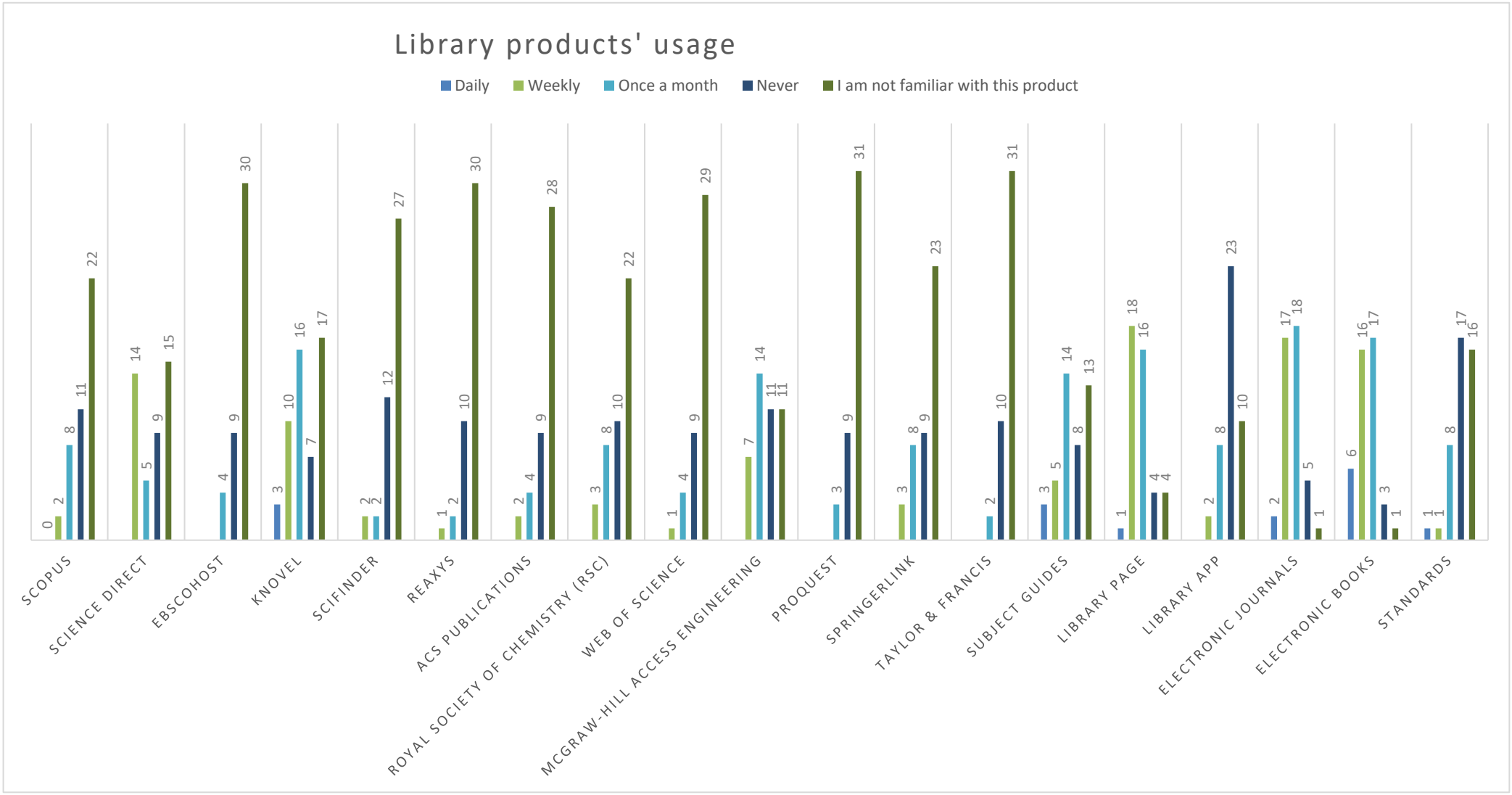
It was interesting to see that the respondents indicated that they were not familiar with most of the products. The only products where usage outweighed the non-familiarity of students with the product include: the library page (42%; 18/43 weekly), then the electronic journals (42%; 18/43 once a month, 40%; 17/43 weekly), e-books (40%; 17/43 once a month), 37%; 16/43 weekly), subject guides (33%; 14/43 once a month), and McGraw-Hill Access Engineering (33%; 14/43 once a month). It was concerning to see that 9% (4/43) of the respondents are not familiar with the library page. These respondents are all Chemical Engineering students. Two of the respondents who indicated that they are not familiar with the library page also indicated that they have had IL training (the IL training that is provided to students starts off an orientation of the library page and how to use it); the other two who selected 'not familiar with this product' had also selected that they did not have IL training.

The majority of the respondents who use Science Direct (10/43 weekly), Knovel (13/43 once a month), McGraw-Hill Access Engineering (11/43 once a month) subject guides (11/43 once a month), library page (11/43 weekly), electronic journals (13/43 once a month), and electronic books (12/43 once a month) are from Chemical Engineering. Knovel, McGraw-Hill Access Engineering and the subject guides are subject specific. The students would have to search on the library page to get to specific Engineering journals and books.

The first sub-question to question 5, question 5.1., asked the respondents to mention any other products that they may be using, and they mentioned the following products: Elsevier (1/3), Engineering tool box (1/3), and Google Scholar (1/3). Elsevier cannot be classified as a product, it is an organisation that provides access to some library products such as Science Direct. The researcher chose to view the Elsevier response as meaning Science Direct as it is the most commonly known and most commonly used library product. Google Scholar is a service that provides access to resources and will not be counted as a library product – it is rather a 'link' that should not be forgotten. Engineering tool box is not subscribed to by the

library but is worth exploring. A graph summarising the findings on library products usage is provided on the next page.

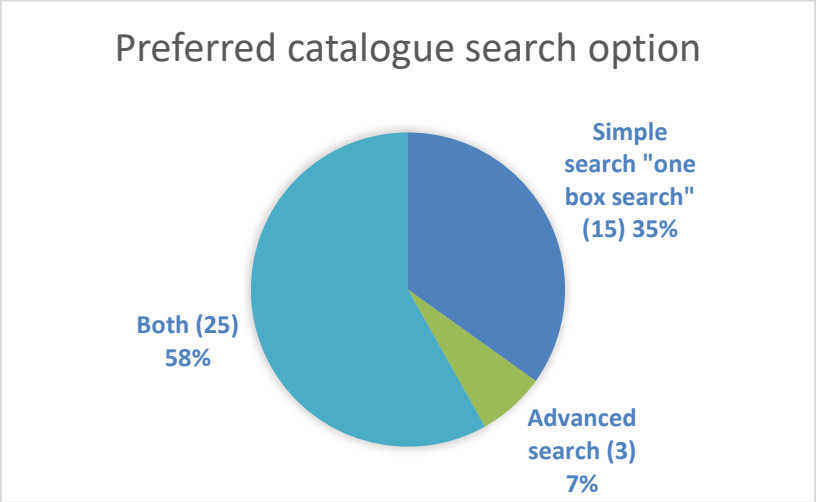
The researcher observed that not all of the library products listed are necessarily relevant to all of the Engineering students and the sub-disciplines of Engineering (for example, ACS publications RSC, Scifinder and Reaxys are relevant to Chemical Engineering but not necessarily to Material Science and Metallurgical Engineering and Mining Engineering). This may explain why the students are not familiar with many of the products. However, it is also possible that the students just do not know about all the resources that are available.



Graph 2: Library products usage of Engineering students

e. Preferred means for searching the library catalogue

The second sub-question 5.2., was meant to gauge the respondents' preferred search option when searching the catalogue. The researcher was surprised to see that the majority of the users preferred to use both the simple and advanced search (58%; 25/43), followed by the simple search (35%; 15/43) and the minority prefer to use the advanced search (7%; 3/43). A chart summarising the results can be found below:



Graph 3: Engineering students' preferred catalogue search options

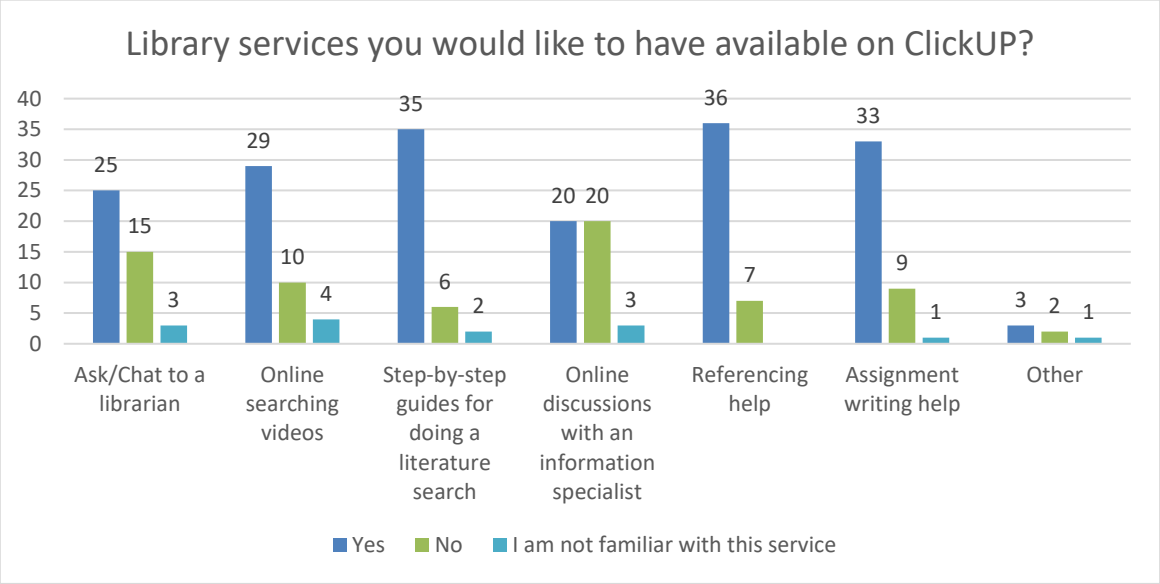
The advanced search option of the catalogue is underutilised, and this provides an opportunity for the IS to train the students on the functionality as well as to help improve the students' searching skills. This also provides an opportunity for the IS to find out from the students that only use the advanced search option why they prefer the option over the simple search and find a way to incorporate the students' feedback into the proposed training.

f. Library services' usage by Engineering students

Question 6 in section D of the questionnaire was focused on the services that Engineering students would like to have available on ClickUP. The options given to the respondents were 'Yes', 'No' and 'I am not familiar with this service'. The majority of the respondents wanted to have the services available on ClickUP with one service, online discussions with an IS, receiving an equal number of responses (47%; 20/43) for both 'Yes' and 'No' to the service. The majority of respondents (84%; 36/43) indicated that they would like to have 'Referencing help'. This specific service is the only service that none of the participants indicated not being

familiar with. The second service respondents would like to have is 'Step-by-step guides for doing a literature search' (35/43). The service that came in third is 'Assignment writing help' (33/43) which was followed by 'Online searching videos' (29/43), 'Ask/chat to a librarian' (25/43), and then lastly 'Online discussions' (20/20).

Three respondents answered 'Yes' to other however, none of the respondents specified the additional services they would like to have available on ClickUP as their responses were either 'none' or 'not applicable'. Below is a graph depicting the services that the respondents would like to have available on ClickUP.



