

**INFORMATION BEHAVIOUR OF MECHANICAL ENGINEERING STUDENTS AT A SOUTH
AFRICAN INSTITUTION OF HIGHER EDUCATION AND THE ROLE OF THE ACADEMIC LIBRARY
IN MEETING THEIR INFORMATION NEEDS**

by



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A full thesis submitted in fulfilment of the requirements for the degree of Master in

**UNIVERSITY of the
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ABSTRACT

Academic libraries in South Africa are increasingly shifting their focus towards providing online resources to meet the needs of off-campus students, especially due to the COVID-19 pandemic's emphasis on the necessity of online access to library resources and services. Therefore, the study aimed to investigate the information needs, retrieval methods, and behaviour of mechanical engineering students at a higher education institution, specifically focusing on their use of online resources.

The study employed a sequential, explanatory, and mixed-methods approach, using a web-based questionnaire for students and interviews with subject librarians to collect both quantitative and qualitative data. Despite numerous reminders and resending of the questionnaire, the response rate was low, which may have been due to factors, such as the difficulty of reaching and motivating students, who were off campus during the pandemic, reduced engagement with email during this time, or the general stress and disruption caused by the pandemic.

The study findings revealed that few mechanical engineering students utilised the available online library resources and those who did often faced difficulties in using them. This might have been due to the academic library's inability to offer its regular information literacy training, relying instead on video tutorials and online initiatives that were poorly attended because of connectivity and data challenges. However, those students who had received training before the pandemic demonstrated an understanding of how to use online resources. In addition, the findings revealed that many students were unaware of subject librarians offering services and assistance, although the two engineering librarians made significant

efforts to help students find relevant information for their projects and navigate online resources.

Recommendations based on the findings are that academic libraries raise awareness of their online services through lectures and departmental meetings and utilise social media as a tool for marketing library services. Furthermore, librarians should not only ensure that all students receive information literacy training but also take steps to address the low usage of online library resources.

Keywords: information seeking, information needs, information literacy, information behaviour, information sources, COVID-19, mechanical engineering students, LibGuides



DECLARATION

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DEDICATION

I give all glory to the all-powerful God and dedicate this thesis to my late parents, Alec Joas Dibakoane and Mary-Magdeline Dibakoane. I would also like to thank you for instilling the value of education in me. Enkosi moLaodi and maMokoena!



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The logo of the University of the Western Cape, featuring a stylized classical building with columns and a pediment, positioned above the text "UNIVERSITY of the WESTERN CAPE".

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The study aimed to examine the information behaviour of mechanical engineering students, ranging from those in the Extended Curriculum Programme (ECP) to fourth-year level students, at a tertiary institution. The study also aimed to investigate the role of the academic library in providing support to students for their information needs. When working on assignments or projects, students require information, and their information-seeking behaviour is influenced by various factors such as discipline, faculty demands, the curriculum, and personal characteristics, according to Korobili et al. (2011). Most of the students at the higher education institution where the study was conducted come from disadvantaged backgrounds, and the lack of information literacy education in schools makes it difficult for them to access, retrieve, and use information, as suggested by Nel (2015). Traditional libraries have undergone a significant transformation due to advancements in technology and digital tools, which poses a challenge for South African students experiencing the digital divide, which is the unequal distribution and accessibility of technology and digital resources between different socio-economic groups. Wilson (2000) argues that studying library information systems involves investigating how users navigate a given system and how they utilise the information provided by the system.

The data collection phase of the study was initially planned to take place just before the outbreak of the COVID-19 pandemic. However, owing to the pandemic, the study incorporated information on students' information-seeking behaviour and the role of the academic library during the pandemic when students had limited or no access to the campus

and the library. Before the pandemic, students had access to both print and electronic resources. However, as Rodrigues and Mandrekar (2021) point out, during the pandemic, librarians were compelled to disseminate information and provide training via digital media platforms. Begun and Elahi (2021) reported in their study that digital services, such as remote access and online resources facilities were crucial in supporting students at East West University, which is a private university in Dhaka, Bangladesh, through online teaching to access information resources.

1.2 Background and motivation

The study was inspired by the researcher's experiences working in academic libraries. Working at the information point of the higher education institution where the study was conducted, she observed that undergraduate engineering students frequently utilised the academic library's information resources to complete assignments and prepare for classroom discussions, seminars, projects, and tasks at future workplaces. It was found that students sought information daily to fulfil their information needs. However, students' information-seeking needs and behaviour varied depending on factors, such as their academic level, information literacy skills, and their ability to access and use information resources, including e-resources.

Kerins et al. (2004) conducted a study using Leckie et al.'s (1996) model of information seeking behaviour as a theoretical basis, which found that engineering students primarily learn their information-seeking skills from educators. However, students often hold misperceptions about the library's role, leading them to exclude it from their information-seeking strategies. Therefore, information literacy education is crucially needed.

To address this need, the library at the institution where the study was conducted offers information literacy skills training for students in the ECP who are in the programme because they do not meet the requirements for direct entry into various faculties. In addition, in the engineering faculty, information literacy is incorporated into the communications module, with a compulsory weighting of 15% added to students' final marks for the course. The information literacy training comprises five modules: Search Strategy; Information Sources and Tools; Evaluation of Information Sources; Copyright and Plagiarism; and Referencing. The library is responsible for teaching the first three modules, while lecturers teach Copyright and Plagiarism as well as Referencing.

The following outcomes are expected from the information literacy training:

- Read and understand the topic
- Identify needed information
- Identify keywords
- Search techniques and strategies

Owing to the outbreak of the pandemic, academic libraries had to teach information literacy modules through the online learning platform called Blackboard and had to communicate with students via emails or social media.

Rajendraprasath and Muthusamy (2013) as well as Wilson (2000) define information behaviour as a broad term that encompasses activities such as expressing information needs, seeking, evaluating, selecting, and ultimately using the information to satisfy those needs. According to Wilson (2000, p.49), information behaviour covers all aspects of human behaviour related to information, including information seeking, searching, and use. Information seeking is defined as the purposeful search for information to meet an

information need (Wilson, 1999, p.552), while information searching is the interaction between the searcher and the information system (Wilson, 2000, p.49). Information use involves the assimilation of retrieved information into the knowledge base (Wilson, 2000, p.49).

According to Kakai et al. (2004), students engage in active and purposeful information-seeking behaviours, but their methods of seeking, retrieving, evaluating, and using information vary because of different levels of information literacy. Therefore, librarians are essential in assisting students to access relevant information from diverse sources and formats to complete academic assignments. Information literacy education not only equips students with skills to locate needed information but also embeds critical thinking skills and teaches them how to evaluate and use retrieved information effectively. In addition, academic libraries provide support to postgraduate students in conducting research, preserving research data, and facilitating scholarly communication.

Du Preez and Evans (2013) suggest that academic libraries should offer training programmes to improve users' information literacy skills and assist them in finding and using information resources. There is an increasing demand for assistance with e-resources and electronic information. Therefore, information literacy education is in high demand at most South African higher education institutions, as many undergraduate students come from underprivileged communities where there are no schools or public libraries. This results in a lack of library, digital, or information literacy skills. Thus, the library plays a significant role in exposing these students to library resources and teaching them how to find, access, and use information.

1.3 Problem statement

Despite the availability of information literacy education and the collaboration between academic libraries and teaching staff to provide support for students, some students still struggle to find and use relevant information for their academic tasks. Thus, as research shows, librarians play a crucial role in assisting students to identify their information needs and find appropriate resources. In particular, the researcher, who is an academic librarian working with mechanical engineering students, has observed that some students who attend information literacy training still approach her for all their information needs, from locating a book on the shelves to finding relevant journal articles in discipline databases.

In other words, the researcher has noticed that the current information literacy education programmes for mechanical engineering students do not train them to meet their academic information needs. Therefore, research needs to be conducted to understand what these programmes have missed in their understanding of the information behaviour of mechanical engineering when interacting with knowledge. The information of mechanical engineering students depends on their academic needs and includes and determines how they seek, retrieve, evaluate, and use the information to complete academic tasks. In addition, research into their information behaviour needs to discover the extent to which they are satisfied with library services offered and critically assess the role of the library in rendering an effective library service to these students.

1.4 Research objectives and questions

1.4.1 Primary research objective

The primary research objective of the study was to determine the information behaviour of mechanical engineering students

1.4.2 Secondary research objectives

To achieve the primary research objective, the following secondary research objectives were formulated to do the following:

- 1 Determine what motivated the mechanical engineering students in the study to seek information
- 2 Determine what types of information the mechanical engineering students in the study needed for academic purposes
- 3 Determine how the mechanical engineering students in the study located information to complete their academic tasks
- 4 Determine how the mechanical engineering students in the study evaluated the located information
- 5 Determine the differences in the information behaviour of the different year levels of students
- 6 Determine the role librarians can play to render an effective library service to mechanical engineering students

1.4.3 Primary research question

The primary research question was what was the information behaviour of the mechanical engineering students in the study?

1.4.4 Secondary research questions

To answer the primary research question, the following secondary research questions were derived from the secondary research objectives:

- 1 What motivated the mechanical engineering students in the study to seek information?
- 2 What types of information did the mechanical engineering students in the study need for academic purposes?
- 3 How did the mechanical engineering students in the study locate information to complete their academic tasks?
- 4 How did the mechanical engineering students in the study evaluate the located information?
- 5 What were the differences in the information behaviour of the different levels of students?
- 6 What role can librarians play to render an effective library service to mechanical engineering students?

1.5 Theoretical framework

Case (2007) defines theory as a set of interconnected statements that offer explanations, descriptions, or predictions for phenomena within a specific context. He notes that in the field of information behaviour, various theoretical frameworks have been developed, but there is no consensus on what constitutes a theory. Ikoja-Odongo and Mostert (2006) describe the theory as assumptions that explain a collection of observed facts or phenomena within a particular field of study. According to Robson and Robinson (2013), models are useful for describing and predicting phenomena, understanding them, and developing theories. Robson and Robinson (2013) maintain that numerous models have been developed in an attempt to describe information behaviour.

Ford (2015), Godbold (2006), and Wilson (1999) have provided critiques and comparative summaries of various information behaviour and, in particular, information-seeking behaviour models. After reviewing several models of information-seeking behaviour, the

researcher selected the Model of Information Seeking of Professionals (Leckie et al., 1996) as the most suitable for this study. This model was specifically developed to address professional information seeking, primarily for three professional groups: engineers, healthcare professionals, and lawyers. The Model of Information Seeking of Professionals consists of six components: work roles, associated tasks, characteristics of information needs, and three factors that affect information seeking: awareness, sources, and outcomes. Figure 1.1 presents Leckie et al.'s (1996) Model of Information Seeking of Professionals. The theoretical framework is discussed in detail in Chapter 3.

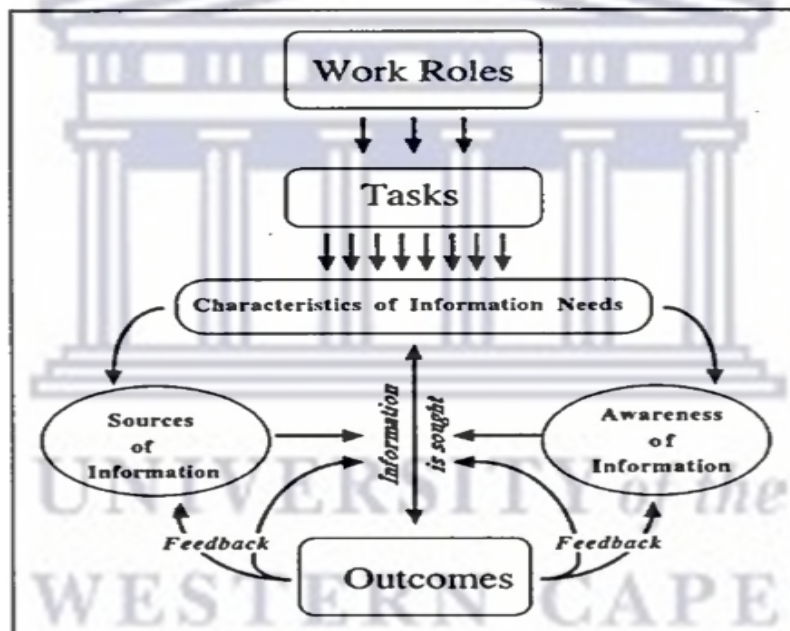


Figure 1.1 Model of Information-Seeking Behaviour of Professionals

Source: Leckie et al., 1996

1.6 Research design and methodology

Kumar (2005, p. 84) defines research design as a planned structure for obtaining answers to research questions and problems. A research paradigm or worldview, which can be positivist, constructivist, transformative or pragmatic, determines the research design and the research

methodology or strategies of inquiry, which can comprise qualitative, quantitative or mixed methods (Cresswell & Cresswell 2018). The study followed a constructivist research paradigm to investigate how research participants experienced the real world. It employed a sequential, explanatory, and mixed methods research design, which involved two methodological phases to collect first quantitative and then qualitative data.

The study population comprised 1349 mechanical engineering students registered for the ECP up to the fourth year in 2020 and two engineering subject librarians. A stratified random sampling method and a Raosoft sample size calculator were used to select a representative sample of 300 students with a 10% margin of error and a 99% level of confidence (Krejcie & Morgan 1970, p.608). The data collection methods used were web-based questionnaires, virtual interviews and document analysis. Policy documents and reference queries from the librarian's statistics records were sourced for the document analysis. Data were captured in Excel spreadsheets.

The research design and methodology are discussed in detail in Chapter 4.

1.7 Significance of the study

There is a dearth of research on the information behaviour of mechanical engineering students in South Africa. Therefore, the results of this study could be used to equip and prepare subject librarians to understand the information behaviour of engineering students. Furthermore, these findings might aid in the development of the engineering library resource collection and services to accommodate the information needs of these students.

1.8 Delimitation and limitations

The study focused on undergraduate mechanical engineering students and did not include postgraduate students, students from other engineering departments or tertiary institutions. Due to this delimitation and the low response rate resulting from the COVID-19 pandemic, the study's results cannot be generalised to all engineering students at all higher education institutions.

1.9 Ethical considerations

Throughout the study, the researcher adhered to the ethical guidelines set forth by the Research Committee of the University of the Western Cape (UWC). Ethical clearance to conduct the research was obtained from both the UWC (see Appendix A) and the institution of higher education where the study was conducted (see Appendix B). The researcher respected the rights of the participants at all times. Informed consent (see Appendix C) was obtained after participants were informed about the study (see Appendix D). Anonymity is maintained throughout the presentation of findings in this thesis, with no participant names mentioned. Participation in the project was voluntary, and participants were free to withdraw at any stage of the research process.

1.10 Definitions of key concepts

The key concepts used in the study are defined in this section.

1.10.1 Information behaviour

Information behaviour, as defined by Wilson (2000), encompasses the complete range of human behaviour in interacting with information from various sources and channels,

including information-seeking behaviour. Students vary in their approach to seeking information and often use different sources based on their personal preferences.

1.10.2 Information Needs

Miranda and Tarapanoff (2008) define information need as a state or process in which an individual becomes aware of or perceives a gap between the information and knowledge available and the information and knowledge required to solve a problem or achieve a desired outcome. In the context of students, when they are assigned a project or task, they often realise that they need additional information to complete it. However, information need is not limited to academic contexts; it is also important for everyday life situations, such as purchasing a house or car, where information is required to make informed decisions.

1.10.3 Information literacy

Jiyane and Onyancha (2010) define information literacy (IL) according to the UNESCO definition, which involves recognising information needs, locating and evaluating the quality of information, storing and retrieving information, making effective and ethical use of information, and applying the information to create and communicate knowledge. Talikka et al. (2018) contend that students seek information to find answers to their research problems but often lack knowledge of how to search for information and the skills to evaluate and interpret data. As a result, information literacy has become an essential part of higher education curricula to equip students with the necessary skills for finding and evaluating information.

1.11 Chapter outline

The chapter outline for the thesis is as follows:

Chapter 1 introduces the study, explains the rationale and defines the key concepts.

Chapter 3 discusses the theoretical framework of the study.

Chapter 2 discusses and critically analyses existing research and professional literature on the information behaviour of engineering students and the role of librarians in meeting their information needs.

Chapter 4 explains the research design and methodology followed in the study.

Chapter 5 presents the results and findings of the data analysis

Chapter 6 interprets and discusses the research results and findings.

Chapter 7 concludes the study by answering the research questions, drawing conclusions and making recommendations.

1.12 Chapter summary

The chapter introduced the study by explaining the rationale behind the project, identifying the research problem, stating the research objectives, and listing the research questions. The chapter briefly introduced the theoretical theory underpinning the study and provided a brief overview of the research design and methodology employed. To obtain a clear understanding of the conceptual terms, the main keywords used in the study were defined.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Brynard et al. (2014) and Arshed and Danson (2015) argue that reviewing the literature is essential for researchers to provide an overview of a particular topic, to gain an understanding of the literature before shaping an argument, to explain relevant concepts, to identify existing research and prevent duplication, to identify research gaps related to the topic, and to position the planned research study within the larger field of study.

Numerous studies have explored the information behaviour of students in higher education institutions at both national and international levels (Howlader & Islam, 2019; Doraswamy, 2013; Dlamini, 2014; Chinnasamy, 2016; Baro & Osaheni, 2010). However, there is a dearth of research on the information behaviour of South African engineering students in particular. This chapter aims to provide a comprehensive overview of previous research on the information behaviour of students in general, as well as engineering students specifically, within both national and international contexts. In addition, this chapter includes a discussion of information literacy education, the roles of academic libraries and librarians, the impact of the COVID-19 pandemic on students' information behaviour and the evolving role of academic libraries, as the data collection for this study was carried out during the peak of the pandemic when students did not have access to physical library resources.

2.2 Information behaviour

Kakai et al. (2004) defined information behaviour as a basic activity people engage in, manifested through particular behaviours when interacting with information. Spink and

Heinström (2011) developed an information behaviour paradigm that defines information behaviour as follows:

- A complex phenomenon that involves interactive and innate dimensions shaped by both culture and environment. The interaction between people and the environment plays a crucial role in shaping their information behaviour
- Influenced by both smaller and larger perspectives, which encompass individual factors, societal norms, and cultural values
- Occurs in various contexts, including leisure, and is a response to different needs, including effective ones
- Influenced by individual differences, such as personal preferences, prior knowledge, and cognitive abilities

Nadzir et al. (2015, p.48) define information-seeking behaviour, which is part of information behaviour in general, as the process individuals use to identify their information needs, and search for and use the information found to support their work.

2.3 Information behaviour of students

In 2014, Lacovic conducted a review of various studies conducted in different countries focusing on student information behaviour. The review highlighted the students' information needs, the sources of information they used, their library literacy, and the role of the library. The review concluded that the majority of students required information for academic purposes and relied on books, journal articles, and online sources for retrieving information. Additionally, students received guidance from their lecturers, peers, and librarians.

After conducting a study on information-seeking behaviour, a subset of information behaviour, at the State University of Zanzibar, El Maamiry (2016) discusses the impact of information technology on students and argues that due to their exposure to the internet and social media, such as Twitter, Facebook and blogs, undergraduate students may believe that they can complete academic work by relying solely on these platforms. This shift in information behaviour aligns with the discussion on information behaviour by Karlova and Fisher (2013), who warned about the spread of misinformation and disinformation and emphasised the need for information literacy to establish the credibility of information and to verify and evaluate information obtained through social media. Similar findings were reported by Ali et al. (2010), whose study conducted at a Malaysian College found that engineering students lacked skills, including the ability to evaluate information on the Internet and use information ethically.

In 2015, Nadzir et al. conducted a preliminary study on the information-seeking behaviour and needs of undergraduate students at a higher learning institution in Malaysia. The study aimed to identify how students seek information to fulfil their needs. A survey questionnaire was distributed to final-year students from two IT-related programmes, and 39 completed questionnaires were collected. The study found that students mostly needed information about development tools for their research projects and that they commonly used the Google search engine, with some preferring to use e-resources.

Kakai et al. (2004) conducted a cross-sectional survey with 104 undergraduate students from two different departments at Makerere University to improve their information-seeking behaviour and promote the utilisation of expensive library information resources. The findings showed that 97.1% of students used textbooks to complete their academic work. In

contrast, Steinerova and Susol (2005) conducted a study on information behaviour in the electronic environment and found that users preferred easily accessible and well-arranged information sources and frequently looked for new ideas to extend their knowledge.

Similar findings were reported by Daniels (2018) who studied first-year undergraduate students at the University for the Creative Arts in Canterbury. The study revealed that despite the library offering high-quality resources, students still preferred the immediacy and currency of information offered by other platforms, such as search engines, social media, and websites (Daniels, 2018, p. 147).

Meirose and Lian (2019) conducted a study on the interaction of first-year medical students at Mercer University School of Medicine, Macon, USA with EBSCO discovery services. The study revealed that students experienced difficulties in retrieving relevant full-text e-books and peer-reviewed journal articles due to confusion when formulating search terms and refining searches.

In their study, Kadir et al. (2018) compared the information needs and sources used by 274 students at SEGi University Library in Malaysia. They analysed the types of information sought, user awareness, and training provided by the library. The study found bivariate linear relationships between information needs and all the variables examined. The authors emphasised the importance of technological skills for students and recommended that the library provide regular training to create better awareness of its resources, e-resources, and services.

In 2006, Karim et al. highlighted students' willingness to use mobile devices to access library services. Lippincott (2010) examined the impact of mobile devices on future academic library services and found that students owned a variety of devices, but some faced difficulties due

to a lack of digital literacy and limited Internet connectivity. Lippincott (2010) concluded that keeping up with changes was challenging, but mobile access was significant for educational institutions if free access to information could be provided. Chaputula and Matula (2018) found that 88.1% of students in Malawi used their smartphones to access library services such as e-books, e-journals, websites, and the library catalogue. Johnson and Howard (2019) conducted a study focusing on medical students, which confirmed the usage of mobile technology by educators and librarians in medical education.

El Maamiry (2016) argues that self-efficacy, which refers to an individual's belief in their ability to perform a specific task and is closely related to self-confidence and self-esteem, influences their information behaviour. El Maamiry (2016) conducted an online questionnaire survey involving 180 registered students from the Departments of Natural Science, Computer Science, and Information Technology at the State University of Zanzibar to investigate the four sources of self-efficacy, namely past performance, experiences of observing others, social feedback, and emotional state. The findings suggested that the devices used by students as well as the development of information technology raised self-efficacy.

These findings aligned with the results of a study conducted by Tang and Tseng (2017) at Jacksonville State University in Alabama, USA, which investigated undergraduate student information self-efficacy. The study aimed to determine whether information-seeking skills can be developed with library instruction and the role of library intervention. Results from a web-based survey completed by 98 undergraduate students enrolled in 2014 reflected high skills in information evaluation, but low skills in using the library catalogue and/or databases as well as organising information. Students exposed to multiple library instructions showed higher information-seeking skills and self-efficacy compared to students attending a single

library instruction session. This study supported the finding by Kadir et al. (2018) that library training is needed to improve information-seeking skills.

Following an analysis of 339 questionnaires on the information-seeking behaviour of undergraduate students at Dhaka University in Bangladesh, Howlader and Islam (2019) discovered that most students relied on class lectures for academic work and used the library only for job-related information. As a result, they needed academic semester-related information to complete assessment tasks, such as projects, assignments, and examinations. To satisfy their needs, the students used various information sources, with the majority relying on social media, followed by group discussions. The study concluded that undergraduate students had poor information-seeking skills and were unaware of the library resources available to them.

Other researchers have investigated the sources used in students' information-seeking behaviour, including El Maamiry (2016) and Lacovic (2014), who found that many students depended on social media, class notes, lecturers, peers, and librarians to complete their academic work. All three studies concluded that student information-seeking behaviour depended on the sources they believed contained the information they needed. Additionally, Connaway and Valenza (2021) confirmed that Wikipedia is a popular starting point in the information-seeking process.

Komissarov and Murray (2016) conducted a survey of undergraduate students at the University of Wisconsin-La Crosse to understand their information-seeking behaviour, from start to finish, and identify factors that influence it. The study examined variables, such as academic characteristics, demographics, and instructions received. The results indicated that

students highly value e-resources, such as library subscription databases, the library catalogue, and the library website.

Dlamini (2014) conducted a South African study at the University of the Western Cape to examine the everyday life information-seeking behaviour of Generation Y students. The study aimed to determine both their academic and non-academic information needs to gain a holistic understanding. The findings from questionnaires and interviews revealed that most students used smartphones to access information, had social media accounts, acknowledged their full dependence on the Internet for academic and non-academic information needs, and only occasionally or never verified the trustworthiness of information sources used.

2.3.1 Information behaviour of engineering students

Engineering students have unique information needs compared to other undergraduate students. They need to find relevant discipline and subject-specific information from reliable sources to complete academic assessment tasks and prepare for examinations. Moreover, as practising engineers, they will frequently require information to solve the problems encountered in their working environment. Therefore, engineering students need to develop effective information-seeking behaviour as part of their general information behaviour to obtain the exact and required information to complete their academic and professional tasks.

2.3.2 Information needs of engineering students

After investigating the information needs and the role of academic libraries in providing information to engineering students, Lakshmi et al. (2011) and Doraswamy (2013) concluded that students require ready access to core academic information, research materials, and examination resources daily. This finding is supported by the case study conducted by

Chinnasamy (2016, p. 139) at Madurai Kamaraj University, which found that the majority (56%) of engineering students use the library to prepare for examinations.

In a similar vein, Qin et al. (2020) explored the information needs and information-seeking behaviour of a new generation of engineering designers. Their survey-based approach revealed that the information needs of engineering designers develop throughout a project and that they require assistance at different levels. Additionally, the study found that engineering designers need "know-why" knowledge to help them complete design tasks and that newly developed technologies have influenced their information-seeking practices.

A recent study conducted by Hagiwara et al. (2022) examined the search skills of 40 engineering master's students in Japan. The study revealed that owing to their lack of experience, the students had difficulty using various resources and applying search results effectively in different situations. Similarly, Majid and Tan (2002) investigated the information needs and information-seeking behaviour of computer engineering undergraduate students at Nanyang Technological University in Singapore. The study aimed to determine the types of information sources students used, as well as the formats and preferences for information. The results of 102 randomly distributed questionnaires indicated that students consulted resources, such as books, manuals, lecture notes, and the internet, as well as friends.