Graph 4: Services Engineering students prefer to have available on ClickUP

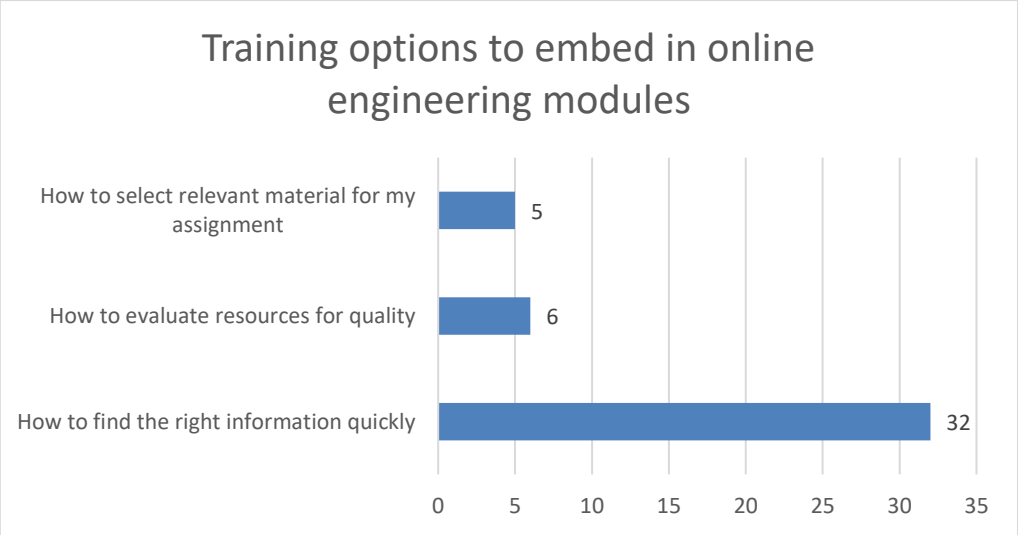
Online discussions with an IS yielded interesting results. Two of the departments' responses, Chemical Engineering and Material Science and Metallurgical Engineering, had the 'No; responses outweighing the 'Yes' responses in both cases. Chemical Engineering had 50% (15/30) responses opposed to having an IS facilitate discussions online and 47% (14/30) who were for the idea of having an IS facilitate discussions online; only 3% (1/30) was not familiar with the service. material science had 50% (2/4) against the idea and 25% (1/4) for having an IS facilitate discussions online; 25% (1/4) of the respondents was not familiar with the service. Mining Engineering had a different result. The majority of the respondents (56%; 5/9) were interested in having an IS facilitate discussions online, 33% (3/9) were opposed to the idea, and 11% (1/9) was not familiar with the service. The respondents that selected 'other' were asked to specify the services that they would like to have available and only one of the four respondents suggested that information from other universities should also be made available on ClickUP; the other respondents' responses were either 'none' or 'not applicable.

Overall, there is an equal interest and opposition to discussions with an IS using the VLE, however, it is also clear that the IS would have to trial the online chat with the students to see how they react to it. A chatbot can be developed to assist the IS in answering the students' queries online.

g. Online training options of Engineering students

The last question in section D, question 7, asked which training options respondents would like to have available directly in their online Engineering modules. Three options were supplied: 'How to find the right information quickly', 'How to evaluate resources for quality', and 'How to select relevant material for my assignment'. Respondents were allowed to select more than one of the options. A majority of 74% (32/43) respondents selected that they would like to have training on how to find the right information quickly. Fourteen percent of the respondents (6/43) wanted training on how to evaluate resources for quality, while only 12% (5/43) expressed an interest in having training on how to select relevant material for their assignments embedded in their online Engineering modules.

The researcher observer that although the majority of the students indicated that they use both simple and advanced search options when searching for information (see section 4.4.2.e), the students have a great need for training on how to find the right information quickly indicating that the students are not using the advanced search option effectively - which would have helped them find the information they require quickly.



Graph 5: Training options to be made available on ClickUP

Table 3 below summarises the training options that each department represented would like to have available directly in their online Engineering modules.

Per department	How to find the right information quickly	How to evaluate resources for quality	How to select relevant material for my assignment	Total for department
Chemical Engineering	21	5	4	30
Material Science and Metallurgical Engineering	3	1	-	4
Mining Engineering	8	-	1	9
Total respondents	**32**	**6**	**5**	**43**

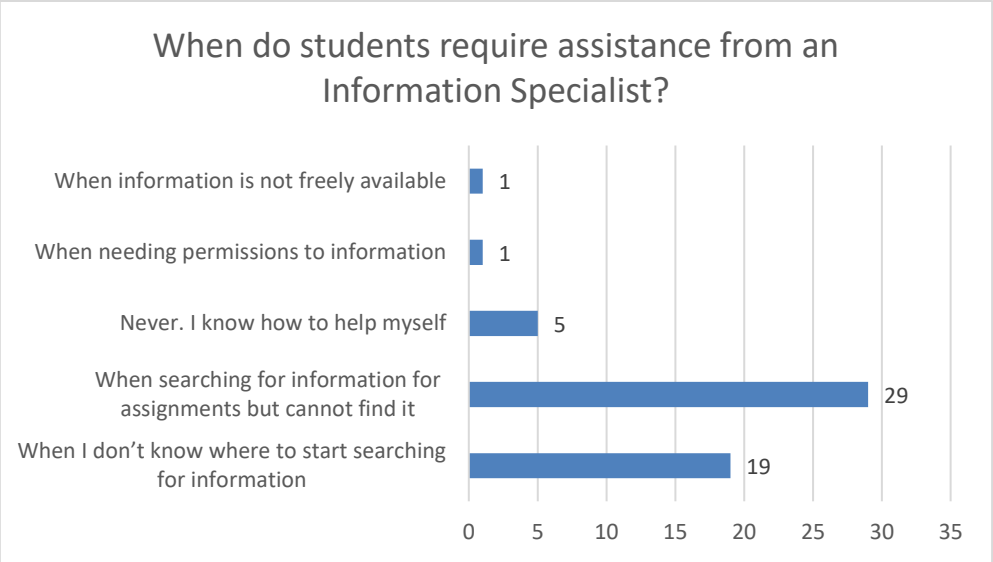
Table 3: Training options per department

The responses for Material Science and Metallurgical Engineering showed that none of the respondents had an interest in having training on how to select relevant material for their assignments available directly in their online Engineering modules. Mining Engineering's responses show that the respondents are not interested in having training on how to evaluate resources for quality. This provides an opportunity for the IS to provide training to the lecturers first in order to convince them of the value that the training will have for their students. The students can then be trained with their lecturers advocating the usefulness of the training for the students. This links to what the lecturers mentioned in section 4.3.8. that any information or training provided by the IS would have to be linked to the students' course expectations in some way.

4.4.3. Role of Information Specialists

a. Assistance required by Engineering students from an Information Specialist

Section E covered the role of the IS. The first question in the section (question 8) asked when respondents require assistance from an IS. The question was meant to gauge the extent to which the Engineering students would like an IS to be involved in their academic tasks. The options provided were: 'When I don't know where to start searching for information', 'When searching for information for assignments but cannot find it', 'Never, 'I know how to help myself', 'When needing permissions to information', and 'When information is not freely available'. The respondents were able to pick more than one of the options. The majority of the respondents reported that they require assistance when searching for information for assignments but cannot find it (29), followed by when they don't know where to start searching for information (19), 'Never, I know how to help myself (5), and the minority with equal responses, 'When needing permissions to information' (1) and 'When information is not freely available' (1). Graph 6 provides a summary of the results.

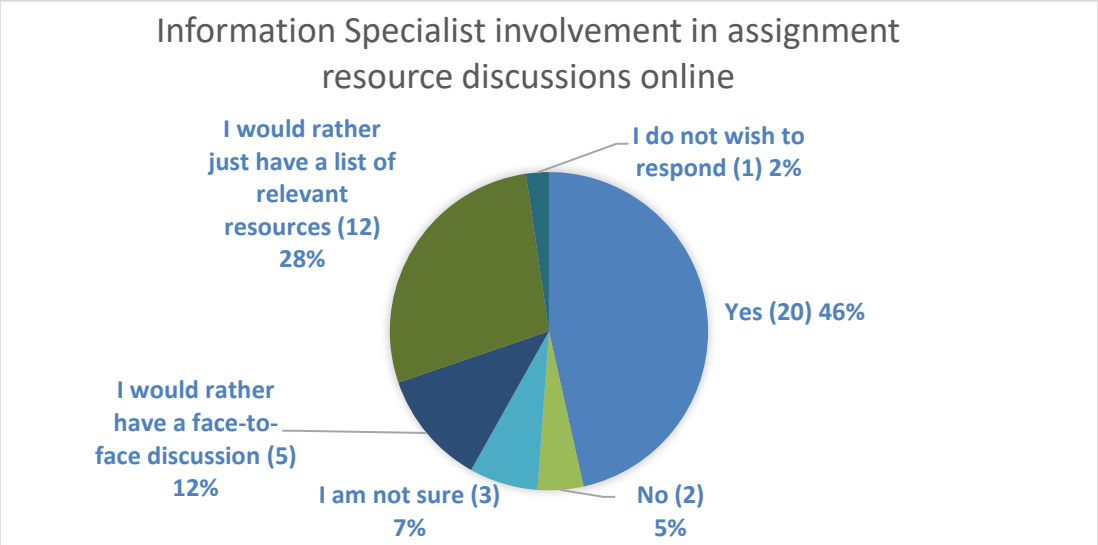


Graph 6: Assistance required by Engineering students from an IS

It is possible to say that, the students who are able to search for information may not necessarily know how to select and use keywords when searching for information. It is also possible that students do not know which resources to use when searching for information because of their lack of IL training and exposure to the resources. The IS can plan training sessions on the use of subject-specific resources as well as effective resource identification.

b. Information Specialist involvement in online discussions for assignments

Question 9 in section E asked whether the respondents would like to have an IS facilitate an online discussion about available resources to use when an assignment is due. The majority of the respondents reported indicated 'Yes' (46%; 20/43), followed by 28% (12/43) who reported that they would rather just have a list of relevant resources. Twelve percent (5/43) reported that they would rather have a face-to-face discussion, 7% (3/43) reported that they are not sure, while 5% (2/43) reported 'No'. A minority of 2% (1/43) did not wish to respond to the question. Graph 7 provides a summary of the results.



Graph 7: Facilitation of online discussion about available resources by an IS

Looking at each department's responses, they all follow the same general trend. Respondents generally reported that they would like to have an IS facilitate online discussions, followed by having a list of relevant resources. Respondents in both Chemical Engineering and Mining Engineering reported that they would rather have a face-to-face discussion, some reported that they are not sure and the 5% (2/43) who reported 'No' were from Chemical Engineering and one of the respondents who reported 'No', had answered in the previous question (question 8) that he/she can help him/herself. Table 4 on the next page provides a breakdown of the responses per department.