These findings aligned with those of a study conducted by Oyadeyi (2014), which examined the information needs and information-seeking behaviour of 89 first and third-year undergraduate engineering students at the Ondo State University of Science and Technology in Nigeria. The results revealed that students' information needs, and information-seeking behaviour were influenced by their coursework, assignments, seminars, and examinations and that they preferred to use a variety of sources, including the Internet, lecture notes and

handouts, and books. In contrast, a study by Arumugam et al. (2015, p. 469) found that the majority of users at engineering college libraries in Chennai, India relied on the library for information that was not available elsewhere. Specifically, these users made frequent use of subject-related textbooks and reference materials.

Hussain and Ahmad (2014) and Patel and Chaudhari (2017) found that engineering students primarily visited the library to borrow books and read newspapers and magazines. Journals were the main formal information source, with textbooks being less frequently used. Informal sources included conferences, seminars, symposia, and workshops. Reddy and Reddy (2019) found that most students visited the library two to three times a week, mainly for checking emails and accessing e-resources, exam preparation, reading newspapers and magazines, borrowing or returning books, and reading books and reference materials. In their study, Poongodi and Sarangapani (2019) found that students primarily visited the library to find information for project work and assignments.

Dumebi (2017) conducted a study to investigate the awareness and use of online information sources amongst undergraduate students at the University of Ibadan. The researcher administered a questionnaire to 300 students and found that while 97.7% of students were aware of online information sources, very few were familiar with the specific online sources available at the university. This finding was consistent with those of Ramaiah and Shimray (2018) at the Muffakham Jah College of Engineering and Technology Library in Hyderabad, India.

Ramaiah and Shimray (2018) used a survey method with questionnaires to collect data on the information needs and information-seeking habits of engineering students and found that students mainly needed information for academic purposes, preferred printed resources, and

required training in the use of e-information. In addition, Ramaiah and Shimray (2018) found that 93.33% of the students did not have difficulty accessing information from available resources. In contrast, Chinnasamy (2016, p.139) found that amongst 300 engineering students at Madurai Kamaraj University, 38% used printed library material, 20% used e-resources, and 24% used both printed and e-resources.

Ansari and Kumar (2010) conducted a study to examine the information needs and information-seeking behaviour of 340 engineering and technology faculty members at the Institutes and Colleges of Uttar Pradesh in India. The study aimed to determine the reasons for information needs, the types of information channels used, and the extent to which library and information services were utilised. The results showed that faculty members had different approaches to information seeking and used different information sources. The top reasons for seeking information were general awareness (64.61%), preparing for lectures (55.38%), and attending conferences and seminars (53.84%). Textbooks were the most used formal information source (92.30%), followed by research reports (67.69%), yearbooks (55.38%), and encyclopaedias (50.76%). Discussions with colleagues (81.53%) and attending conferences (63.07%) were also important sources of information. The study revealed that there were differences in information needs and preferred sources between engineering and technology faculty members.

In a study conducted by Du Preez and Fourie (2009) in South Africa, the Model of Information Seeking of Professionals (Leckie et al., 1996) was applied to investigate the information-seeking behaviour of consulting engineers. The study revealed that the participants did not have formally organised information services, such as libraries available in their companies.

Instead, they relied heavily on their colleagues and other people, personal files, and personal knowledge and experience to obtain information.

Khan and Ahmed (2016) collected data from 177 engineering students in Pakistan on the usage and impact of digital library resources, resulting in changes in the provision of information sources by university libraries. Jayanthi and Saravanan (2013, p. 74) investigated the use of e-resources by engineering students in the Kanchipuram District and found that e-journals (28.16%), emails and discussion groups (21.76%), and online databases (10.64%) were the most used e-resources.

In 2019, three similar studies on the utilisation of e-resources by engineering students in India were conducted by Ganapathy and Jayabal (2019), Reddy and Reddy (2019), and Poongodi and Sarangapani (2019). Ganapathy and Jayabal (2019) found, based on data from 250 engineering students in private engineering colleges in Coimbatore, that the major e-resources used were e-books (72%), e-journals (70%), and e-theses (64%). Reddy and Reddy (2019, p.183) used 500 students registered at the Acharya Nagarjuna University Engineering College as participants and concluded that the most used library e-resources were e-books (36%), e-lecture videos (35.6%), e-news (25.6%), and e-images (22%). Poongodi and Sarangapani (2019) used questionnaire data retrieved from 182 students from engineering colleges in the Kanchipuram district and reported that the most used e-resources were databases (42%), e-journals (37%), and e-books (13%).

Singh (2021), Reddy and Reddy (2019), and Jayanthi and Saravanan (2013) reported gender differences in resource usage. Singh (2021) found that female students used Web 2.0 applications more frequently, while Reddy and Reddy (2019, p. 184) and Jayanthi and

Saravanan (2013, p. 75) reported that female engineering students expressed higher satisfaction with e-resource facilities.

2.4 Online resources

The development of information and communication technology (ICT) has made information available in various digital formats and on different digital platforms. However, according to Reddy and Reddy (2019, p. 184) and Poongodi and Sarangapani (2019, p. 77), power cuts, slow response time, limited Internet access, and lack of skills are barriers to effective utilisation of online resources.

The use of the Internet for academic purposes is hindered by other factors, according to recent studies. For example, Apuke and Iyendo (2018) found that a lack of digital readiness of staff and the absence of scientific databases hampered the use of the Internet for academic purposes amongst 250 undergraduate students in three universities within North-Eastern Nigeria. Because of inadequate Internet facilities in universities, students had to rely on their smartphones to access the Internet through subscriptions and mainly used Google or Yahoo and Open Access journals to find the required information. Similarly, Zafrunnisha and Nagaraju (2017) revealed that despite the portability of mobile phones, slow downloading was perceived as a barrier by students of JNTUA College of Engineering.

2.4.1 Online resources and engineering students

A recent study by Singh (2021) shows that college-level engineering students have significant knowledge of Web 2.0 applications such as Gmail, Google Drive, and social networking. They use these applications to interact and share scholarly information. However, Ali et al. (2010) found that diploma-level engineering students at a Malaysian college lacked the necessary

knowledge and skills to evaluate information from the Internet, formulate search strategies, and use scholarly e-resources.

Salarian et al. (2012) discovered a linear relationship between cognitive style and information seeking whereby postgraduate engineering students at the University of Technology in Malaysia adapted their interactions with the Internet according to their preferences and specific needs. This trend is also reflected in the studies by Patel and Chaudhari (2017) and Dommermuth and Roberts (2022). Patel and Chaudhari (2017) found that engineering students at a college in Gandhinagar, India used the Internet to download course programmes, prepare for research work, access e-journals and e-books, communicate, and for entertainment purposes. Dommermuth and Roberts (2022) reported that undergraduate students at the University of Colorado Boulder used the Internet to find information quickly and significantly relied on social networks for information for assignments, projects, and college life.

2.5 Information literacy skills of engineering students

A study conducted by Ali et al. (2009) aimed to identify the strengths and weaknesses of engineering students' information literacy skills and the mistakes made while searching for information. As indicated earlier (see 1.11.3), information literacy is the ability to identify, locate, evaluate, organise, and effectively use information from a variety of sources. It involves critical thinking, problem-solving, and communication skills, as well as the ability to use technology to access and manage information.

The results of Ali et al.'s (2009) study showed that students lacked skills in constructing efficient search strategies, evaluating the information on the internet, and using information

ethically. Similarly, Gowri and Padma (2018) found that engineering students struggled with combining existing information with the original concept, using new tools, identifying controlled vocabularies, identifying when the information need has been met, and critically evaluating findings.

Liu (2021) reported that information literacy sessions for international engineering students significantly improved their ability to search and locate information, but further sessions were needed for identifying and evaluating information. On the other hand, Dommermuth and Roberts (2022) found that information literacy education enabled first-generation engineering students to use discipline-specific practices to retrieve and evaluate information.

Talikka et al. (2018) found that information literacy education resulted in Finnish undergraduate engineering students being able to describe interdisciplinary research problems, develop advanced information search questions, and understand the principle of information use. Koler-Povh and Turk (2020) found that students exposed to an introductory course covering information literacy increased their competence and cited more references.

MacKenzie (2020) compared the information literacy of engineering students and professionals and concluded that academic libraries should focus on preparing students for post-university careers to prepare them for professional challenges and information retrieval and use outside the academic environment.

2.6 Library use

Research studies have consistently shown that undergraduate students, including those in engineering, are often unaware of the resources and services offered by academic libraries, resulting in ineffective use of these facilities. Moore and Singley (2019) found that doctoral

students heavily relied on interpersonal interactions to discover resources. In contrast, Lakshmi et al. (2011) suggested that libraries play a crucial role in providing relevant information, especially electronic resources, to the right people at the right time. Several studies have been conducted to examine library usage and satisfaction levels amongst engineering students, including those using the Muffakham Jah College of Engineering and Technology Library, with results indicating satisfaction with library collections, circulation services, and reference services (Ramaiah & Shimray, 2018).

Other studies, however, such as the investigation by Chinnasamy (2016) of 300 engineering college students at Madurai Kamaraj University and the one by Busayo and Akinyede (2020) on 177 agricultural and engineering students at the Federal University in Nigeria, have revealed dissatisfaction with library services, including opening hours, seating capacity, collection relevance and currency, and reading environment. Gudi and Paradkar (2019) found that undergraduate and postgraduate engineering students in Pune City visited the library only once a week for an hour on average, primarily to study, issue/return books, consult reference books, or read newspapers.

Several scholars have made suggestions to enhance library usage. Patra (2016), Manjula (2017), and Ramaiah and Shimray (2018) recommend regular library training programmes for students to increase awareness of resources and services. Salarian et al. (2012) suggest designing user profiles based on cognitive behaviour to meet students' information needs. Kerins et al. (2004) conclude that librarians should actively participate in developing students' information literacy by guiding on changing information needs, search techniques, and information sources. Bauer (2018) recommends that faculty members and librarians should

collaborate to increase the visibility of academic librarians, promote subject-specific resources and services, and develop effective web search skills.

2.7 Information behaviour of students during COVID-19

In March 2020, academic libraries began to face challenges because of the closure of physical libraries, resulting in the need for digital services, which led to many studies. For example, Mehta and Wang (2020) reported on challenges, such as students having financial difficulties and struggling to access academic information with minimal assistance. Zhou (2022) compared measures taken by Chinese and Italian academic libraries during the lockdown, with respondents reporting positive learning remotely. Huang et al. (2021) investigated the information needs and the information-seeking behaviour of 400 college students, with most seeking the latest COVID-19-related information for personal protection.

Amiri et al. (2022) found that COVID-19 news was mostly obtained through social media platforms but acknowledged that these platforms mostly contained rumours. Omeluzor et al. (2022) investigated COVID-19 information dissemination and the information needs of librarians in Nigerian universities. Nelson and Tugwell (2022) investigated the information-seeking behaviour of Caribbean university students, with undergraduate students not changing their information-seeking patterns, and postgraduate students using a variety of library information sources but experiencing challenges in seeking information.

Olaimat et al. (2021) conducted a cross-sectional study to assess the knowledge of COVID-19-related issues and information sources amongst 2,083 undergraduate and postgraduate students at Jordanian universities. Medical science students had higher knowledge scores, and the Internet, social media, and mass media were the primary information sources for undergraduates, while postgraduates mostly accessed scientific websites and articles. Bak et

al. (2022) also conducted a cross-sectional study amongst university students in Denmark and found that 59.9% of the students were sufficiently digitally literate, but many relied on social media for information needs, and 28.1% found it difficult to judge the quality and reliability of retrieved information.

A literature review conducted by Mseleku (2020) examined the effects of e-learning and e-teaching during the COVID-19 pandemic. The author identified various challenges faced by students, such as difficulties accessing and using online learning and teaching tools, as well as adjusting to online learning, especially for those from low-income families or rural areas. Mental health issues such as stress, depression, and anxiety were also associated with the transition to online learning.

2.8 Information literacy education in tertiary institutions

The researcher has noticed that engineering students often face information overload when they start attending lectures at institutions of higher learning. These students may not know how to begin searching for information or which sources to use for their assignments. Many come from disadvantaged backgrounds where they lack access to school or public libraries, leading to lower levels of library literacy. This indicates the need for information literacy education.

2.8.1 Development of information literacy education

Freeman and Lynd-Balta (2010) argue that information literacy education is crucial for all students, particularly those from disadvantaged communities, to become independent information seekers and to prepare for their future careers. The American Library Association (ALA) defines Information literacy as the set of integrated abilities encompassing the

reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning (ACRL, 2016). The ALA developed a model programme and published guidelines to identify best practices for information literacy education. The Information Literacy Framework (ACRL, 2016) was developed to address the changing environment and information ecosystem in higher education. The framework allows students to create new knowledge and understand the changing dynamics of the world's information.

To ensure uniform training efforts, standards and learning outcomes in information literacy education, the framework for information literacy for higher education was developed (ACRL, 2016,). However, different formats of information literacy education programmes with varying contents were developed in higher education institutions, and new developments, technology, and literacies, such as health and media information literacy, must be incorporated into existing courses (Levin-Zamir and Bertschi, 2018). Additionally, discipline-specific information literacy, such as information literacy for engineers, is needed.

2.8.2 General information literacy initiatives

Academic libraries must establish and enforce information literacy policies and standards to guide their education programmes, as stated by the ALA (2000). To assess the effectiveness of these programmes, regular evaluations are necessary.

Studies conducted by Tshuma and Chigada (2018) and Baro et al. (2013) assessed information literacy practices at universities in different countries and found that while librarians acknowledged the importance of information literacy, there were no policies in place,

resulting in inconsistent teaching methods and programme implementation. Challenges, such as a lack of technology and training for librarians, were also identified.

Studies conducted by Wilkes et al. (2015) and Ali et al. (2010) emphasised the importance of information literacy for engineering students and the need for information literacy assessments and initiatives to address gaps in students' knowledge and skills.

To promote a campus-wide culture of information literacy, Owusu-Ansah (2004) and Rockman (2004) suggest integrating information literacy into the core higher education curriculum. Onhwakpor (2013) recommends collaboration between librarians and faculty members and continuous training for academic librarians to teach information literacy skills to are studying remotely, often through online courses, without being physically present on campus.

2.7.3 Information literacy initiatives in South Africa

Jiyane and Oyancha (2010) contend that information literacy should be a critical subject taught in schools and would be an effective means of developing information literacy skills in South African higher education institutions. In South Africa, information literacy programmes should aim to improve learners' ability to access, select, and utilise resources effectively, especially first-year students. However, limited budgets, staff shortages, and inadequate computer training facilities pose significant challenges. Moreover, students who are not computer literate or do not take the information literacy programme seriously, and those who do not register for programmes, contribute to librarians' inability to reach all students.

Somi and De Jager (2005) stress the importance of providing orientation, especially to first-year students, at the Fort Hare University Library, introducing them to library services. At the

University of the Western Cape, a credit-bearing information literacy module was introduced after discovering that first-year students, especially those from disadvantaged areas without schools or public libraries, struggle to find information for academic purposes (King, 2007).

Chisango (2012) investigated the effectiveness of information literacy interventions for first-year business students at Rosebank College in Cape Town. The interventions included general orientation, intensive workshops on library tools, such as the Online Public Access Catalogue (OPAC) and other online databases, referencing and plagiarism, and discipline-specific training focusing on the identification and use of subject resources. The findings indicated that stand-alone information literacy initiatives were ineffective because students did not perceive the importance of attending the course when they did not receive marks or credits.

Moyo and Mavodza (2016) compared the provision of information literacy skills to undergraduate and postgraduate students in South Africa and the United Arab Emirates. The study confirmed that many South African students need information literacy education owing to underdeveloped education and little access to technologies and libraries.

Dauids (2009) studied the effectiveness of an information literacy intervention for first-year mechanical engineering students at the Cape Peninsula University of Technology (CPUT). The intervention was quite effective, but shortcomings were identified, including the limited time allocated to the workshops and no follow-up to assess longer-term benefits. In addition, Lockhart (2011) articulated the challenges and opportunities presented in developing an Information Literacy Policy for CPUT, enabling a credit-bearing module integrated into the curriculum for all undergraduate programmes.

Dauids and Omar (2018) evaluated the effectiveness of a certificate-based information literacy programme at CPUT, assessing whether it improved students' academic performance, the collaboration between the library and lecturers, and how librarians and lecturers evaluated the programme. The study was limited to two faculties and students in their first year or the ECP. Findings indicated that the information literacy programme was effective in improving academic performance, but concerns were raised about the lack of interest amongst students, fluctuating attendance, incomplete modules, and low completion of assessments.

Bharuthram, Muhamed & Louw (2019) emphasized the value of information literacy in higher education institutions. Their study's objective was to discuss the intervention at the University of the Western Cape (UWC) in incorporating information literacy abilities in academic literacy courses. The value of partnerships between academic librarians and lecturers during interventions to achieve academic literacy skills was emphasised. The study's findings indicated that the collaboration between academics and librarians can be fruitful, but that institutional resources like computer laboratories may play a role in the initiative's success. In a later study, Mohamed (2020) worked with a lecturer in the Faculty of Economic Management Sciences at UWC to decipher specific disciplinary challenges and improve the information literacy practices for student learning. This qualitative study used the Decoding the Disciplines Paradigm to recognize and break down some challenging ideas in the Business and Finance modules. According to the study's findings, certain information literacy skills need to be improved or developed in classroom instruction.

To assess the effectiveness of the Decoding the Disciplines paradigm in helping students build disciplinary habits of mind, Mohamed and Bayat (2022) conducted a comprehensive

assessment of the literature. They searched several databases between 2004 and 2020 and found 500 articles from nine databases. Based on title and abstract screening, 33 papers were selected for analysis to demonstrate how Decoding the Disciplines paradigm influences students' ability to think like experts.

2.9 Role of academic libraries

Liman et al. (2017) conducted a literature review of 118 publications on the skills, abilities, and competencies needed by academic librarians in a world dominated by the Internet. They found that librarians in developed countries need to have knowledge of and abilities in technology to provide innovative library services. Silas and Greenidge (2020) reviewed literature spanning 20 years on librarians connecting online with university off-campus students and found that most distance-learning students are unaware of the library resources and services, preferring to use other information sources before consulting librarians.

While the teaching role of librarians has been questioned, scholars like Bundy (1999) argue that librarians are most familiar with information literacy issues, can share their expertise, and are experienced in accomplishing information literacy goals. Librarians should, therefore, be actively responsible for information literacy teaching or at least some aspects of it. Collaboration between librarians and academics is necessary to integrate information literacy programmes across the academic curriculum.

These could serve as a foundation for academics to develop and apply discipline-specific skills. In addition to offering formal information literacy education, faculty librarians would play an important role in assisting students' information needs. The COVID-19 pandemic forced academic libraries to provide online information literacy training, which presented new challenges.

Soltani and Nikou (2020) found that international students have a very low level of information literacy skills compared to domestic students at Finnish universities. A case study by Becker et al. (2021) revealed that academic librarians successfully used LibGuides, a web-based content management and information-sharing system designed specifically for libraries, to provide online services during the pandemic. However, students had problems accessing them due to a lack of data and connectivity. Martzoukou (2020) argues that the pandemic made online learning the "new normal" in higher education institutions but identified challenges such as remote tool implementation, accessibility, and equity for all students.

Ashiq et al. (2022) conducted a systematic review of relevant literature on academic library services during COVID-19 and concluded that the pandemic was effective in transforming libraries and their services. Alabi and Sani (2021) found that librarians assisted users in solving their queries, provided current awareness services, and delivered electronic information via social media platforms, library websites, and emails during the pandemic.

Adomi and Oyovwe-Tinuoye (2020) conducted a study in Nigeria, using an online survey administered via WhatsApp to examine the information needs, seeking, use and evaluation during COVID-19 amongst 167 library professionals. The data revealed that the main information needs of the participants were related to the causes, symptoms, test procedures, transmission mechanisms, treatments, and vaccines of COVID-19, as well as the provision of library services during and after the pandemic.

2.10 Chapter summary

In this chapter, several studies on the information behaviour of students, particularly engineering students in higher education, as well as information literacy education and the role of academic libraries were reviewed. The studies showed the following:

- Engineering students tend to use general search engines like Google as a starting point for information seeking.
- They often use mobile devices to access and retrieve information.
- They typically accept information at face value without evaluating it critically.
- They require subject-specific information for their studies.
- Many are not aware of the resources and services provided by academic libraries.
- They are not library literate and therefore require assistance from librarians.
- They often need help from librarians for academic-related assessments.
- There is a need for information literacy education amongst engineering students.
- Many do not recognise the value of information literacy education.

Therefore, academic librarians should play an active role in assisting students and developing their information literacy skills. Knowledge of the information behaviour of undergraduate students can help librarians to provide effective information literacy education and support their academic needs.

The next chapter will discuss the theoretical grounding of the study.

CHAPTER 3

THEORETICAL GROUNDING

3.1 Introduction

The previous chapter provided an overview of relevant literature on the information behaviour and information literacy education of undergraduate students in higher education institutions. It also reviewed studies on the role of academic libraries in providing information literacy education and assisting students with academic information needs.

The purpose of this chapter is to present an overview of information behaviour theories and models and to provide a critical discussion of the model that underpins the study.

3.2 Information behaviour models

Gard (2016) defines a model as a framework for problem-solving that can evolve into a statement of relationships amongst theoretical propositions. According to Kundu (2017), not all information behaviour models developed by scientists apply to all user groups. However, most information-seeking behaviour models describe the process of information-seeking in general and attempt to explain the causes and relationships amongst the stages of information-seeking behaviour. Nevertheless, some models reflect the information-seeking process in different ways and predict how different types of users, from students to career professionals, behave. This chapter provides a brief discussion of relevant information behaviour models to contextualise the models chosen to frame the current study.

3.2.1 Wilson's models of information behaviour

Wilson's (1981) model, as discussed by Wilson (1999), posits that an information need serves as a motivation for an individual to seek information. However, the way individuals seek information varies, as they use different resources and retrieval methods to obtain the required information. Wilson also suggested that part of information-seeking behaviour may involve interaction with other people through information exchange. In the context of engineering students, this could manifest as students seeking information from their peers, instructors, or librarians. Figure 3.1 below illustrates Wilson's (1981) model.

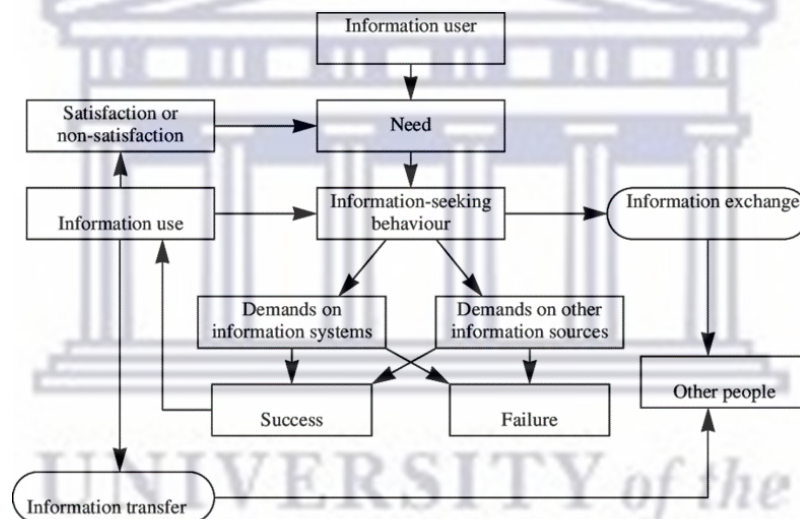


Figure 3.1: Wilson's (1981) model of information behaviour

Source: Wilson, 1999

Wilson revised his 1981 model in 1996 to illustrate the various cycles of information activities that occur and arise from information needs during the process of information seeking and use (Kundu, 2017). He identified four types of information seeking, including active search whereby the user actively searches for specific information. The model also considered the variables that affect information needs and how these needs motivate an individual's perception of need. In addition, the model included the factors that influence the individual's

response to the perception of his/her needs and the processes and actions involved in satisfying them. Wilson's (1996) revised model is illustrated in Figure 3.2 below:

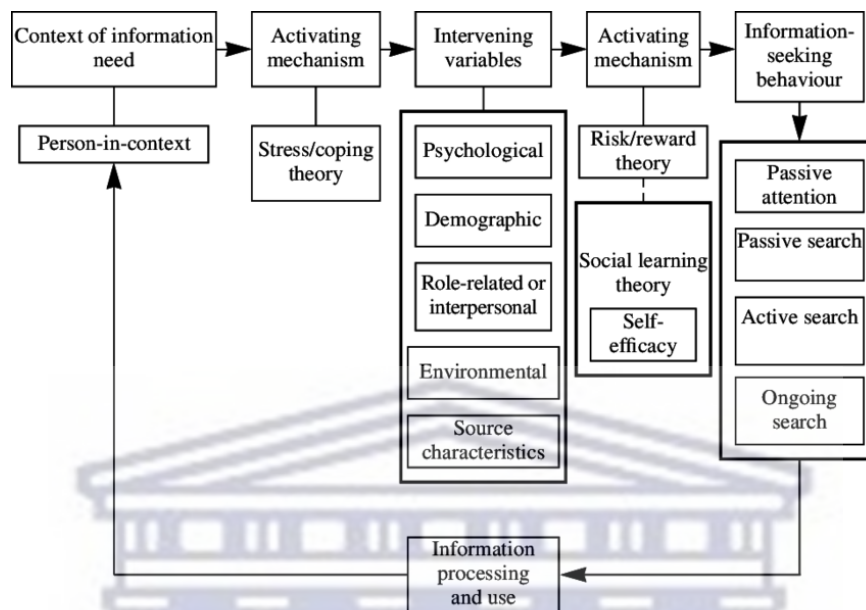


Figure.3.2: Wilson's (1996) Model of Information Behaviour

Source: Kundu, 2017

Wilson's (1999) Macro or Nested Model explores why some information needs are more pressing than others, why certain sources of information are preferred, and how users' beliefs about their competencies impact their success in meeting their information needs. This model emphasises the importance of user feedback and the interactive nature of information seeking. For engineering students, providing feedback to librarians about the relevance of recommended information sources is crucial. This information can guide librarians in saving relevant information for future use by other students with similar requests. The model is depicted in Figure 3.4 below.