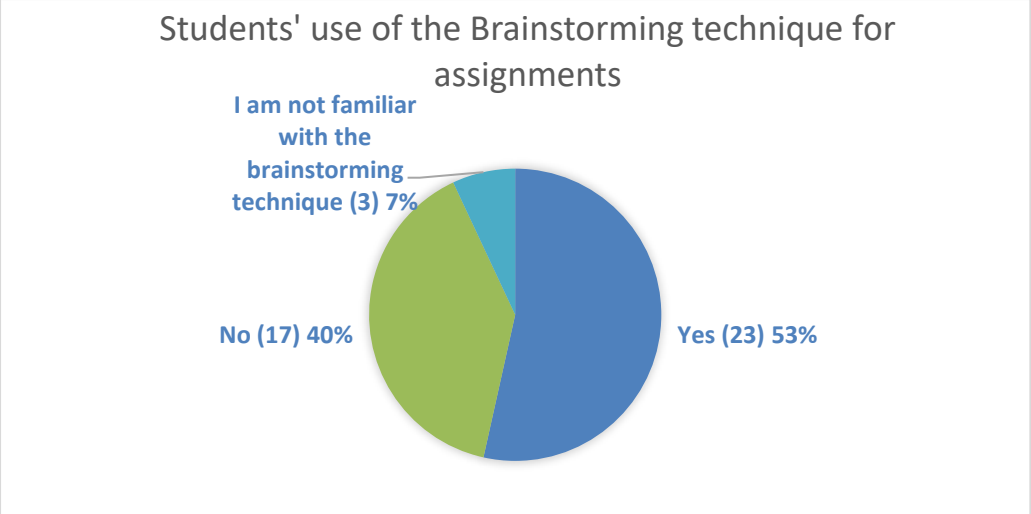
Department	Yes	No	I am not sure	I would rather have a face-to-face discussion	I would rather just have a list of relevant resources	I do not wish to respond	Total responses
Chemical Engineering	14	2	2	2	9	1	**30**
Material Science and Metallurgical Engineering	2	-	-	1	1	-	**4**
Mining Engineering	4	-	1	2	2	-	**9**
Total	**20**	**2**	**3**	**5**	**12**	**1**	**43**

Table 4: Departments' responses to IS facilitated online discussions

The students would like to have an IS facilitate online discussions on available resources. The lecturers are opposed to the IS providing a list of resources as they want the students to do searching for themselves (see section 4.3.6). However, there are a number of students that would like to have a list of resources. The IS has an opportunity to assist the students in the VLE while honouring what the lecturers want in terms of student independence.

c. Brainstorming practices of Engineering students

The second question to section E, question 10, asked if the respondents brainstorm or write down ideas before looking for resources to complete their assignments. A small majority of respondents 53% (23/43) reported using the brainstorming technique while 40% (17/43) responded 'No', only 7% (3/43) of the respondents reported not being familiar with the brainstorming technique. Graph 8 presents a visual representation of the results.



Graph 8: Engineering students' use of the brainstorming technique

Looking at the results per department, for Chemical Engineering, 50% (15/30) of the respondents from the department brainstorm when completing assignments. Forty-seven percent of the Chemical Engineering respondents reported that they do not brainstorm when completing assignments while 3% (1/30) reported not being familiar with the brainstorming technique. A majority of 75% (3/4) in Material Science and Metallurgical Engineering reported 'Yes' to using the brainstorming technique while 25% (1/4) reported not using the technique when completing assignments. Mining Engineering reported 56% (5/9) brainstorm, 22% (2/9) do not brainstorm and 22% (2/9) are not familiar with the brainstorming technique.

It is possible that the students are not aware they are using the brainstorming technique when they complete assignments. It is also possible that the students do not understand what the brainstorming technique is. This provides the IS with a chance to educate the students.

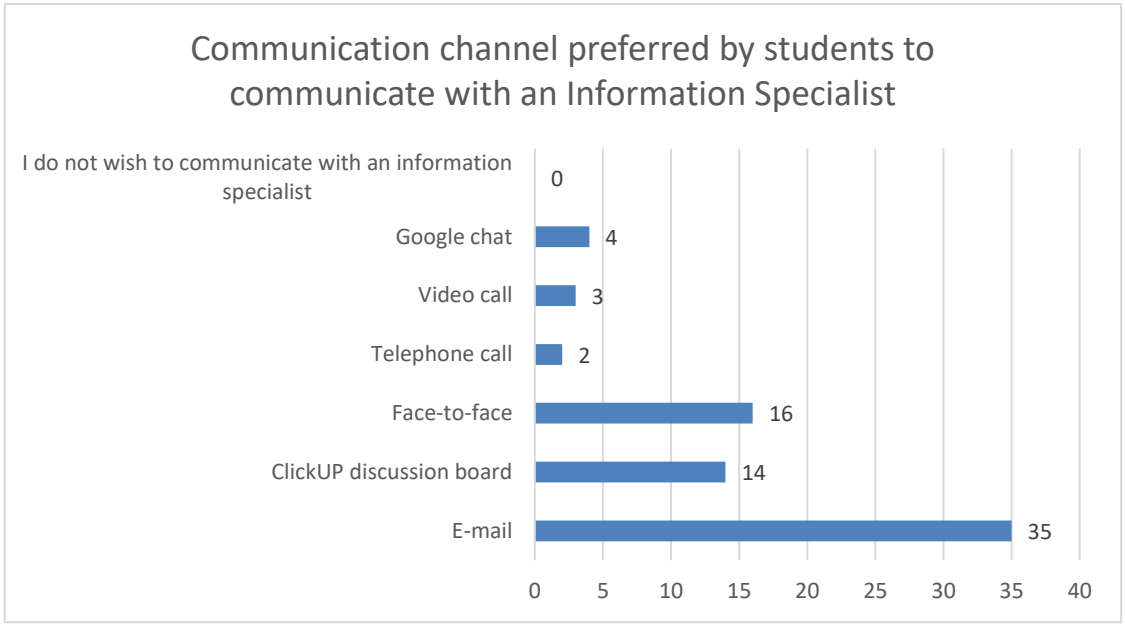
d. Students' preferred communication means with Information Specialists

The last question in section E was question 11. The question asked which communication channel the respondents would prefer to communicate with an IS. Respondents were able to pick more than one of the options. The options provided were:

- Email
- ClickUP discussion board
- Face-to-face
- Telephone call

- Video call
- Google chat
- I do not wish to communicate with an Information Specialist

The majority of respondents (35/43) prefer e-mail, followed by face-to-face (16/43), ClickUP discussion board (14/43), Google chat (4/43), video call (3/43) and the minority reported that they prefer a telephone call (2/43). None of the respondents reported not wishing to communicate with an Information Specialist. Graph 9 summarises the findings.



Graph 9: Engineering students' preferred communication channels with an IS

Material Science and Metallurgical Engineering reported an equal number of responses for e-mail (2/4), face-to-face (2/4), and ClickUP discussion board (2/4). Chemical Engineering and Mining Engineering both reported a majority of e-mail preferences. Table 5 on the next page reports each department's reported preferences.

Department	E-mail	ClickUP discussion board	Face-to-face	Telephone call	Video call	Google chat	I do not wish to communicate with an Information Specialist
Chemical Engineering	26	11	8	2	3	3	-
Material Science and Metallurgical Engineering	2	2	2	-	-	-	-
Mining Engineering	7	1	6	-	-	1	-
Total	**35**	**14**	**16**	**2**	**3**	**4**	**-**

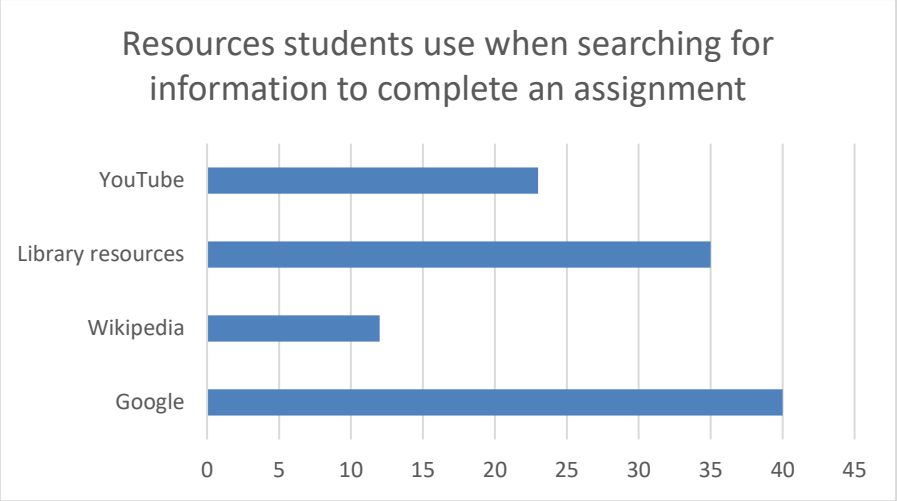
Table 5: Individual departments' communication preferences

4.4.4. Finding information

a. Resources used by students to search for information for assignments

Question 12 in section F asked what resources the respondents use when searching for information to complete an assignment. Four options were provided, Google, Wikipedia, library resources, and YouTube. An option for other was also provided and respondents could fill in their own response. The respondents could select more than one option.

A clear majority of respondents (93% (40/43)) reported using Google when searching for information for assignments. This was followed by 77% (33/43) who use library resources. The respondents that selected other wrote Google Scholar and UP library. The researcher found that this formed part of the library resources and decided to consolidate the result. The new total for library resources was then 81% (35/43). YouTube was third with 54% (23/43), and the minority was Wikipedia with 28% (12/43). Each of the departments' results also followed a similar trend. Graph 10 on the next page summarises the results.



Graph 10: Resources used for assignments

It is clear that Google is still a highly preferred resource among students. This means that the library is subscribing to resources which some students do not use. The library would have to continuously market and inform the students about the advantages of using Google Scholar. For example, it is necessary to explain that library resources, of value, are accessible when using Google Scholar because library resources are linked to this search engine).

b. Keyword identification potential of students

Question 13 in section F was meant to gauge the respondents' ability to select keywords before conducting a search. A question was posed to critically discuss the advantages and disadvantages of studying towards an Engineering degree at a university versus a college.

The following words were the top keywords by the respondents with the numbers that the words recurred as keywords in brackets:

- Engineering (33)
- Degree (15)
- University (29)
- College (28)
- Advantages and disadvantages (14)

Some of the respondents used Boolean operators, for example *"Engineering degree".* This points to the students' ability to effectively search for information. The keywords provided by most of the respondents were *Engineering, university, college, advantages, and disadvantages.* The most common keywords used were *university versus college*. The researcher found that many of the respondents were able to select keywords effectively. Three of the respondents only had partial keywords that were focused on only one part of the question while the other was disregarded completely. Four of the respondents' keywords were general keywords i.e. *Engineering degree.* One of the respondents was off topic and the keywords that the respondent selected were comparing a university to a college and had nothing to do with studying Engineering.

A word cloud summarising the themes that occurred from the results is presented below. Only words that had a minimum frequency of two (2) or more were included. The letter case used was the most common (sentence case).

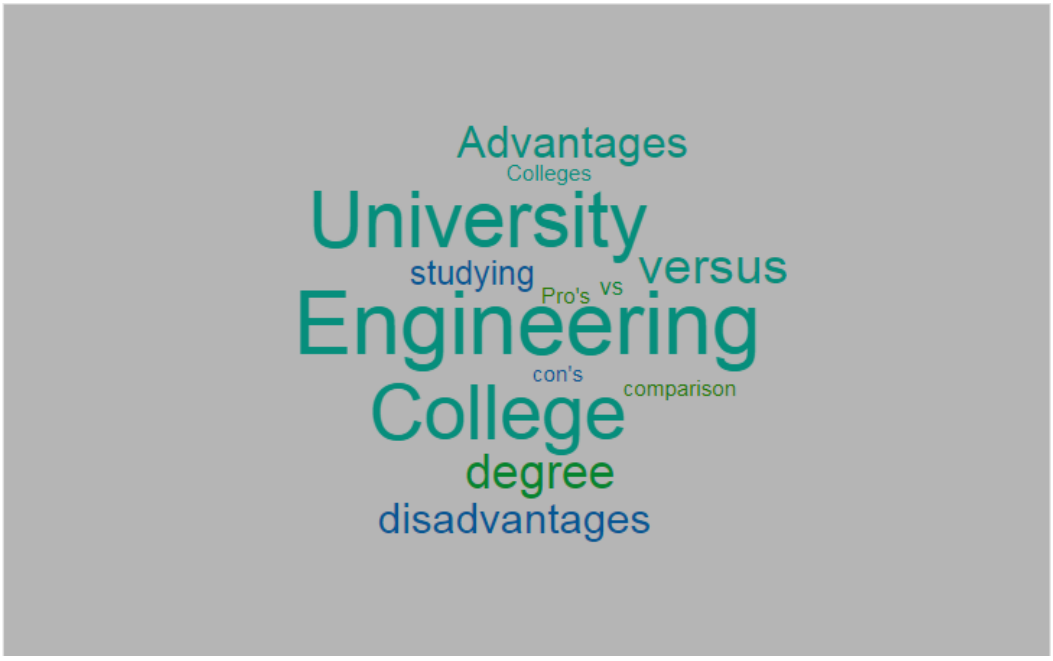


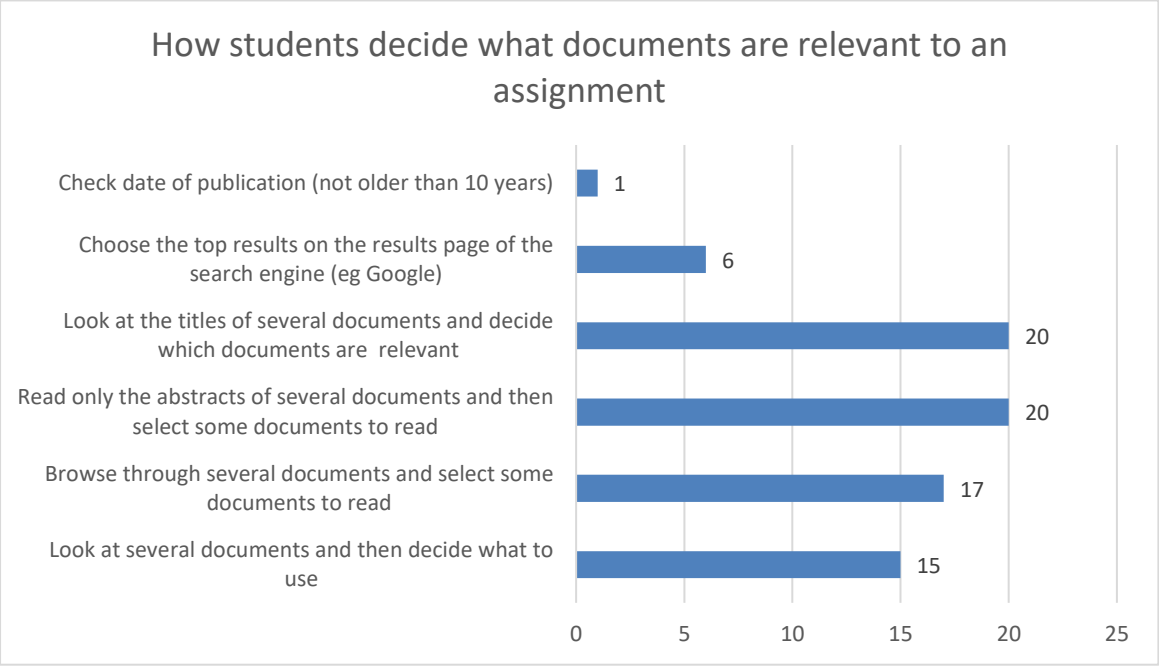
Figure 7: Keyword selection by Engineering students

The students' preference for Google over library resources, as was discussed in section 4.4.4.a, points to the fact that the students may not be able to use keywords effectively. However, the high percentage of students who do use library resources, indicates that the students may be able to use their selected keywords effectively as the library resources will retrieve the relevant and peer-reviewed information, which the students can use.

c. Engineering students' information behaviour (seeking, selection and use practices)

Question 14 in section F asked how respondents decide which documents are relevant to the assignment that was posed in the previous question (question 13). Respondents were able to select more than one option had to be provided for those that select 'other'. An equal majority of 47% (20/43) respondents reported that they would, either look at the titles of several documents and decide which documents are relevant and/or read only the abstracts of several documents and then select some documents to read. Browse through several documents and select some documents to read was reported at 40% (17/43), followed by look at several documents and then decide what to use at 35 % (15/43), choose the top results on the results page of the search engine was 14% (6/43) and a minority of 2% (1/43) opted for other and reported that he/she would check the date of publication (not older than 10 years).

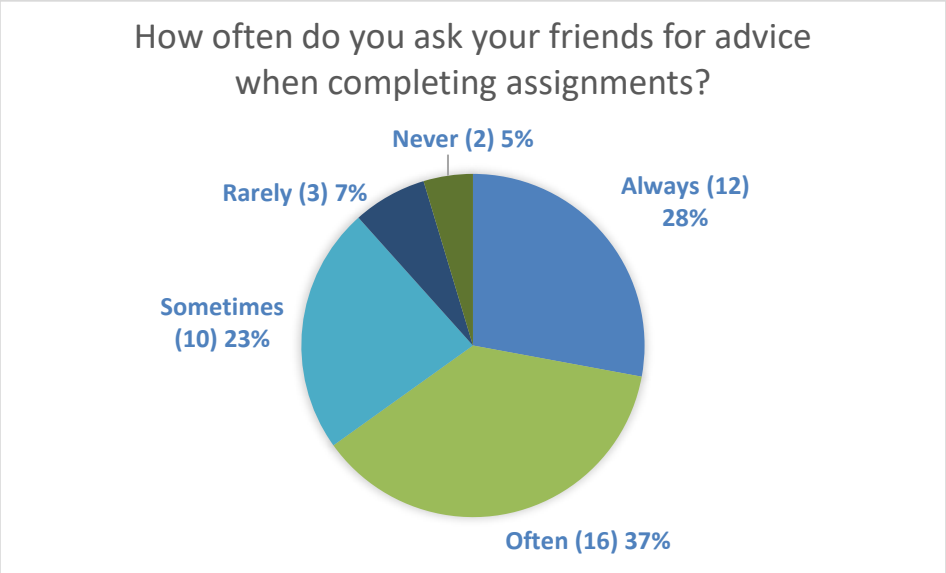
Graph 11 summarises the results.



Graph 11: Engineering students' information selection practices

The first sub-question (question 14.1.) asked how often the respondents ask their friends for advice when completing assignments. A majority of 37% (16/43) reported that they often ask their friends for advice, 28% (12/43) indicated that they always ask their friends for advice, 23% (10/43) sometimes ask their friends for advice, while 7% (3/43) rarely ask their friends for advice. A minority of 5% (2/43) reported that they never ask their friends for advice. The

researcher found that the respondents seek advice from friends when completing assignments. Graph 12 provides a summary of the results.



Graph 12: Engineering students' seeking of advice from friends for assignments

The second sub-question to question 14, question 14.2, asked what other resources respondents would use to complete an assignment. Seven percent (3/43) of the respondents reported that they use no other resources. Ninety-three percent (40/43) reported using other resources, however, 33% (14/43) mentioned resources that had already been covered in question 12 (Library resources (10), Google (2), and YouTube (2)). The researcher decided to not count the responses as they were deemed to be a repetition. It seems that the respondents find lecturers and textbooks to be useful resources to use. It was interesting to find that 5% (3/43) of the respondents who are in both Chemical Engineering and Mining Engineering, reported that they consult with postgraduate students, while 5% (2/43) also consult publications from industry and industry professionals.

The addition resources that the respondents reported using when completing assignments are listed below with the number of recurrences in brackets starting from the highest to lowest:

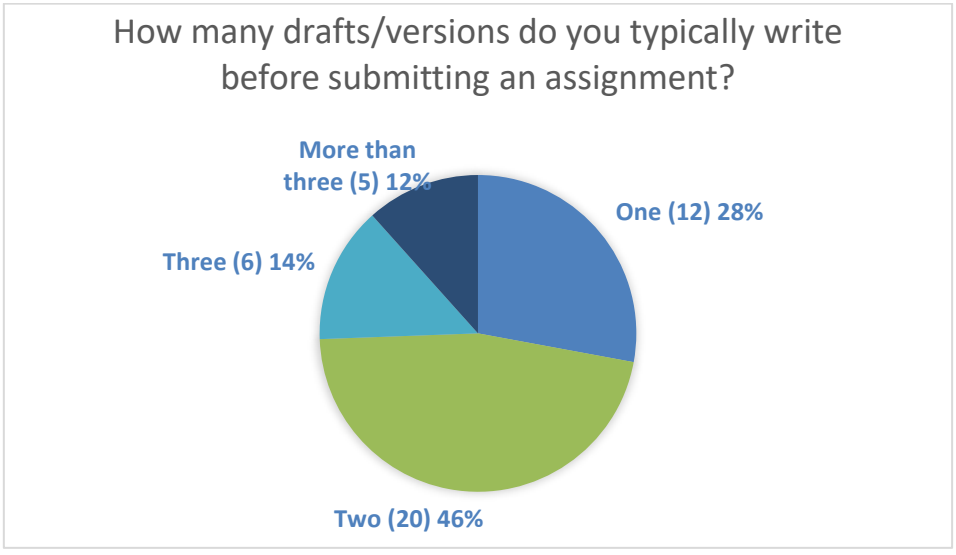
- Consult with a lecturer (9)
- Textbooks (9)
- Lecture notes (3)
- Postgraduate students (3)

- Publications from industry and industry professionals (2)
- Completed assignments (1)
- Templates (1)
- Google Drive (1)
- Formatting guide (1)
- Programming software, simulations and word processing (1)

The additional resources identified by the students support the blended nature of their courses since they consult both traditional and online resources. When embedding in a VLE, the IS would need to take into consideration the students' use of other resources (for example, industry publications).

d. Engineering students' assignment writing practices

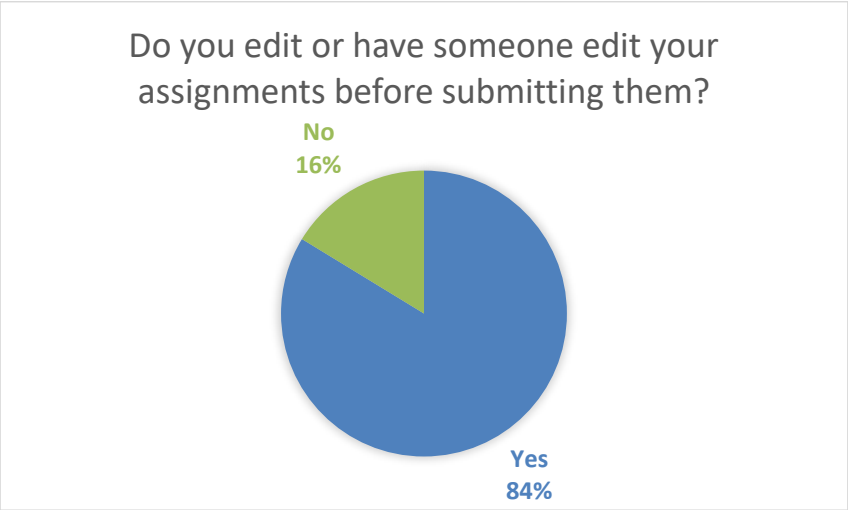
Question 15 in section F was also related to assignment writing. The question asked respondents how many drafts or versions of an assignment they typically write before submitting. The options provided were: one, two, three, and more than three. A majority of 46% (20/43) reported that they write two (2) drafts before submitting. This was followed by 28% (12/43) who reported writing only one (1) version. Fourteen percent (6/43) reported that they write three (3) drafts while a minority of 12% (5/43) reported that they write more than three (3) drafts of an assignment before they submit. The trend, to write two (2) versions, seems to be widespread practice across all departments. Graph 13 summarises the results.