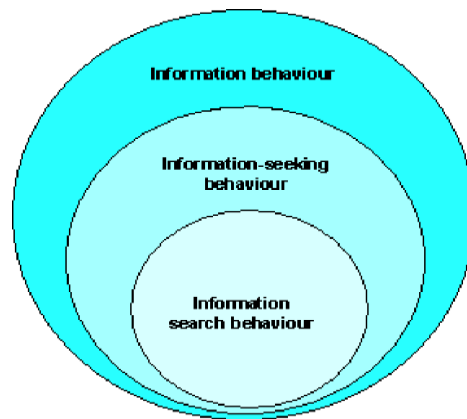


Figure 3.3: Wilson's (1999) Macro or Nested Model of Information Behaviour

Source: Wilson, 1999

3.2.2 Dervin's (1983) Sense-Making Model

Dervin's (1983) Sense-making Model proposes that a person's encounter with a situation or problem triggers an information-seeking process whereby they become aware of a gap in their knowledge or information needs that must be fulfilled. The information used to fill the gap must be comprehensible to the individual to bridge the gap. This bridge refers to any means of sense-making that is used to connect the current situation with the desired outcome to move towards a goal.

Once the required information is gathered, it is evaluated to identify whether any more gaps exist. While the model was originally designed for studying information-seeking needs from a communication perspective, it has since evolved into a more generalised communication-based model that is useful for studying human sense-making (and sense-unmaking) in any context. The model comprises four major elements: the situation (information problem), the outcome (analysing information needs), the gap (information needs), and the bridge (retrieved information), as shown in Figure 3.4 below.

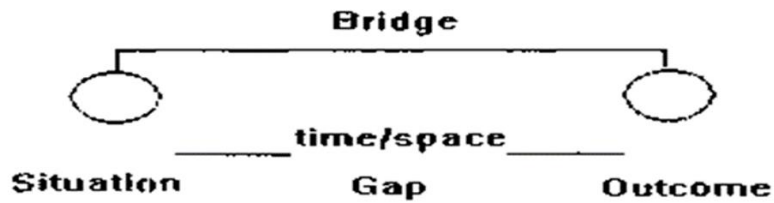


Figure 3.4: Dervin's (1983) Sense-Making Model

Source: Wilson, 1999

3.2.3 Ellis's (1989) Behavioural Model of Information-Searching Strategies

In 1989, David Ellis proposed the Behavioural Model of Information Searching Strategies (Kundu, 2017), which initially consisted of five actions: Starting (identifying information sources expected to contain relevant information), Chaining (following chains to obtain needed information), Monitoring (keeping up-to-date with developments in the area of study), Differentiating (using and filtering information from various sources), and Extracting (selecting required information). Later, two additional actions were added: Verifying (evaluating information) and Ending (stopping the search when the information need is satisfied). The sequence of these actions is illustrated in Figure 3.5 below.

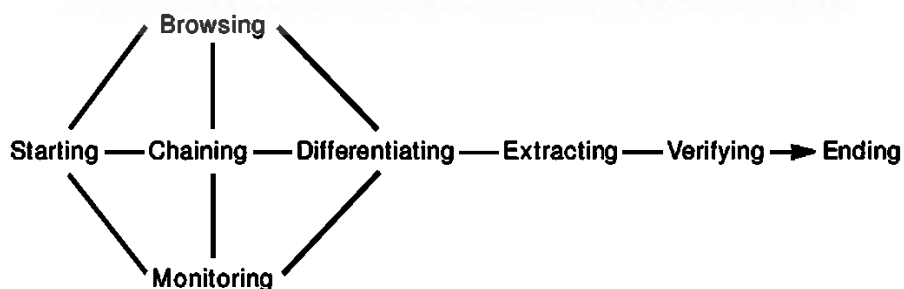


Figure 3.5: Ellis's (1989) Behavioural Model of Information-Searching Strategies

Source: Kundu, 2017

3.2.4 Carol Kuhlthau's Information-Search Process Models

In 1991, Carol Kuhlthau proposed an Information Search Process model based on Ellis's (1989) model. She revised it in 1992 to include stages of the information search process associated with feelings, thoughts, actions, and information tasks. The model outlined a process of six tasks, each of which is associated with emotions (affective), thoughts (cognitive), and actions (physical) (Kuhlthau et al., 2008). The process is illustrated in Figure 3.6 below.

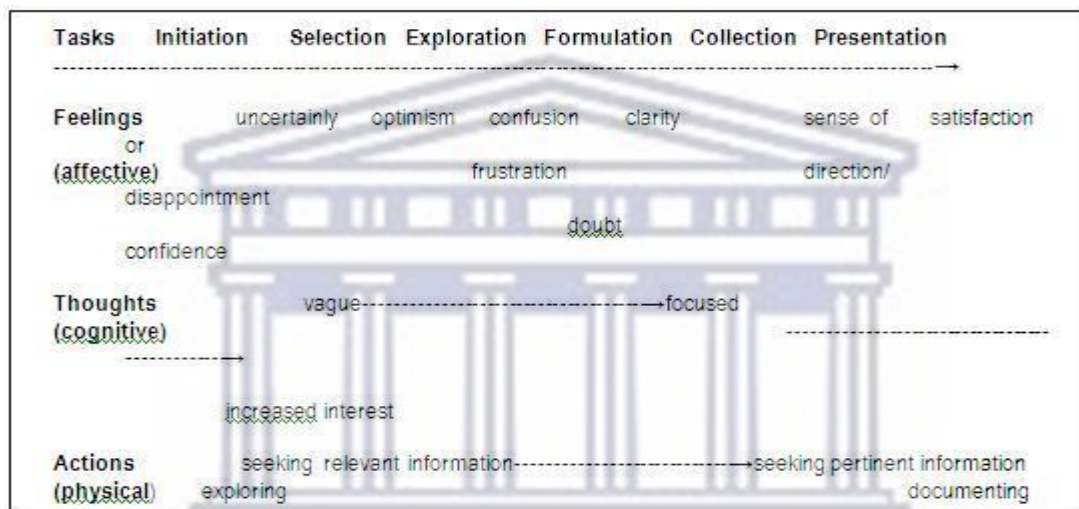


Figure 3.6: Kuhlthau's (1992) Information-Search Process Model

Source: Kuhlthau et al., 2008

3.2.5 Choo et al.'s (1998) Behavioural Model of Information Seeking on the Web

Choo et al.'s (1998) Behavioural Model of Information Seeking on the Web was first proposed in 1998 as a comprehensive model for understanding the complex process of retrieving information on the Internet (Choo et al., 1998). It recognises that the search process is influenced by factors, such as user processes, motivational issues, information needs, technology skills, and system-related processes, including search engines and interface design. The information-seeking activities focus on the selection of and engagement with information sources, as well as the accessibility and quality of the information sought. Marton

and Choo (2011) added that the model applies not only to professional health workers seeking health information but also to engineers and lawyers. Figure 3.7 below presents the model.

	Starting	Chaining	Browsing	Differentiating	Monitoring	Extracting
Undirected Viewing	12 Episodes					
Conditioned Viewing			18 Episodes			
Informal Search				23 Episodes		
Formal Search						8 Episodes

Figure 3.7: Choo et al.'s (1998) Behavioural Model of Information-Seeking on the Web

Source: Choo et al., 1998

3.2.6 Krikelas's (1993) Model Of Information-Seeking Behaviour

According to Krikelas (1993), individuals have both short-term information needs that require immediate attention and long-term needs that may require information over a more extended period. To satisfy these needs, people often rely on internal and external sources of information. Internal sources may include personal knowledge, past experiences, and observations, while external sources may include experts, formal information sources, such as books and articles, and various types of information systems. Figure 3.8 below illustrates Krikelas's model of information sources.

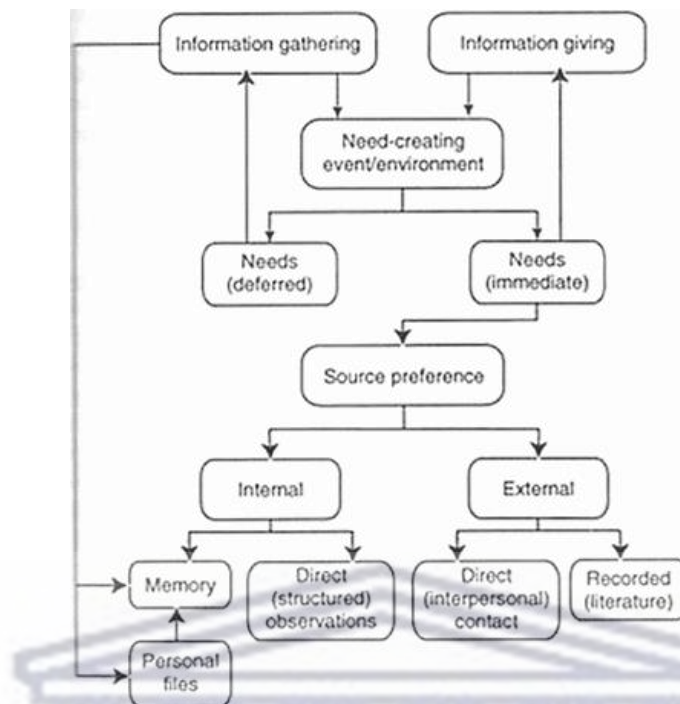


Figure 3.8: Krikelas's (1983) Model of Information-Seeking Behaviour

Source: Krikelas, 1983

3.2.7 Cheuk Wai-Yi's (1998) Information-Seeking-and-Using Process Model

The Information-Seeking and Using-Process Model was originally proposed by Cheuk Wai-Yi in 1998. This model outlined seven distinct situations that professionals may encounter in the workplace when seeking and using information:

- Task-initiating situation - This is when a group of professionals receives an assignment or task to complete.
- Focus formulating situation - The group then works to identify the nature and scope of the project at hand.
- Idea assuming situation - Once the focus area is determined, the group collects relevant information.

- Idea rejection situation - Conflicting information or unexpected obstacles may arise, leading to frustration.
- Idea confirmation situation - Seeking confirmation from third-party sources may help to resolve any conflicts.
- Idea finalising situation - With the information confirmed, the group can finalise their ideas and seek consensus from relevant parties.
- Passing on idea situation - Finally, the group can express feelings of relief as they switch from information seekers to information providers, passing on their completed ideas to others.

Overall, the Information Seeking and Using Process Model provides a useful framework for understanding the different stages of information gathering and decision-making in the workplace.

3.3 Model of Information-Seeking Behaviour of Professionals

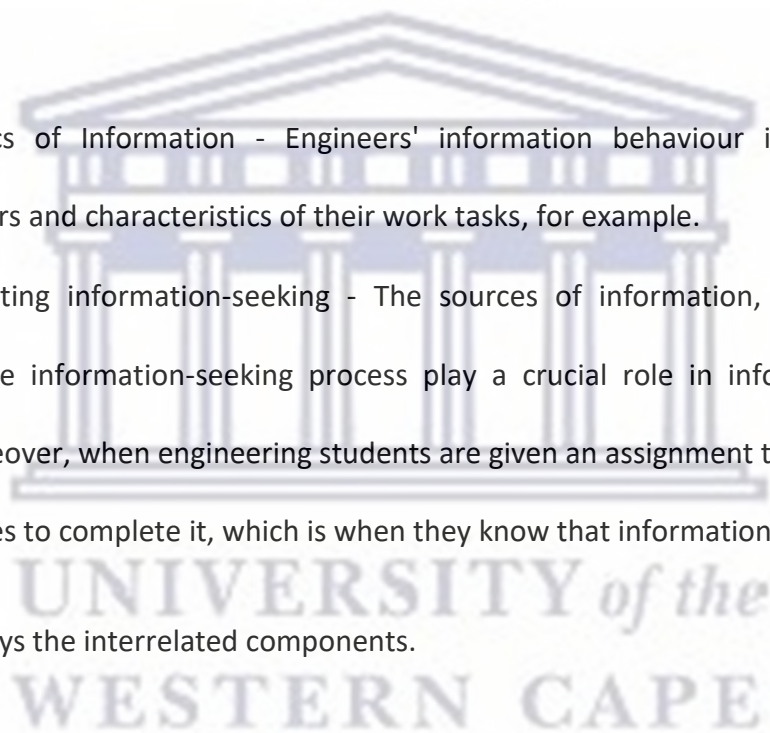
The Model of Information-Seeking Behaviour of Professionals, developed by Leckie et al. (1996), was chosen to underpin the current study and is discussed in detail. This model is regarded as the original model of information-seeking behaviour applicable to all professionals. It was developed through careful analysis and interpretation of studies on the information habits and practices of three groups: engineers, healthcare professionals, and lawyers.

According to Bitso and Fourie (2012), the Model of Information Seeking of Professionals incorporates both the information-seeking and work roles of professionals, including engineers. Leckie et al. (1996) observed that a single professional performs various jobs, and this is reflected in the Work Roles and Associated Tasks section of the model. Leckie et al.

(1996) also predicted that engineers' information needs are determined by factors, such as the context, frequency, predictability, importance and complexity of the task, age, specialisation, career stage, and geographic location, as reflected in the Characteristics of Information Needs component. However, factors affecting information-seeking include the sources of information, awareness of information, and outcomes of the information process. Therefore, the model consists of the following components:

- Work roles and associated tasks - Professionals play multiple roles in the course of their daily work.
- Characteristics of Information - Engineers' information behaviour is influenced by contextual factors and characteristics of their work tasks, for example.
- Factors affecting information-seeking - The sources of information, awareness, and outcomes of the information-seeking process play a crucial role in information-seeking behaviour. Moreover, when engineering students are given an assignment to complete, they must find sources to complete it, which is when they know that information is needed.

Figure 3.9 displays the interrelated components.