Graph 13: Assignment drafting by Engineering students

It is interesting to note that 46% write more than two versions while 28% write a single version. Students should perhaps be made aware that most of their peers write more than one version of a paper.

Question 16 in section F also relates to the assignment writing process and the question asked was whether the respondents edit or have someone edit their assignments before they submit them. The options given were 'Yes' and 'No'. Eighty-four percent (36/43) of the respondents reported that they edit or have someone edit their assignments before submitting them. The remaining 16% reported that they do not edit or have someone edit their assignments before submitting them. No single department stood out in terms of having the majority of the respondents not having their assignments edited. Material Science and Metallurgical Engineering had exactly the same number of 'Yes' as well as 'No' responses. Graph 14 summarises the results.



Graph 14: Assignment editing by Engineering students

e. Challenges faced by Engineering students when completing assignments

Question 17, the last question in section F, asked the respondents what aspect of assignment writing they find really difficult. All the respondents reported challenges with being able to complete assignments. In Chapter 2 section 2.5.3, the student self-study process was discussed and figure 4 in the same section, illustrated the process for effectively completing an assignment. The challenges reported by the respondents are linked to the research and writing aspects of the assignment process. None of the respondents reported having a

challenge understanding the assignment question or specifications. The results are reported in two ways, the research challenges, and then the writing challenges.

Research

Ten (10) of the respondents reported having a challenge in terms of finding and gathering relevant information.

"Finding the right information for literature review can be quite challenging sometimes..."

"… finding recent and relevant sources"

Five (5) respondents reported having a challenge with the structuring of the assignment, while, one (1) respondent reported having a challenge with research in general.

"Structuring"

"Everything"

None of the respondents reported having a challenge with selecting information to use.

Write

In terms of assignment writing, starting on the assignment is the biggest challenge that the respondents reported having with twelve (12) responses.

"Finding the will to start doing it"

"Initial motivation to start"

"How to start"

"Typing up the first draft, it's hard to know where to start"

Writing a literature review was reported as a challenge by two respondents (2) while paraphrasing was reported by one (1) respondent and writing introductions and abstracts were also reported by one (1) respondent.

"Paraphrasing journals, writing introductions, conclusions and abstracts"

Five (5) respondents reported having a challenge with the synthesis of information when completing assignments.

"Connecting the literature and results to find an in-depth conclusion"

Referencing and language use was reported by seven (7) respondents as being an assignment writing challenge.

"I find referencing annoying rather than difficult, nothing is too difficult"

"Referencing…and language use"

One (1) respondent reported having a challenge with formatting of the assignment, while one (1) other respondent reported a challenge with the editing of assignments.

Time management was reported by two (2) respondents as being a challenge they encounter when completing assignments.

In summary, the students face challenges with conducting research as well as with the writing of assignments. Information literacy training can equip the students with the necessary skills to search for and find relevant information. This means that the IS has the task of identifying subject-specific resources (for example journals, books and databases) that students can use.

4.4.6. General remarks, concerns or suggestion by participants

The following concerns were reported by the respondents:

- South African articles are more difficult to find than international articles
- Engineering students should also do AIM (Academic Information Management)
- Awareness of the availability of library resources only happened in the third or final year. Earlier awareness would have helped with the completion of projects.
- It is difficult to navigate the library resources on the library website
- Library resources are not easy to use

The following suggestions were noted by the respondents:

- Access to more recent scientific/ Engineering books
- Provide online courses to improve research skills and efficiency
- Start a more interactive library

The following remarks were also captured:

"*Library services make life easier. I get access to a plethora of papers I wouldn't have been able to afford"*

"Information sessions from the Information Specialists are really helpful"

"I believe this work will enable students to access resources at one convenient location. In addition it has broadened my basic knowledge of available resources"

4.5. Discussion of the findings

Findings were analysed in this section using the themes identified in section 4.2.

4.5.1. Level of information literacy

In terms of the level of IL, the 51% result of information literate University of Pretoria Engineering third and final year students, is ambiguous. The school of Engineering does not offer an IL course, which means that the 51% that have IL, received instruction from their subject library who may have negotiated the training with the lecturers for each year group involved. It is also possible that the 49% that have no IL training, may have been absent or not part of the courses on the days that the training sessions were conducted as most students within the same year groups responded to having IL training. It also means that 49% of the Engineering students in the different departments struggle to find, retrieve, filter and use information that is available through the library. The Mining Engineering respondents all answered 'No' to receiving training before. This is also reflected in the response of the lecturer from the department (discussed in section 4.3.7) who mentioned that he did not know that the library offered the service. This perception is however not correct as the researcher herself has for the past two years been providing training to the second year Mining Engineering students with the assumption that they would remember the training in their third year but it seems none of them do. This means that they either did not understand the question or they truly feel themselves incapable of working well with information and information resources.

The lecturers from both Chemical and Material Science and Metallurgical Engineering mentioned that students should essentially be trained in the third and fourth year and the researcher, through personal communication with the lecturers, was made aware that the students in the specified year groups have received IL training. This contradicts what the students reported in terms of not having any IL training. This could be due to the students not

knowing that they were receiving IL training or the jargon used (for example, the students sometimes refer to it as library training).

Looking at the results, it is clear that the students place emphasis on being able to find resources that they can use as well as being able to access the information that the library has available to use it in their research. The researcher was pleasantly surprised that the use of Boolean operators was mentioned as one of the ways of conducting searches. The researcher came to the conclusion that the respondent is focused on finding and retrieving only information that is relevant and useful. When designing an embedded service for the students, the designer should make provision for both information literate and information illiterate users. Step-by-step guides, tutorials, videos and useful links, should be included to assist the students in being able to conduct searches effectively.

4.5.2. Usage of Library products

The respondents were not familiar with a majority of the library products listed (see section 4.4.2.d.). There are similarities as well as differences in the library products being used by respondents from the different Engineering departments. Looking at it from a departmental perspective, Chemical Engineering respondents used the following top five library products the most (ordered from highest to lowest, based on daily use to monthly use):

- Library page (11/30 weekly)
- Science Direct (10/30 weekly)
- Knovel (13/30 once a month)
- Electronic journals (13/30 once a month)
- Electronic books (12/30 once a month)

The products mentioned in section 4.4.2.d support what the lecturer (Participant A) mentioned in section 4.3.3 that there is a link to some library products available on ClickUP and that students are required to consult books as well as journal articles.

The library products most used by respondents in Material Science and Metallurgical Engineering are:

- Library page (3/4 daily),
- Science Direct weekly (4/4),
- Knovel (3/4 weekly),
- Electronic books (3/4 weekly), and
- McGraw-Hill Access Engineering, subject guides and electronic journals were tied with the same amount of usage weekly (2/4) (refer to section 4.4.2.d).

The lecturers interviewed had noted that they don't make library products available on ClickUP however, it is highly likely that the IL sessions conducted by the IS helped equip the students with the necessary skills to be able to use library products that they have been exposed to by the IS.

Respondents from Mining Engineering do not use any library products on a daily basis. Their weekly usage of some of the library products is also poor (1/9). This supports the lecturer's response in section 4.3.3 that there's only a link to the library and nothing else and that students have to make use of articles from journals as well conference proceedings, hence the electronic journals ranking higher. The library products that Mining Engineering students mostly use are:

- Electronic journals (5/9 once a month),
- Library page (4/9 once a month),
- Electronic books (4/9 once a month),
- Knovel (2/9 once a month), and
- Subject guides (2/9 once a month) (refer to section 4.4.2.d).

Comparing Chemical Engineering to Material Science and Metallurgical Engineering, respondents from both groups use the library page the most, followed by Science Direct and the Knovel. Chemical Engineering respondents use electronic journals more than electronic books while Material Science and Metallurgical Engineering respondents use electronic books more than electronic journals. Mining Engineering respondents use journals more than they use the library page. It is possible that a reference page with a list of journals and their direct

links may have been created for the students on their online modules. When asked what other products the respondents would like to have available, one respondent mentioned Engineering tool box. Engineering toolbox is worth exploring as the library does not currently subscribe to it. The designer of the embedded service would have to investigate Engineering toolbox, including its cost, functionality, scope, usability, interoperability and any other factors that may impact on it being embedded into the VLE. All stakeholders would have to be consulted before the product can be embedded.

4.5.3. Usage of Library services

Once the results were analysed, the researcher found that only one of the departments was in support of having an IS facilitate online discussions for assignments. Fifty-six percent (56%) of the Mining Engineering respondents indicated that they would like to have an IS facilitate online discussions for assignments, while Chemical Engineering and Material Science and Metallurgical Engineering were not supportive of the idea (50% Chemical Engineering; 50% Material Science and Metallurgical Engineering). The researcher found a correlation between the students' IL and their use of library services; the students from the department that had a high rate for having an IS facilitate online discussions, also indicated not having had IL training. Looking at the overall results, there is an equal number for and against having an IS facilitate online discussions on ClickUP. The researcher found that the service would make the embedded service undertaken by the IS in a BLE more effective. Refer to section 2.4.1 for detailed opportunities the service will have.

The services that respondents would most like to have available on ClickUP are:

- Referencing help,
- Step-by-step guides for doing a literature search,
- Assignment writing help,
- Online searching videos, and
- Ask/Chat to a librarian (refer to section 4.4.4)

When looking at the results of the online training options that the respondents would like to have embedded on ClickUP (refer to section 4.4.2.g), most respondents indicated that they want training on how to find the right information quickly. There is minimal interest in being able to evaluate resources for quality and how to select material for an assignment. The

researcher observed that training on how to find the right information quickly would have to be developed by the embedding IS.

4.5.4. Information Specialist role

The assistance that respondents mostly require from an IS is when they are searching for information for assignments but cannot find it. This is followed by when they don't know where to start searching for information (refer to section 4.4.3.a). A small number of respondents are able to help themselves and indicated that they don't require assistance; this could be because they had indicated that they did receive IL training. All the lecturers interviewed, support the idea of having a librarian embedded in ClickUP, however, two of the lecturers noted that the module or activities that are embedded should form part of the students' assessment or coursework so that it forces the students to work through the activities that will be provided by the embedded librarian. The embedding IS would have to consult with the lectures to find a way to incorporate the embedded products and services into the students' coursework. This can be in the form of online activities, short assignments and quizzes.

When the respondents were generally asked if they would like to have an IS facilitate online discussions for assignments, there was an equal response for both 'Yes' and 'No' (see section 4.5.4), however, when the respondents were asked if they would like to have an IS facilitate online discussions about available resources, the majority had responded 'Yes'. It seems the students want the IS to help in the acquisition of available resources more than in helping them with their assignments. This supports what the lecturers said in that they do not directly inform the IS when assignments are due as they would essentially like the students to do the work themselves and have the IS only equip the students with the skills that can help them to find information independently (refer to section 4.3.6). One of the two respondents who had responded no, had answered in the previously that he/she can help him/herself.

Students prefer to communicate with an IS via e-mail, followed by ClickUP discussion board and then face-to-face (see section 4.4.3.d).

4.5.5. Engineering students' information behaviour

The majority of students use both simple and advanced search when searching on the library catalogue followed by 35% who prefer the simple search and a 7% minority prefer the advanced search option. As was indicated previously in section 4.4.2.e, skills development needs to be facilitated so that the students could be more efficient searchers of information.

More than half of the respondents use the brainstorming technique for assignments while 40% don't; less than 10% are not familiar with the technique (refer to section 4.4.3.c). The departments follow a similar trend in their responses. A large number of the respondents use Google when searching for information for assignments; the library resources are second, YouTube is third. This is reflected in the lecturers' responses when asked which types of library material the students are required to use for assignments. Participant A mentioned YouTube videos, while participant B mentioned the use of Google (they are not library products but confirm that students use them). Library resources were mentioned by all the lecturers as being used for assignments, for example, journal articles and books (refer to section 4.3.2.). A large number of the respondents are able to successfully identify keywords to use for an information search, with a small minority struggling to identify keywords (refer to section 4.4.4.b).

There is a split in the respondents on whether they know how to select documents to use as an even majority responded that they would either, look at the titles of several documents and decide which documents are relevant and/or read only the abstracts of several documents and select some documents to read. Merely selecting documents on titles in not always accurate and enough as some article's titles do not correspond with the content, however, reading the abstract gives a good indication of what is contained within. Browsing through several documents and selecting documents to use is also popular; this can help to get an idea of what is useful and be able to quickly filter. Asking friends for advice when completing assignments is done by less than 40% of the respondents (see section 4.4.4.c). The researcher got the impression that advice from peers is not regarded as important in assignment completion for the respondents. Almost half of the respondents write two drafts, followed by less than 30% that only write one draft of an assignment. A little over 25% write three or three or more drafts. Editing of assignments is prominent among the respondents as more than 80% edit or have someone edit their assignments (see section 4.4.4.d). The researcher opted not to pursue the editing of assignment further than creating a user guide that highlight the stages of completing an assignment successfully; one of the stages is editing (see section 2.5.3 for an example). It would also be possible to create a list of editors to contact and to embed that in the learning module.

4.5.6. Challenges to assignment completion

The aspects of assignment writing that the student respondents struggle with when completing assignments are the research and writing aspects of the assignment process. The biggest challenge is related to writing. The respondents indicated that they struggle with their

assignments as they don't know how or where to start (see section 4.4.5). Participant B's interview response supports this notion as the participant noted that the student's writing skills are lacking (see section 4.3.5). The research aspect of finding information is a close second. The respondents also indicated that they have a challenge with finding the right information as well as finding recent and relevant resources, as well as referencing. One lecturer did mention that plagiarism is a problem among the third-year students as they simply copy and paste into their assignments. Another lecturer mentioned that referencing is a problem.

IL training will equip the students with the necessary skills they need to be able to find relevant information and use it effectively. The IS can train the students on how to use subject-specific resources and could also provide a step-by-step guide as well as video tutorials on how to locate and use the resources. The IS can create an assignment writing guide that the students can use and the lecturers could embed in the VLE. A referencing guide and referencing software training can also be provided by the IS in order to address the referencing problem that students are experiencing. Anti-plagiarism training would also help the students in learning how to paraphrase, while helping to minimise plagiarism.

4.6. Conclusion

The results provided in this chapter illustrate the current situation for the Engineering departments included in the study at UP. As was expected the research brought about an understanding of the potential role of an embedded librarian in a VLE for undergraduate Engineering studies. The researcher also gained better insight into student expectations when it comes to the library products and services in a VLE. This will assist the UP library in establishing whether it is equipped well enough to support Engineering students in a VLE and if not, what can be done to better serve the Engineering students.

As was anticipated, participants confirmed the importance of librarians embedding in VLE modules. They were also receptive and accepting of librarians embedding online. It is foreseeable that librarians who embed online will be able to meet the needs of the students as well as build stronger relationships with the students while successively increasing the use of library resources by students.

It was also found that the line between being information literate and information illiteracy, for the Engineering students at UP, is really a fine one. The library products and services are not being optimally used by the Engineering students because mainly, they are not aware of their existence. The respondents expressed a willingness to have an IS facilitate online discussions when assignments are due, and they prefer to also communicate with an IS via email followed

by face-to-face consultations. Google is still preferred above library resources when this group of students are searching for information to complete assignments. It is evident that the Engineering students are able to search and retrieve information; their main struggle is getting started with the writing process. The library has an opportunity to address this by providing training and user aids such as tutorials and step-by-step guides on how to undertake the assignment writing process from start to finish. Embedding these in the VLE, right there where and when the students need the training would, in all probability, enhance the likelihood of them actually using the relevant resources.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The previous chapter presented the findings from the data that were collected during the study. The current chapter will link the findings to the central research question, as well as sub-questions that were discussed in Chapters 1 and 2. Recommendations on developing an embedded librarianship programme are made in this chapter, as well as recommendations for future studies on embedding library products and services in a VLE for BLE. The questions that guided the research and some of the key findings, are provided in the next section.

5.2. Key Research Findings

The study investigated what needs to be done to ensure that relevant library products and information services, that are of value to both students and lecturers, are embedded into the evolving, online learning environment for Engineering students at the University of Pretoria. Three sub-questions were formulated in order to help answer the central research question. The sub-questions were answered using literature that was reviewed in Chapter 2, as well as using the data that were collected with the use of the staff interviews and online student questionnaires discussed in Chapter 3, and the results were presented in Chapter 4. The first sub-question to the central research question, is answered in section 5.2.1.

5.2.1. What is meant by embeddedness?

Embeddedness refers to both integration into and collaboration with a user group (refer to section 2.5.1 for more detail).

What is an embedded librarian?

The researcher's working definition of an embedded librarian is, a librarian who is integrated in and actively collaborates with a group of users in a VLE. She participates in the activities for the purpose of providing customised information services and products to suit the needs of the user group. A more detailed discussion, on how this definition was developed, is provided in Chapter 2, section 2.5.1.

What knowledge and skills do ISs require to embed in a hybrid teaching and learning environment?

From the literature (refer to section 2.5.5), it was established that an IS requires the following knowledge and skills in order to embed in a virtual/ blended teaching and learning environment:

- Interpersonal communication skills — the IS must be a team player and be able to build trusted relationships;
- Influential – the IS should be able to obtain support from the institution and get support from colleagues;
- Proficient in library research, referencing, information organization and possess IT skills;
- Should have knowledge of the subject area of users — the IS should be able to accept risk, move outside her own comfort zone, and think and act outside the box while recognising the constraints of the subject area;
- Marketing, entrepreneurial & innovative skills — the IS should have an entrepreneurial mindset.

Some of the above require soft skills such as persuasion and relationship building while others refer to technical skills (for example marketing). To be appointed as an IS at the UPDLS, candidates are required to already have all the above-mentioned knowledge and skills. It is therefore important for the IS to undergo continued professional development such as attending workshops, taking up short courses online, formal studies, conferences and seminars. It is also advised that the IS meetings, where best practices are shared, are attended. Relationship building is crucial for IS in the UPDLS.

The findings that address the way in which as embedded librarian can participate in a BLE are discussed below.

In what ways can an embedded librarian participate in a blended learning environment (BLE)?

From the literature (see section 2.5.8), it was established that an embedded librarian can participate in a BLE at different tiers of participation or levels of embeddedness in the following ways:

- As a *course administrator* by requesting a link to the library as well as the embedded librarian's contact information to be added on the online course module on the VLE.
- As a *course instructor* who creates tutorials and assessments that can be graded for the specific course.
- As a *course designer* that collaborates with a faculty and uses librarian expertise to help create or redesign the courses so that library resources are integrated.

Refer to section 3.5.8 for a detailed discussion on the tiers of embedded librarian participation. The recommended level of participation is discussed in section 5.4 below, but in essence, it is a combination of all three of the tiers.

Section 5.2.2. below provides answers to the second research sub question that was deemed essential to being able to answer the main research question.

5.2.2. The characteristics of a BLE

The relevant sub-question was: What are the characteristics of an effective blended learning environment (BLE)?

It was established that:

- A library module that is open to all the online students,
- Contact details of the embedded librarian appearing on the course page in various places,
- Announcements or topics for discussion posted in a single library-specific or assignment-specific discussion board, and
- Information posted proactively,

are all characteristics of an effective BLE (refer to Chapter 2 section 2.4.1).

This aligned with the requirements expressed by the participants (refer to section 4.3.8, 4.4.2.f and 4.4.3.b), where the participants expressed a need for very similar information.

What are regarded as typical embedded services?

The following table shows, on the left, what, according to literature, are regarded as typical embedded services (refer to section 2.5.6 of Chapter 2 for a more detailed discussion) in a virtual learning environment for blended learning environments. In the column on the right the services requested by the participants were noted (see section 4.4.2.f and 4.5.3 for detailed findings):

Services recommended by literature	Services requested by the participants
General links to web pages	
Provision of highly interactive content	
Personal interaction with a librarian	Ask/chat to a librarian Online discussions with an IS
Creating and posting of tips and tutorials	
Suggesting resources	
Set up training sessions on the use of library resources that integrate the information requirements of the students	Online searching videos Step-by-step guides for doing a literature search Assignment writing help Referencing help
Share information that is relevant to the students in the course	
FAQs	

Table 6: Embedded services to consider

The table shows a good correlation between the services suggested in literature and the needs of the participants and it could therefore be assumed that all of these would be the services that should be embedded in the UP's Engineering VLE.

What products are typically embedded in learning environments?

Refer to Chapter 2 section 2.5.7 of the literature review for more detail. The section discusses the products that are typically embedded in learning environments. The following products were products that were identified to be embedded in virtual learning environments for blended learning environment use:

- E-course reserves, databases and images
- An interlibrary request form for material that the library does not already have
- Style guides and writing resources
- Book and article searching
- An email or chat-to-a-librarian feature
- Access to online books
- Video tutorials

The research participants (lecturers) were asked what products they prescribed to students (refer to section 4.3.1), and, in turn, the respondents (students) were asked what products they used to find information (refer to section 4.4.2.d and 4.4.4.a). There is clear alignment between the lecturers' and students' responses. These requirements, in turn, corresponded with the list provided above.

What typical Engineering information products should be embedded?

The library page was indicated as the most important product that Engineering students use (refer to Chapter 4 section 4.4.2, b.). The following Engineering information products should also typically be embedded in a BLE using a VLE as identified in the analysis in Chapter 4 section 4.5.2:

- Engineering databases
- Electronic journals for Engineering subjects
- Electronic books on Engineering
- Subject guides for Engineers

Taking the two previous sections into consideration, the definitive list of products to be embedded is as follows:

- Subject specific databases

- Relevant electronic journals
- Relevant electronic books
- Subject guides
- Style guides and writing resources
- Book and article searching training material
- An email or chat-to-a-librarian feature

The subject guide can be designed in such a way that it incorporates some of the products listed above such as: the electronic journals and books, style guides and writing resources, and email/ chat-to-a-librarian. This will make it easier for the IS to change the content in one place, without having to interfere much with the ClickUP module content.

5.2.3. Variances in the information needs

The following was asked: Do the information needs of learners from the various sub-disciplines in Engineering show any variation?

There are certainly variations in the needs of the students from the three sub-disciplines of Engineering that were included in the research. Firstly, in terms of training options, Chemical Engineering has a number of students that would like to have each of the three identified training options with the majority wanting training on how to find the right information. In Material Science and Metallurgical Engineering, none of the students indicated that they were interested in training on how to select relevant material for assignments. In Mining Engineering, none of the respondents indicated that were interested in being trained on how to evaluate resources for quality (see Chapter 4 section 4.4.2.g).