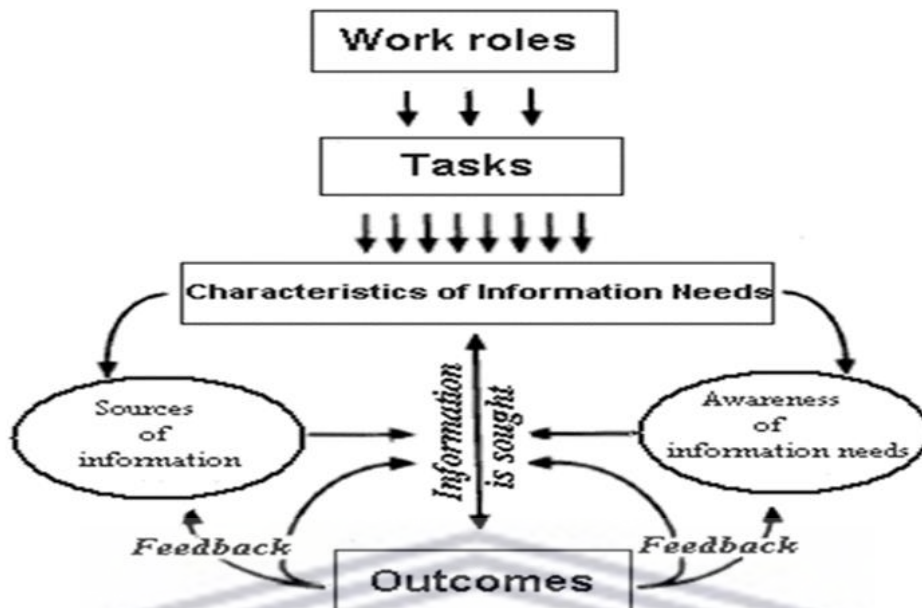


Figure 3.9: Model of Information-Seeking Behaviour of Professionals

Source: Leckie et al., 1996

Robson and Robinson (2013) suggest that the awareness of information sources has a significant impact on the information-seeking process. To address this issue, Leckie et al. (1996) proposed several characteristics of information sources that affect the information-seeking behaviour of professionals, including engineers. These factors are as follows:

- Familiarity with the information source and previous success in using it -engineers often choose sources based on authors they have used before, as they have had success finding relevant information from them.
- Trust and belief in the accuracy of the information source - Professionals are more likely to use sources recommended by experts in their field, as they believe the information to be accurate and trustworthy.
- The format of the information source – Professionals are often pressed for time and need sources that are easy to access and handle.

- The amount of time required to find information using the information source - Professionals require sources that are quick to use, as they are often working under tight deadlines.
- The cost of finding and using the source - If a source is too costly to find or use, it may be difficult for professionals to access the information they need.
- The quality of the source, including the trustworthiness of the links - Engineers need sources that are accessible with one or two clicks. If there are too many links before finding the relevant information, this can discourage users from finding the information they need.
- The accessibility of the source - Professionals need information that is easily accessible without any hassle, for example, with one or two clicks.

By considering these factors, professionals, including engineers, can make more informed decisions about which sources to use when seeking information, which can ultimately lead to more efficient and effective work practices.

3.3.1 Critiquing the Model of Information-Seeking Behaviour of Professionals

The Model of Information Seeking Behaviour of Professionals (Leckie et al., 1996) has been subject to criticism for its limited scope in terms of applicability to a range of people, specifically focusing on professionals, and for its emphasis on work-related information seeking at the expense of non-work settings. In comparison to other models, such as Ellis's (1989) Behavioural Model of Information Searching Strategies, Leckie et al.'s model has limited applicability to the general population. Gortz (2011, p.105) has noted that the model does not provide a detailed analysis of behavioural patterns and does not offer conclusions

on the use of social software as an information source in the workplace of young professionals.

Fischer and Niedźwiedzka (2003) have criticised the model for its conceptual content and geographical presentation, highlighting its inability to describe the information behaviour of managers who mainly acquire information through intermediaries rather than external or computerised information services. The model's applicability is also limited to specific categories of information users, such as health professionals, engineers, and lawyers.

3.3.2 Motivation for the use of the Model of Information-Seeking Behaviour of Professionals

3.3.2.1 Information-seeking behaviour of mechanical engineering students

As mentioned above, the Model of Information Seeking Behaviour of Professionals (Leckie et al., 1996) was originally designed for three specific professional groups: engineers, lawyers, and healthcare professionals. Therefore, it is relevant to the current study, the primary objective of which is to determine the information behaviour of mechanical engineering students at a higher education, which includes their information-seeking behaviour.

3.3.2.2 Work roles

Not only does the Model of Information Seeking of Professionals (Leckie et al., 1996) provide a framework for understanding the information-seeking behaviour of professionals it also explains their information needs due to their work roles. According to Kundu (2017), the model highlights the varied roles that professionals may perform, and the associated information needs that arise from these roles. For instance, engineers may serve both as operational workers and supervisors, and their information needs may vary depending on

their specific roles. Kundu (2017) points out that the model is particularly relevant for engineers, who often have complex and varied job responsibilities. In the context of the study, the information needs of mechanical engineering students are determined by their role in completing academic tasks such as research assignments.

3.3.2.3 *Students*

The information needs of mechanical engineering students can also be explained by the Model of Information Seeking Behaviour of Professionals (Leckie et al., 1996), which sheds light on how these students seek, locate, retrieve, evaluate, and use the information to complete their academic tasks. Thus, understanding the information-seeking behaviour of engineering students might help researchers and educators support students in developing the skills needed for success in their future careers. Kerins et al. (2004) report that engineering students often consult their peers and lecturers for information in their general coursework and individual projects.

3.4 **Application of the Model of Information-Seeking Behaviour of Professionals**

The Model of Information Seeking Behaviour of Professionals (Leckie et al., 1996) has been used to understand not only the information-seeking behaviour of various professions but related aspects as well. For example, Bitso and Fourie (2012) noted that the model incorporates information needs in its explanation of information-seeking behaviour. In addition, it was developed to examine common information behavioural characteristics amongst different professional groups (Kerins et al., 2004). Thus, studies have been conducted using the model to understand the information-seeking behaviour of professionals.

Using the model, Guclu (2018) conducted a study on the information-seeking behaviour of police officers in police stations, using telephone surveys and face-to-face interviews to identify both information needs and information-seeking behaviour. The study revealed that police officers relied heavily on personal knowledge and experience and rarely consulted external sources. Age was identified as a demographic variable influencing the information needs of these professionals.

Greyson et al. (2011) studied the information behaviour of fifteen pharmaceutical policymakers in Canada and compared the results of the descriptive qualitative analysis with the Model of Information Seeking of Professionals. The types and times of need, as well as the lack of established sources for pharmaceutical policy research, pointed to areas of potential improvement. In the absence of a dedicated independent source or centre for research, Canadian pharmaceutical policymakers continued to use available but inappropriate resources, and barriers persisted.

Landry (2006) investigated the effects of work roles, as explained in the model, on the choice of information sources to meet twelve private practice dentists' information needs in Seattle, Tacoma, and Everett, Washington. The study revealed that the type of work shaped the dentists' choice of information sources, and the Internet emerged as the main source because it provided up-to-date information. The dentists' information needs were also determined by context, urgency, and complexity.

Hertzum and Simonsen (2019) conducted a study to analyse the information-seeking behaviour of those responsible for healthcare tasks governed by triage and timeout procedures in Denmark. The study revealed that nurses triaged patients without information seeking while physicians suspended treatments to seek information consciously and

collaboratively during timeouts. In line with the Model of Information Seeking of Professionals, tasks arose from professional work and prompted information seeking.

In 2008, Du Preez conducted a study to determine the information needs and information-seeking behaviour of consulting engineers concerning their daily work tasks and roles. The study identified the information sources and services that consulting engineers consult, as well as the factors that influence their information needs. The primary aim of the study was to develop a suitable model for future studies on the information behaviour of consulting engineers based on Leckie et al.'s (1996) Model of Information Seeking Behaviour of Professionals.

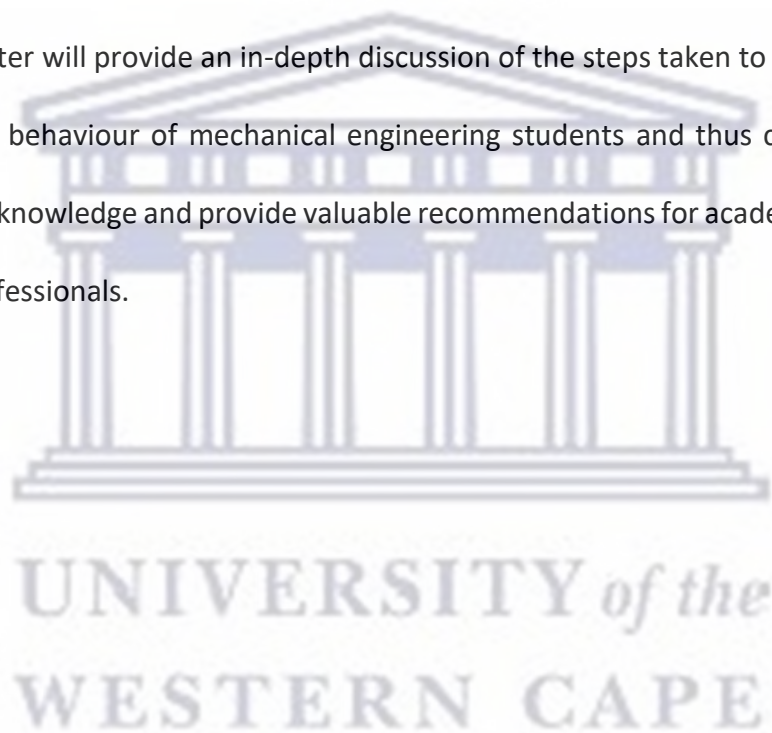
The study found that consulting engineers mostly rely on the Internet as their primary source of information, with some using subject portals and web directories, although these have been replaced by search engines today. All consulting engineers in the study made use of freely available trade literature provided by engineering companies. The results were used to adapt Leckie et al.'s (1996) Model of Information Seeking of Professionals to illustrate the different stages in engineering projects and the various sources of information used during information seeking. The study also revealed that consulting engineers use a variety of sources, including digital cameras to record progress on projects, the Internet, and emails to communicate project progress, but they rely mainly on interpersonal information.

3.5 Chapter summary

In conclusion, this chapter offered a comprehensive overview of the theoretical background of the study. While several models were explained, the Model of Information Seeking Behavior of Professionals, developed by Leckie et al. in 1996, was deemed the most relevant for this study. The chapter provided a detailed explanation of the model, its stages, and its

relevance to the study's research objectives. Thus, the motivation for using this model as a framework for the study was elaborated upon, along with how it has been previously applied by other researchers, which emphasised its relevance. These discussions served to highlight the applicability of the model in various research contexts and underscored its importance in understanding the information behaviour of professionals and students preparing for a future as mechanical engineers.

The subsequent chapter will delve into the research design and methodology followed in the study. This chapter will provide an in-depth discussion of the steps taken to gain insights into the information behaviour of mechanical engineering students and thus contribute to the existing body of knowledge and provide valuable recommendations for academic libraries and information professionals.



CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

The previous chapter discussed the theoretical framework of the study, with special emphasis on Leckie et al.'s (1996) Model of the Information Seeking Behaviour of Professionals used for the study. This chapter discusses the research design and methodology followed to achieve the research objectives and answer the research questions.

4.2 Research philosophy

As discussed in Section 1.7, a research design is influenced by a research philosophy or paradigm. In the current study, a constructivist paradigm was adopted, which is based on the belief that individuals actively construct their understanding and knowledge of the world around them (Bada, 2015). This theory is based on the observation and scientific study of how people learn, and it emphasises the importance of social and cultural contexts in knowledge acquisition.

Mills et al. (2006) describe constructivism as a theory widely used for qualitative research, aimed at identifying characteristics specific to a particular group of people. They highlight that constructivist research involves the interactive relationship between the researcher and the participants during the Charmaz research process, as the researcher actively engages with the participants to co-construct knowledge. Charmaz (2020) argues that the constructivist approach directs researchers to focus on what is happening in the research field, to become part of the research process, to remain flexible and open to new ideas, and to take full responsibility for any issues arising during the research process.

According to Lee et al. (2018), constructivism suggests that learning takes place through learners' interaction with their environment, emphasising the significance of context in knowledge building. In their study conducted in South Korea with 36 nursing students from 4 universities, Lee et al. (2018) examined how information was managed to construct knowledge. The cognitive processes identified in the study by Lee et al. (2018) demonstrated how learners interact with information in their environment to build knowledge, which aligns with the constructivist perspective.

Constructivism emphasises that individuals actively construct their knowledge through their experiences and interactions with the environment. Lee et al.'s (2018) study highlighted how the constructivist paradigm can be used to examine how learners manage and build knowledge, which is a key aspect of the constructivist approach. Similarly, the current research on the information behaviour of mechanical engineering students, which was grounded in the constructivist paradigm focused on how students manage and build knowledge in their field.

4.3 Research design

Leedy and Ormrod (2015, p.92) argue that a research design serves as the foundation for the data collection and data analysis methods that the researcher employs. The choice of research design is heavily influenced by the research objectives and questions (Berg, 2019). According to Marczyk et al. (2005, p. 123), once the research objectives and questions have been formulated, the variables operationalised, and the hypotheses identified, a researcher can then determine an appropriate research design.