In terms of students' need to communicate with an IS, Chemical Engineering ticked all the boxes with the majority preferring email, then the ClickUP discussion board, and then face-to-face communication. Metallurgical Engineering took a different stance with an equal number preferring the above-mentioned options but none being interested in telephone or video calls or Google chat. Mining Engineering students, on the other hand, had different needs; they prefer email followed by face-to-face, but they have no interest in telephone or video calls; a few wanted to use the ClickUP discussion board and Google chat (see Chapter 4 section 4.4.3.b).

There are also variations in the library products used by students. Firstly, Chemical Engineering students make use of electronic journals more, while Material Science and Metallurgical Engineering students prefer McGraw-Hill Access Engineering and subject guides above electronic journals. Mining Engineering students prioritise the use of electronic journals above the use of the library page, and the use of electronic books above Knovel; Science Direct did not make the top five list for Mining Engineering, instead, subject guides did (see Chapter 4 section 4.5.2).

What services does the library at the University of Pretoria (UP) currently offer its faculty of Engineering learners?

The following services are currently being offered by the UPDLS:

- IS consultations
- E-resource links
- Standards and patents
- Subject related website links
- IL training
- Training material

These are not embedded but are rather available from the UPDLS web site. Refer to section 1.4 for more detail on each of the above.

The students' service preferences have some similarities to those listed above (see sections 4.5.3 and 5.2.2). The differences that exist are that firstly, there is only slight interest in having access to standards and patents. Secondly, there was no mention by the students to having subject-related website links, however, they did indicate an interest in ask/chat-to-a-librarian. Referencing help, step-by-step guides for conducting literature searches and online searching videos, would all fall under training material.

What is the current level of IL as indicated by the respondents?

Actual IL was not tested. With that as background, it is possible to say that the perception of the level of IL of the Engineering respondents and their actual ability to retrieve information may not reflect reality. Using IL training as a proxy for literacy and reflecting only upon their perception, respondents indicated that 51% were information literate and 49% were

information illiterate. All the Mining Engineering respondents indicated that they are not information literate at all. There is therefore a clear gap that needs to be addressed – most probably through structured training.

The lack of training can be attributed to the UP School of Engineering not offering any academic information management modules- which form the basis of the students' IL training at the institution. Training by ISs is on an invitation basis by lecturers and can only take place if the lecturers approves of it. As was noted by one interview participant: they have no knowledge of the services that the library and the librarians offer. They are also not aware of the availability of IL training.

To some extent, the Chemical Engineering and Material Science and Metallurgical Engineering responses to the question on IL training, contradicted the lecturers' opinion as it was mentioned that the IS for their departments conducts IL training for the students. Refer to Chapter 4 section 4.4.2.a for the results and section 4.5.1 for a more detailed discussion.

What is the current information behaviour as reported by respondents?

The current information behaviour reported by the respondents was that they are able to use both simple and advanced search options when searching for library resources, and Google is still a preferred resource for finding information for assignments. The respondents are able to successfully identify keywords to use when searching for information. The respondents prefer to select documents to use by looking at the titles of several documents and selecting documents to read, as well as reading only the abstracts of a number of documents before selecting the final documents to read. The respondents do ask friends for advice for assignments but only to a limited extent. A majority of the respondents write at least two drafts of an assignment. Editing of assignments is also a common practice among the respondents. See Chapter 4 section 4.4.4 for results and section 4.5.6 for the analysis of the results.

What services can the UPDLS add to their existing services to support a hybrid learning environment developed for Engineering (undergraduate) students?

It was established that the following services can be added by the UPDLS to the existing services to support the undergraduate Engineering blended learning environment:

- Referencing help
- Step-by-step guides for doing a literature search

- Assignment writing help
- Online videos demonstrating the search technique
- Ask/ chat to a librarian
- Online discussions with an IS

Refer to Chapter 4, section 4.4.2.f for details on the results yielded by the research, as well as section 4.5.3 for the analysed results.

Having identified the products and services to embed it is essential to also reflect upon the process to follow so that the students and lecturers would value the intervention. This process is discussed in the next section.

5.2.4. Valued embedded products and services

The question that was asked: What needs to be done to ensure appropriate library products and information services, that are of value to both students and lecturers, are embedded into the evolving learning environment for Engineering students at UP?

The following process would have to be put in motion to ensure that appropriate library products and information services, that are of value to both Engineering students and staff, are embedded into the UP BLE:

Consultations with stakeholders when designing the embedded service

The IS, wishing to embed in the environment, would first need to consult with the library and gain support from management and colleagues (see section 2.5.5). The faculty instructional designer would have to approve the creation of a module now that the need for it has been established. The IS would have to have consultations with the lecturers to plan how the embedded products and services will be incorporated into the students' coursework (refer to sections 2.5.4 and 4.5.4). Incorporation can take place in the form of a number of online activities. Examples are quizzes and short assignments that the students will have to complete to get a mark that goes towards their total assignment/semester mark. The lecturer and the IS would have to collaborate to select appropriate activities with maximum impact at the correct time.

Student consultations should inform how the embedded products and services will be presented in terms of the layout and the format that the students prefer.

The designer of the embedded service would have to make provision for both information literate and information illiterate users (see section 4.5.1 for more details). This means that help guides and instructions on how to use the products and services should be included in the VLE (refer to section 4.5.1 for examples). Subject-specific products would have to be selected as well as services that will be useful and will be used by both students and staff.

Training

The IS would have to first make sure that they have the skills necessary to effectively participate, collaborate and be integrated with the lecturers and students in the VLE (refer to section 2.5 in Chapter 2). IL training would need to be conducted to equip students with the skills they need to find and use information effectively (refer to section 4.5.6). Training should also be provided to students on how to find relevant information quickly (see section 4.5.3). This means that the embedding IS would have to focus on training the students on how to use the advanced search functionality to find subject-specific resources (refer to section 4.5.5 and 4.5.6). Training can also be conducted for lecturers to orientate them on the resources that are available to them and the students to support their teaching and learning. It would obviously be possible to create fully online learning content but at this stage it is anticipated that some face-to-face contact would be required.

Embedding the service

The importance of having an embedded IS in a VLE for BL is discussed in Chapter 2 section 2.4.2. The IS would have to make sure that the embedded service has the features discussed in section 2.4.1 in Chapter 2. The products to embed were identified in Chapter 4 section 4.5.2. Similarly, the services were identified in section 4.5.3. The role that the IS should play was discussed in section 4.5.4, while the students' information behaviour was mentioned in section 4.5.5., and the challenges that they have when completing assignments in section 4.5.6. All of these aspects need to be taken into consideration when creating the embedded service. Further recommendations are provided in the section that follows.

5.3. Recommendations

The recommendations for embedding in an Engineering VLE, as well as the recommendations for future studies, are listed below.

5.3.1. Recommendations for Embedding in a VLE for Engineering

It is recommended that when embedding in a VLE, the embedded librarian must:

- Consult with all relevant stakeholders such as lecturers, library staff, students, as well as the instructional designer to plan the embedded service, including its layout, activities and assessment components as well as to enrol students in the IL module.
- Inform lecturers of library products and services that are available for their discipline. The IS should identify and select library products and services that are prescribed and/or recommended by lecturers (such as electronic journals, electronic books and other library resources) and embed these for each of the courses so that the students would have easy access to relevant products.
- Make certain that the contact details of the embedded IS and any additional relevant library support services (such as the MakerSpace), are available from a variety of access points in the module on the VLE.
- Provide IL training and training material to both students and lecturers so that they will be able to use the embedded service effectively. The IS also has an opportunity to develop a training module for IL that could be embedded into the students' coursework. Some components of the training could also be used by the lecturers as it seems they too need exposure to IL which will help them discover subject-specific library products and services which they can use in their courses.
- Pilot the embedded service with students, library and lecturing staff and obtain feedback that could be used to improve the service. Make sure that the research findings are incorporated into the module during the design phase.
- Align the expectations and the activities of the program with those of the course to make sure that the students use the module and complete the activities included in the module.
- Regularly review progress and the use of the content in order to gauge the impact the embedded service has on the students' progress and their studies.

All the above will help the IS. As was mentioned in Chapter 2 section 2.1. there is no definitive guide on how to create an embedded program, and individual ISs should report on their person experiences.

5.3.2. Recommendations for products and services to be embedded

- Ensure that embedding takes place in stages and not all at once.
- Keep the focus on the Engineers – do not embed generic material which should rather be on the library site.
- Create alerts that will ensure the proactive identification of specific products/ services to embed.
- Encourage regular feedback and make adaptations until all participants and users are happy.
- Focus groups with students can be carried out to confirm the recommendations before implementing the planned activities.

The literature discussed in section 2.1. of Chapter 2 endorses the statements above since it was mentioned that ISs provide their best practices and their services in an online environment using a CMS.

5.3.3. Recommendations for the library

It is recommended that the library provides the IS with the following training and support so that embedding in the VLE is feasible and sustainable:

- Training in the effective use of the lecturer component of the VLE (introductory level).
- Training in the effective facilitation/ management of online communities (advanced level).
- Training on how to use gamification in online education (intermediate level).
- Training on the production of training videos and the use of multimedia production tools (beginner level).
- Designing course material/ web content (beginner level).
- Programming of chatbots (beginner level).

The IS should also:

- Get involved in online communities that address embedded librarianship and associated technologies.

- Encourage other ISs to also embed in the VLE modules where they are responsible for assisting undergraduate students.

5.3.4. Recommendations to the Department of Information Science

It is recommended that the Department of Information Science considers the following to prepare future ISs for the work environment:

- Provide hands-on exposure to VLEs (undergraduate level) because it will make it easier for new recruits when they have to embed in their professional careers. This can be done in the form of practical sessions or a project where the students create (or assist current ISs) in a single-department embedded programme in their final year of study as part of the experiential learning module using the UP VLE.
- Include embedded librarianship theory, including VLEs and BLEs in the undergraduate curriculum.
- Invite ISs to give their experiences and give a lecture on some of the best practices for embedding in a VLE

5.4. Recommendations for future studies

The following are the researcher's recommendations for potential studies on the topic:

- A similar study can be carried out over a longer period of time to allow for the inclusion of more Engineering departments as well as study participants.
- More staff interviews could be carried out with a lengthier study.
- The embedded librarian program can be piloted with a before and after-action review.
- A similar study could be conducted for another faculty.

5.5. Conclusion

The impact of IT has led to rapid changes taking place in libraries and also in the teaching and learning activities of the university. Libraries remain important in the academic success of students. Online learning is increasing and VLEs such as ClickUP, allow the library to provide

timeous services to students across geographical barriers. The challenge to develop the students' IL skills could be addressed through embedded services and products.

This study was conducted to explore what needs to be done to ensure that appropriate library products and information services, that are of value to both students and lecturers, are embedded into the evolving learning environment for Engineering students at the University of Pretoria. The study found that IL training is the first step to making sure that the embedded products and services will be used by the students when completing assignments. The IL skills will not only help the students with their studies but also reach into their professional careers and inevitably improve their professional activities.

The IS has an opportunity to develop a training module for IL that could be embedded into the students' coursework. Some components of the training can also be used by the lecturers as it seems they also need exposure to IL, which will help them discover subject-specific library products and services that they can use in their courses.

The study was qualitative in nature; therefore, the results cannot be generalized but the participants confirmed the importance of librarians embedding in their online modules. They are receptive to and accepting of the embedded librarian being available online. It is assumed that the research results and the recommendations would be valid to be used as a guide for a similar study which includes all Engineering students and all relevant staff members.