A research design is a critical component of any research project as it provides the overall structure and determines the methodology for the study. By selecting an appropriate

research design, the researcher can ensure that the study is conducted rigorously and systematically, and that the resulting data is reliable and valid. Ultimately, the research design is instrumental in determining the success of a research project and plays a vital role in achieving the research objectives.

As explained in Section 1.7 of this thesis, the study followed a sequential, explanatory and mixed methods research design, which involved two methodological phases to collect first quantitative and then qualitative data.

4.3.1 Explanatory research design

An explanatory research design is a type of research design that seeks to explore cause-and-effect relationships between variables (Creswell, 2014). This design is used to explain why certain phenomena occur and to identify the underlying factors that contribute to these phenomena. Explanatory research often involves collecting quantitative data through surveys, experiments, or observations, and then analysing this data using statistical methods.

4.3.2 Sequential research design

A sequential research design is a research design that involves collecting data in stages or phases (Creswell & Creswell, 2018). In this design, one type of data is collected and analysed first, followed by another type of data. The data collected in each stage informs the subsequent stages of the research. Sequential research designs are often used in longitudinal studies, where data is collected from the same participants over an extended period (see 4.2.3 below for the different types of sequential research designs).

4.3.3 Mixed-methods research approach

A mixed-methods research design is a research design that combines both qualitative and quantitative data collection and analysis methods (Creswell & Plano Clark, 2018). This design seeks to provide a more comprehensive understanding of the research problem by using both quantitative and qualitative data to triangulate findings. Mixed-methods research designs are often used when the research question requires a more nuanced understanding of the phenomenon being studied. This design typically involves collecting data through surveys, interviews, focus groups, observations, and other methods, and then analysing this data using both quantitative and qualitative data analysis techniques.

Schoonenboom and Johnson (2017) referred to mixed methods as a sibling of multi-method research combining qualitative and quantitative approaches. Aspers and Corte (2019) defined qualitative research as an interactive process in which an improved understanding of the scientific community is achieved by making significant distinctions resulting from getting closer to the phenomenon studied. Quantitative research as explained by Apuke (2017) involves the collection and analysis of numerical data using specific statistical techniques to answer questions like who, how much/many, what, when, and where. However, qualitative research uses verbal data to answer questions like how and why. In addition, it explores the meaning individuals or groups ascribe to a social or human problem expressed in words, such as those of research participants (Creswell & Creswell, 2018).

Biddix et al. (2018, p.270) suggest that a mixed-methods research design integrates qualitative and quantitative data, and Johnson et al. (2007) argue that it considers multiple perspectives and standpoints. Green et al. (1989) maintain that researchers should consider using a mixed-methods research design because it allows for the following:

- Triangulation, as more than one data-gathering method is used to answer the same research question
- Complementarity to gain a fuller understanding of the research problem based on qualitative and quantitative data
- Development of either method - for example, quantitative data can inform the interview questions for qualitative data gathering
- Initiation of a new study to answer questions raised or clarify findings
- Expansion to extend detailed findings to future research.

In summary, a mixed-methods research design allows for a diversity of divergent views, which following a qualitative or quantitative research design separately does not (Molina-Azori, 2007, pp.41-42). However, Pluye and Hong (2014) explain three types of mixed-methods research designs:

- Sequential, explanatory and mixed-methods design whereby the collection of quantitative data is followed by that of qualitative data with the former informing the data collection instruments of the latter (which was the case in the current study)
- Explanatory, sequential and mixed methods design whereby the process is reversed
- Convergent, mixed methods research design whereby quantitative and qualitative data are collected and/or analysed at the same time.

The sequential, explanatory and mixed-methods research design used in the current study determined the quantitative data collection using an online questionnaire followed by qualitative data collection through interviews. Ivankova et al. (2006) argue that the sequential, explanatory and mixed-methods and the explanatory, sequential and mixed-methods research designs are popular and straightforward, but not easy to implement.

Researchers must consider certain the priority or weight given to the qualitative and quantitative data analysis, the sequence of collecting data and stages in the research process where the qualitative and quantitative research methods are connected. Furthermore, Ivankova et al. (2006) maintain that clarification is needed as to how researchers decide on which method to prioritise, implementation, the connection of the phases and the integration of the research results.

Li et al. (2015) confirm that the sequential, explanatory and mixed method approach allows for an initial quantitative survey and follow-up qualitative interviews. The qualitative findings assist with explaining the quantitative results of the survey. Moreover, according to Merriam and Tisdell (2016, p.6, 15) qualitative methods, became popular when anthropologists and sociologists asked questions about people's lives, their social context and the cultural context in which they lived and the way they understood their world, extend quantitative results to understanding how people make sense of their world.

4.4 Research methodology

Section 1.7 stated that the research design determines the research methodology or strategy followed to answer the research questions and objectives of a study (Canals,2017, p.390).

Therefore, in the current study, the explanatory research design determined the methods used to collect numerical data and establish relationships and patterns between variables through statistical analysis. The sequential research design determined the method of conducting the study in two phases whereby quantitative data was collected in the first phase and used to inform the qualitative data (in the form of words) collected in the second phase.

The mixed-methods research design determined the use of qualitative and quantitative methods in a single study for a comprehensive understanding of the information behaviour of mechanical engineering students.

The data collection and analysis will be discussed later in this section. However, the research site, study population and the sampling of the participants will first be explained.

4.4.1 Research site selection

The research site for the carrying out of the research methodology was an institution of higher learning in South Africa. The researcher worked during the period of the study as an assistant librarian at the Information point of the institution's academic library, which has two engineering faculty librarians. These staff members have offices in the library, and students may either make an appointment to consult with them or if they are not busy with another student, may just walk in line with their open-door policy. Alternatively, students may seek help from the senior library assistant based at the library's information point in the library, which is the first point of call and is a visible desk staffed by the senior library assistant.

The institution's faculty of engineering is divided into eight departments, each with its unique field of study. The departments are Construction Management and Quantity Surveying; Chemical Engineering; Civil Engineering and Geomatics; Clothing and Textile Technology; Electrical, Electronic and Computer Engineering; Industrial and Systems Engineering; Maritime Studies; and Mechanical and Mechatronic Engineering. The current study focused on students studying mechanical engineering in the Department of Mechanical and Mechatronic Engineering.

4.4.2 Study population

Polit and Hungler (1999) defined a study population as the totality of all subjects that conform to a set of specifications, are of interest to the researcher and to whom the research results can be generalised. In the current study, the first study population for the first phase of the research comprised all undergraduate mechanical engineering students in the ECP up to the final (fourth) year who were registered during the 2020 academic year at the selected institution of higher education. The study population totalled 1349 (Department of Mechanical and Mechatronic Engineering, 2020). Table 4.1 below summarises the study population.

Table 4.1: Mechanical engineering student numbers (2020)

Year level	Number of registered students
ECP	139
Level 1	368
Level 2	324
Level 3	398
Level 4	116
TOTAL	1349

The second study population comprised two engineering librarians at the selected institution of higher education.

4.4.3 Sampling

Sharma (2017) defines sampling as a method for systematically selecting a small number of individuals (a sample) from a pre-defined study population to serve as participants in a study, whilst Etikan et al. (2016) define a sample as a portion of a study population.

There are two general sampling techniques (Sharma, 2017), namely probability and non-probability sampling. Probability sampling involves random selection, and requires more work but is reliable. Probability sampling involves stratified sampling, cluster sampling, simple random sampling and systematic sampling. Non-Probability sampling is based on the researcher's judgement and involves quota sampling, purposive sampling, self-selection sampling and snowballing sampling.

4.4.3.1 Stratified sampling

To ensure that the heterogeneity of the population was addressed, stratified sampling, which is probability sampling, was used in the study. According to Kothari (2004), stratified sampling is a sampling technique used in statistics and research that involves dividing a population into smaller, homogeneous and non-overlapping groups called strata (p. 236). The strata are based on specific characteristics, such as age, gender, income, or education level, such as different levels of mechanical engineering students. Individuals within each stratum are similar to each other in terms of the characteristic being used to define the stratum (Babbie, 2013, p. 238).

Stratified sampling can be more effective than simple random sampling in situations where subgroups may have different characteristics within them (Sekaran & Bougie, 2016, p. 256). In the case of the study, the subgroups were mechanical engineering students registered for different streams (the ECP up to the final (fourth) year of the degree). Each stratum (subgroup) was thus made up of the number of registered students in each subgroup. The

strata are indicated in Table 4.1 above. From each stratum, the researcher then randomly selected a cluster of students who would make up the final sample for the study.

4.4.3.2 Cluster sampling

According to Kothari (2004), cluster sampling is a sampling technique used in statistics and research that involves dividing a population into smaller, heterogeneous groups called clusters, and then randomly selecting some of those clusters to form a sample (p. 237). This sounds like stratified sampling, but the key difference between cluster sampling and stratified sampling is that in cluster sampling, the clusters are heterogeneous, whereas, in stratified sampling, the strata are homogeneous (Babbie, 2013, p. 240).

Cluster sampling is often used when the population is large and dispersed over a wide area, making it impractical or costly to sample homogenous individuals from each stratum or segment (Sekaran & Bougie, 2016, p. 257). In addition, in some cases, researchers may use a combination of stratified and cluster sampling to achieve their sampling goals (Bryman, 2016, p. 179), which was the case in the current study. Thus, cluster sampling is used for a large population with pre-existing units, which in the study's case were the various year levels. The units ECP, the first, second, third and fourth year of study were the strata, and a cluster was selected from each.

4.4.3.3 Sample size

Kadam and Bhalerao (2010) define a sample size as the number of participants in a study. For the population of 1349 in the current study, a representative sample size of 300 with a 10% margin of error and a 99% level of confidence was calculated using a 2004 Raosoft sample size calculator (Krejcie & Morgan, 1970, p.608;). To ensure representation, 23% of the registered students in each stratum were selected randomly from class lists obtained from

the faculty administrator. To achieve single-stage cluster sampling, students from all the year levels were chosen. Table 4.2 below reflects the sample size determined by single-stage cluster sampling.

Table 4.2: Cluster sampling

Year level	Number of registered students	23% as sample
ECP	139	32
Level 1	368	85
Level 2	324	75
Level 3	398	92
Level 4	116	27
TOTAL	1349	311

The sample selected for the interviews was determined by purposive sampling. This was because there were only two engineering subject librarians in the institution. Therefore, librarians were interviewed after sending them the interview questions via email.

4.5 Data collection methods

Both quantitative and qualitative data were collected to address the objectives of the study.

4.5.1 Quantitative data collection

The survey method was employed to collect quantitative data. Lazar et al. (2017, p. 105) define a survey as a well-defined and well-written set of questions to which an individual is

asked to respond. Quantitative data were collected using an online questionnaire survey and telephonic interviews.

This study collected quantitative data from fixed-response questions in the online questionnaire. Lutabingwa and Auriacombe (2007) as well as Siepel and Dejardin (2020, p.4) indicated that quantitative research methods are widely applied to studies dealing with individuals, teams, enterprises, or geographical regions. But this does not lend itself to constructivism

4.5.2 Qualitative data collection

For the gathering of qualitative data, some open-ended questions were included in the questionnaire allowing students to provide their answers, opinions and experiences. Qualitative data was also gathered from conducting interviews with the engineering subject librarians to provide rich in-depth data to gain an understanding of the information needs and information-seeking behaviour of mechanical engineering students. Both Schurink (2009) and Green and Thorogood (2018, p.7) suggest that interviews are valuable for collecting qualitative data.

4.6 Data collection instruments

The questionnaire and interview questions were the instruments used to gather data in the study. These questions were based on a list of information-seeking activities and the problems that students are faced with when engaged in them informed by Chowdhury and Gibb's (2014) study on the complexities associated with information seeking in the digital environment.

4.6.1 Questionnaire design

The web-based self-administered questionnaire (see Appendix E) was designed using Google Forms. Both open- and closed-ended (fixed response) questions were included. The closed-ended questions allowed for a quick and easy collection of quantitative data. The open-ended questions allowed respondents to word their own opinions, ideas and experiences.

The first part of the questionnaire gathered demographic information on the age, level of education and gender of the participants. The reason for these questions was to determine information-seeking behaviour in terms of student age, level of education and gender.

The second part of the questionnaire included questions to determine the students' information-seeking behaviour in terms of, for example, what prompted them to search for information, the kind of tasks that prompted information seeking and the methods used to search for information. These questions aimed to determine the students' information needs and the actions that are taken to satisfy them.

The third part of the questionnaire aimed to determine the students' perspectives on and the extent of their satisfaction with the mechanical engineering library collection and the role of subject librarians in satisfying their academic needs.

a) Validity and reliability of the questionnaire

Heale and Twycross (2015) define validity as the extent to which a concept is accurately measured in a quantitative study and reliability as the consistency of the measure. To test the validity and reliability of the questionnaire, which was the measuring instrument in the study, it was piloted by administering it to subject librarians whose role was not to assist engineering studies.

Administering a pilot test helps to test the validity and reliability of a questionnaire by identifying any potential issues or flaws with the instrument before it is used in the actual study.

Testing Validity

During the pilot test, if the subject librarians who were not involved in assisting mechanical engineering students found the questions unclear or confusing, the questions might not have been measuring the intended concepts accurately. Therefore, they would need to be reformulated to improve their validity. By refining the questionnaire in response to feedback from the pilot test, the researcher could improve the validity of the instrument by ensuring that it accurately measured the intended concepts. Mistakes and misperceptions were addressed.