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APPENDIX A

Interview Schedule for Lecturers

Research title: The use of ClickUP to embed library products and information services in a blended learning environment: a University of Pretoria Engineering case study

Introduction

The purpose of this interview is to establishing the role that you foresee that the library should play in assisting Engineering students when they have assignments to complete but also to assist them when they leave the University and enter the job market. I am investigating whether it will be possible to give the Engineering students direct access to these products and services that you expect them to be familiar with from ClickUP.

Please note that the responses to the interview questions will be treated as confidential and no personal information will be shared or used to identify you. Clarification to questions will be provided when needed. Should you not wish to answer a question, please state that in the interview. Feel free to give detailed responses and ask questions if you have any.

[Confirmation of approval to record the interview]

[Consent form to be signed]

This interview will be approximately 45-60 minutes in duration

Questions:

1. What information / library material are students required to consult for the course(s) that you teach?

   Note to the interviewer: If the lecturer responds that only the prescribed text is required ask what is done to assist the gifted student who is capable of more

2. What types of library material are the students required to use when completing assignments?

   Note to the interviewer: If the lecturer is not sure what is meant by 'types of material' explain as follows …types of materials are the different forms or mediums that information is packaged in, for example, newspapers, books and journals

3. Are there any library products that you make available to students on ClickUP? Please specify

Note to the interviewer: If the lecturer is not sure what is meant by 'library products explain as follows …library products are the digital or physical material that are available through the library such as databases, subject guides, library app, e-journals and books, and standards. Is a librarian's contact information present in your ClickUP module? Yes/No …please expand

4. Is a link to the library's web site present in your ClickUP module? Yes/No …please expand

5. What aspects of assignment writing do students struggle with?

Note to the interviewer: if asked for an example, mention that this could range from finding information sources, evaluating sources, understanding the requirements, the actual written language, referencing, antiplagiarism.

6. Do you inform the librarian when an assignment is due?

Note to the interviewer: If the lecturer does not understand why, explain that the librarian would be able to build a collection for the students to use if there is advance warning.

7. At what stage do you expect the students to attend any of the information literacy sessions offered by the library?

Note to the interviewer: when asked, explain that this could range from a specific time such as first year until final year, in a specific year or semester of study or at a specific stage of a task, assignment or project…

8. If the library staff were to develop specific course material to assist Engineering students with information literacy what would be your viewpoint if you were asked to embed the course within your Engineering module(s) in ClickUP?

Note to the interviewer: explain that to 'embed' is to make something a permanent and important part of something else

Thank you for participating in this interview. A copy of the note for record will be made available to you. The responses will be kept confidential and the audio tapes will be destroyed as soon as the transcription has been sent to you for approval. You may accept the transcription 'as is' or make changes where necessary. Please note that you will be given a limited period of time (no more than a week) to alter the record of our discussion.

APPENDIX B

The use of ClickUP to embed library products and information services in a blended learning environment: a University of Pretoria Engineering case study

Required

SECTION A: INTRODUCTION

The purpose of this questionnaire is to establish the role that engineering students expect an Information Specialist to play in their virtual learning environment (ClickUP) and to also establish what products and services an engineering student would expect to gain access to from within ClickUP modules.

The questionnaire will not take longer than 30 minutes to complete.

My name is Lesego Makhafola and I am an M.IT (Master of Information Technology) student at the University of Pretoria. I am required to complete a mini-dissertation in order to fulfil the requirements for the degree. The focus of my mini-dissertation is to look at the library products and services that can be embedded into a virtual learning system for undergraduate students. I chose to investigate the options available to students from the various departments of the School of Engineering at the University of Pretoria.

If you are willing to participate in this research please click on the 'Next' button so that you could complete the informed consent declaration.

SECTION B: INFORMED CONSENT

Project information

Title of research project: The use of ClickUP to embed library products and information services in a blended learning environment: a University of Pretoria Engineering case study o Researcher details: Lesego Makhafola
University of Pretoria, Department of Information Science.
makhafola.lesego@gmail.com • (012) 420 3082 (w) o Research study description. The purpose of the research is to look at the library services that can be embedded into a virtual learning system for undergraduate students in the various departments of the School of Engineering at the University of Pretoria. Participants are required to answer a short series of questions relating to the topic before the embedding takes place and another set of questions post-intervention. Participation in the research is voluntary and participants can decide to discontinue participation at any point of the study should they wish so. All data will be anonymized before analysis. o Possible safety and health implications in participating in the research: None were identified.
Informed consent o I hereby volunteer to participate in the project as explained to me by LESEGO MAKHAFOLA o The nature, objective, possible safety and health implications have been explained to me and I understand them.

I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

Upon acknowledgement of this form, you will be able to proceed with the completion of the questionnaire

1. Do you consent to participate in this study? * *Mark only one oval.*

- ◯ Yes
- ◯ No *Stop filling out this form.*

SECTION B: INFORMED CONSENT

Please provide the last 4 digits of your student number: *

_____

SECTION C: DEMOGRAPHIC INFORMATION

2. Please indicate your year of study * *Mark only one oval.*

- ◯ Third year
- ◯ Fourth year
- ◯ Between Third and Fourth year
- ◯ I am not prepared to say

3. In which department are you enrolled as a student? * *Mark only one oval.*

- ◯ Chemical Engineering
- ◯ Material Science & Metallurgical Engineering
- ◯ Mining Engineering Other:
- ◯ _____

SECTION D: INFORMATION LITERACY

Information literacy is the means of finding, interpreting, evaluating, managing and sharing of information (Beetham and Sharpe, 2010: 2).

4. Have you had information literacy training before? *Mark only one oval.*

- ◯ Yes
- ◯ No *Skip to question 8.*

SECTION D: INFORMATION LITERACY

4.1. What part of the training do you remember?

4.2. What did you learn that you actually use?

SECTION D: INFORMATION LITERACY

5. A list of library products is provided below. Please indicate how often you make use of these products. *

Mark only one oval per row.

	DAILY	WEEKLY	ONCE A MONTH	NEVER	NOT FAMILIAR
Scopus					
ScienceDirect					
EBSCOhost					
Knovel					
Scifinder					
Reaxys					
ACS Publications					
Royal Society of Chemistry (RSC)					
Web of Science					
McGraw-Hill Access Engineering					
Proquest					
SpringerLink					
Taylor & Francis					
Subject Guides					
Library Page					
Library app					
Electronic Journals					
Electronic Books					
Standards					

5.1 If you use other products, please specify:

5.2 Which option of the catalogue search do you prefer to use? *Mark only one oval.*

- Simple search ("one box search")
- Advanced search
- I use both

6. Which of the following library services would you like to have available on ClickUP? * *Mark only one oval per row.*

	YES	NO	NOT FAMILIAR
Ask/Chat to a librarian			
Online searching videos			
Step-by-step guides			
Online discussions			
Referencing help			
Assignment writing help			
Other:			

6.1 If other, please specify:

_____

7. Which of the following training options would you like to have available directly in your online Engineering modules? * *Check all that apply.*

- [ ] How to find the right information quickly
- [ ] How to evaluate resources for quality
- [ ] How to select relevant material for my assignment
- [ ] Other: _____

SECTION E: THE ROLE OF THE INFORMATION SPECIALIST

Description of an Information Specialist: A library staff member who has been appointed to address the needs of the library's clients (the students). The Information Specialist guides the collection, recording, organizing, storing, preserving, retrieving and disseminating of printed and/or digital information, as well as information literacy training to an identified group of clients (ie Engineering students). The staff member is often referred to as a librarian.

8. When do you require assistance from an Information Specialist? * *Check all that apply.*

- [ ] When I don't know where to start searching for information
- [ ] When searching for information for assignments but cannot find it
- [ ] Never. I know how to help myself
- [ ] Other: _____

9. Would you like an Information Specialist to facilitate an online discussion about the available resources to use when an assignment is due? * *Mark only one oval.*

- Yes
- No
- I am not sure
- I would rather have a face-to-face discussion
- I would rather just have a list of relevant resources
- I do not wish to respond

10. Do you brainstorm/ write down ideas before looking for resources to complete your assignments? *

Mark only one oval.

- Yes
- No
- I am not familiar with the brainstorming technique

11. Which communication channel would you prefer to communicate with the Information Specialist for your department? * *Check all that apply.*

- E-mail
- ClickUP discussion board
- Face-to-face
- Telephone call
- Video call
- Google chat
- I do not wish to communicate with an Information Specialist

SECTION F: FINDING INFORMATION

12. What resources do you use when searching for information to complete an assignment? * *Check all that apply.*

- Google
- Wikipedia
- Library resources
- YouTube
- Other: _____

13. Here is a typical question: Critically discuss the advantages and disadvantages of studying towards an Engineering degree at a university versus a college. Which words will you use to search for relevant resources for the assignment?

_____
_____
_____
_____
_____

14. How would you decide what documents are relevant the assignment in question 13? *
Check all that apply.

- [ ] Look at several documents and then decide what to use
- [ ] Browse through several documents and select a few to read
- [ ] Read only the abstracts of several documents
- [ ] Look at the titles of several documents and decide which documents are relevant
- [ ] Choose the top results on the results page of the search engine (eg Google)
- [ ] _____ Other:

14.1 How often do you ask your friends for advice when completing assignments? * *Mark only one oval.*

- ◯ Always
- ◯ Often
- ◯ Sometimes
- ◯ Rarely
- ◯ Never

14.2 What other resources would you use to complete an assignment? *

15. How many drafts/versions do you typically write before submitting an assignment? * *Mark only one oval.*

- ◯ One
- ◯ Two
- ◯ Three
- ◯ More than three

16. Do you edit or have someone edit your assignments before submitting them? * *Mark only one oval.*

- ◯ Yes
- ◯ No

17. What aspect of completing an assignment do you find really difficult? *

SECTION G: GENERAL

18. What general remarks, concerns or suggestions would you like to record? *

19. Would you like to participate in a focus group discussion where the results of this research will be shared? * *Mark only one oval.*

- Yes
- No *Skip to "THANK YOU FOR TAKING THE TIME TO COMPLETE THE QUESTIONNAIRE. PLEASE PROCEED TO SUBMIT THE FORM AND EXIT THE QUESTIONNAIRE.."*

SECTION G: GENERAL

28. **If yes - please leave your e-mail and cell phone number so that I would be able to contact you. ***

THANK YOU FOR TAKING THE TIME TO COMPLETE THE QUESTIONNAIRE. PLEASE PROCEED TO SUBMIT THE FORM AND EXIT THE QUESTIONNAIRE.

APPENDIX C

Informed consent form

(Form for research participant's permission)

1. Project information

1.1 Title of research project: The use of ClickUP to embed library products and information services in a blended learning environment: a University of Pretoria Engineering case study

1.2 Researcher details: Lesego Makhafola

University of Pretoria, Department of Information Science.

makhafola.lesego@gmail.com

(012) 420 3082 (w)

1.3 Research study description. The purpose of the research is to look at the library services that can be embedded into a virtual learning system for undergraduate students in the various departments of the School of Engineering at the University of Pretoria. Participants will be asked questions relevant to the topic. Participation in the research is voluntary and participants can decide to discontinue participation at any point of the study - should they wish to do so.

1.4 Discussions will be recorded for record purposes only. The recording will be destroyed after a note for record has been created.

1.5 All information collected will be anonymised before the data analysis phase will commence.

2. Informed consent

2.1 I, _____ (*Name & Surname)* volunteer to participate in the project as explained to me by Lesego Makhafola

2.2 The nature, objective, possible safety and health implications have been explained to me and I understand them.

2.3 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

2.4 I agree / do not agree to have my responses recorded.

2.4 Upon signature of this form, the participant will be provided with a copy.

Signed: _____ Date: _____

Researcher: _____ Date: _____