Testing Reliability

Administering the questionnaire to a sample of subject librarians who were not involved in mechanical engineering studies during the pilot test allowed for the evaluation of the reliability of the questionnaire. The pilot test helped the researcher to identify any inconsistencies or errors in the responses that could reduce the reliability of the questionnaire. The researcher could then revise the questionnaire to improve its reliability by ensuring that the questions were not only unambiguous but also that the response options were consistent and easily understood by the participants. By addressing any issues with the questionnaire during the pilot test, the researcher could improve the reliability of the instrument and increase the accuracy of the data collected during the study

b) Administering the questionnaire

In the study, the questionnaires were administered to the respondents via their student email addresses using the "send" function of Google Forms. To ensure anonymity, the "blind copy" function was used, which kept the identity of the students hidden.

At the beginning of the questionnaire, an informed consent statement was included. This statement explained the purpose of the research, reassured the participants that their identity would remain anonymous, and emphasised that there were no risks involved in participating. Participants were also informed that they could withdraw from the research at any time. By completing and submitting the questionnaire, participants were providing their consent to participate in the study.

4.6.2 Interview schedule

Appendix F presents the interview schedule followed for interviewing the subject librarians. These questions were designed to find out about the librarians' experience, skills, and knowledge related to their work in the library, as well as their ability to assist students. The questions were inspired by a desire to assess the librarian's familiarity with the types of requests and resources used by students, their approach to helping them, and their ability to manage complex requests and maintain accurate records. The questions were also intended to gauge the librarians' understanding of the common challenges faced by students in their information-seeking behaviour and their ability to provide appropriate recommendations and guidance to address these challenges.

The researcher originally intended to conduct face-to-face interviews with both subject librarians. However, owing to the outbreak of the COVID-19 pandemic, this was no longer possible. Therefore, the interview questions were sent to both librarians via email. After

analysing the data gathered through their responses to the emailed questions, follow-up interviews were conducted with each subject librarian via Microsoft Teams.

Conducting the interviews

As stated above, the interview questions were initially designed to be answered by the two Faculty of Engineering subject librarians in a face-to-face setting. However, owing to the COVID-19 pandemic, this was not possible. After obtaining permission from both librarians, the questions were sent to them via email, and informed consent was included as part of the interview questions.

To obtain more detailed and comprehensive data, follow-up interviews were conducted separately with each subject librarian via Microsoft Teams. These interviews covered a range of topics, including the types of requests received from mechanical engineering students, the information sources recommended to students, the types of resources students prefer to use, the level of expertise students have in finding information in the library, and the common problems encountered by students when seeking information. Consent was obtained before recording the interviews conducted via Microsoft Teams.

4.7 Capturing of collected data

The questionnaires were completed and submitted through Google Forms, which automatically captured the data. The responses were then recorded in an Excel spreadsheet for analysis.

For the emailed interview questions, the responses were printed out and hard copies were used to make notes and identify themes.

The follow-up interviews conducted were recorded and then transcribed for analysis.

4.8 Data analysis

According to Burnard et al. (2008), different approaches are used to analyse qualitative and quantitative data.

4.8.1 Quantitative data analysis

Lutabingwa and Auriacombe (2007) emphasise the importance of researchers having an understanding of the statistical tools available for data analysis and the procedures involved. Various statistical software packages can assist with converting data into a readable form, editing data for correctness and completeness, coding data for analysis, entering data, and cleaning data for errors.

In the study, the statistical analysis was performed using the Excel spreadsheets embedded in Google Forms, with the assistance of relevant statistical tools.

4.8.2 Qualitative data

According to Burnard et al. (2008), there are two approaches to analysing qualitative data: the deductive and the inductive approach. In the inductive approach, the researcher is already familiar with the participants' responses, whereas, in the deductive approach, the researcher knows little or nothing about the study phenomenon. For the current study's data analysis, the researcher used the inductive approach since she is in the field of librarianship and deals with the information behaviour of students.

4.8.2.1 *Inductive theming*

Inductive theming was utilised to analyse the qualitative data, which involves identifying and organising themes or patterns in the data. Thematic content analysis is another term for this approach that aims to derive meaning from the data by identifying themes in the experiences, ideas, opinions, views, constructions, and perceptions of respondents.

4.8.2.2 *Codes*

Inductive theming involves the process of identifying phrases in participants' words, which are allocated a code. The codes are then collated to identify themes. The researcher should ensure that the themes emerging for the codes accurately represent the data and are useful in terms of the topic of discussion. It should be noted that there are degrees of flexibility and subjectivity present when researchers group codes into themes. However, theming software like AtlasTI or NVivo may be used to minimise subjectivity.

4.9 Presentation of data analysis findings

Various formats are used to present the data in Chapter 5, which is the next chapter of this thesis, including text, tables and graphs. As explained by In and Lee (2017), textual information is the primary method for conveying findings and identifying trends. Tables are another effective way to communicate information by presenting data in rows and columns, whether in words or numbers and can accurately represent data that cannot be presented in a graph. Graphical presentation, however, simplifies complex information by using images to highlight data patterns, making them an excellent tool for summarising and explaining quantitative data. Overall, the use of different presentation formats allows for a comprehensive and accessible understanding of the research findings in Chapter 5.

4.10 Chapter summary

This chapter provided an in-depth discussion and justification for the research design and methodology employed in the study.

Specifically, the chapter highlighted the use of a self-administrative web-based survey questionnaire created using Google Forms as the primary tool for data collection. To ensure the questionnaire's validity and reliability, a pilot study was conducted to test the effectiveness and accuracy of the measuring instrument. The pilot study was used to refine the questionnaire, ensuring that it accurately captured the research objectives and could effectively gather data from study participants.

In addition to the web-based survey questionnaire, interviews were conducted as part of the data collection process. The interviews provided an opportunity to obtain in-depth and nuanced information from subject librarians, which could not be captured by the questionnaire alone.

The interview questions were designed to complement the survey questionnaire and provide further insights into the research questions. The participants were selected using purposive sampling, ensuring that they had the relevant knowledge and expertise required for the study.

The interviews were conducted through Google Teams after the interviewees had answered the questions emailed to them. Furthermore, the data obtained from the interviews were recorded and transcribed, and qualitative analysis techniques were employed to analyse the information.

By integrating the findings obtained from both the survey questionnaire and the interviews, a comprehensive understanding of the research topic was achieved.

The penultimate section of this chapter outlined how the analysis of data obtained from the questionnaires and interviews conducted with study participants will be presented in the next chapter, thereby revealing how the study's objectives were achieved, and the research questions answered. Overall, this chapter has served as a critical foundation for the following chapters by providing the necessary context for the subsequent data presentation and interpretation.



CHAPTER 5

PRESENTATION OF DATA ANALYSIS RESULTS AND FINDINGS

5.1 Introduction

The preceding chapter provided an overview of the research design and methodology employed in this study, including information on the research philosophy, approach, data gathering method, population, sampling technique, data collection tools, and data analysis and presentation techniques. This chapter presents the results and findings of the analysis of the quantitative and qualitative data collected from the web-based questionnaire that was administered to mechanical engineering students and the interviews conducted with the engineering subject librarians. The chapter first presents the results and findings of the analysis of the quantitative and qualitative data gathered through the questionnaire and then the findings of the analysis of the qualitative data collected via the interviews with the librarians. The results and findings are interpreted and discussed in the next chapter.

The data were gathered from a sample of mechanical engineering students, who answered the questionnaire, and two subject librarians, who were interviewed. For the data gathered through the questionnaire, a sample size of 311 was required from a population of 1345 registered mechanical engineering students. However, despite multiple reminders and the assistance of some lecturers, only 74 completed questionnaires were received, resulting in a response rate of only 24.67%. The low response rate can be attributed to several factors. Primarily the COVID-19 pandemic prevented students from being physically on campus. Thus, it was not possible to reach them other than by online communication methods and motivating them to participate in the survey was a challenge. Additionally, many students

experienced Internet access and data challenges, which may have prevented them from completing the questionnaire.

Although these factors were beyond the control of the researcher, they impacted the response rate of the study. However, efforts were made to mitigate these issues by sending multiple reminders and helping students as much as possible. Nevertheless, owing to the low response rate, the findings cannot be generalised to all mechanical engineering students at the institution or to engineering students at other higher education institutions.

Despite the challenges faced in obtaining responses from the study participants, the subject librarians were able to complete the interview questions that were emailed to them. In addition, they willingly participated in the follow-up virtual interviews, which provided valuable insights into their experiences and perspectives related to the study topic. Their cooperation and willingness to participate in the research contributed to the overall success of the study.

5.2 Results of analysis of questionnaire responses

The quantitative data gathered through 74 completed questionnaires were analysed and the results are presented below.

5.2.1 Demographic profile of participants

This first part of the questionnaire requested demographic data from the participants on their level of study, gender, and age. As indicated earlier demographic information would help the researcher understand how information behaviour is related to specific groups and ensure that information services and resources meet the needs of all students.

5.2.1.1 Level of study

The quantitative data analysis, presented in Figure 5.1, shows that out of the 69 students who responded to this question, 14 (20.3%) were registered for the ECP, while 15 (21.7%), 17 (24.6%), 7 (10.1%), and 16 (23.2%) were registered for the first-year, second-year, third year, and fourth-year level of study for a mechanical engineering degree, respectively. The results presented in Figure 5.1.

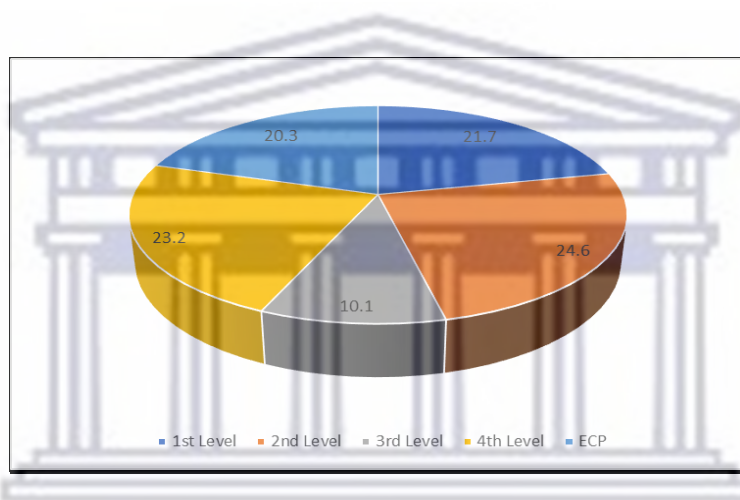


Figure 5.1: Level of study

5.2.1.2 Gender

Only 67 participants responded to the question. Additionally, 2 respondents preferred not to disclose their gender. Of the 67 respondents, 47 (68.1%) disclosed that they were male, and 20 (29%) said that they were female. Figure 5.2 presents the results of the quantitative data analysis.

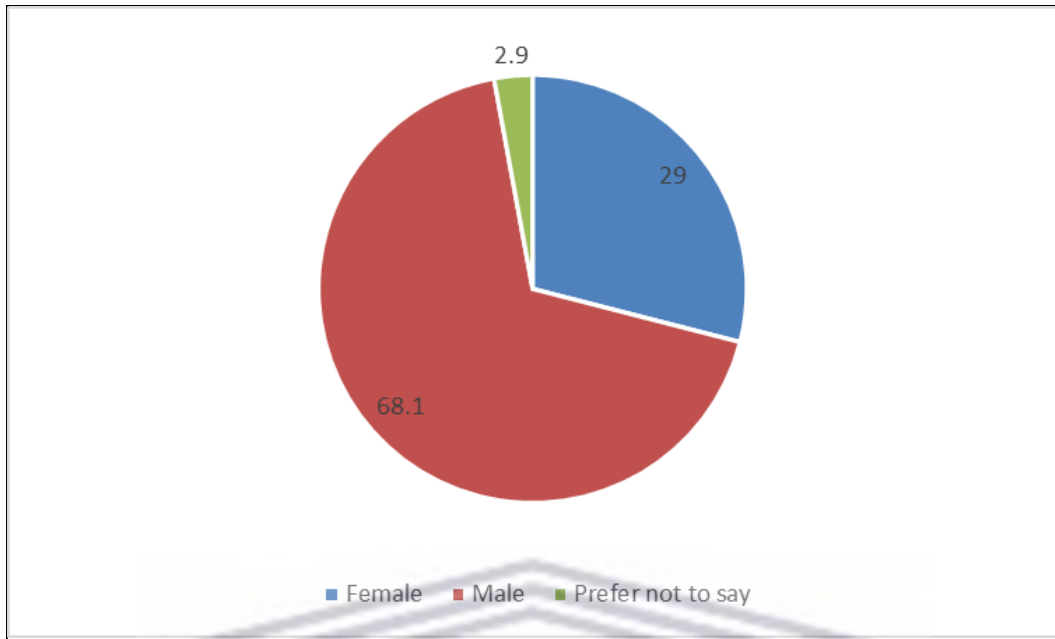


Figure 5.2: Gender (N=69)

a) Level of study and gender

Table 5.1 displays the distribution of gender among the different year levels. Out of the 67 students who responded, 1 second-level student and 1 fourth-level student indicated their gender as "Other". In terms of the ECP students, nine were male and five were female. Notably, there were ten more female first-year students than male first-year students. In the second-year cohort, there were fourteen (14) male students and only one (1) female student.

This gender imbalance continued in the third- and fourth-year cohorts, with five (5) and twelve (12) male students and one (1) and three (3) female students respectively. In addition, Table 5.1 indicates that the largest group of participants were male second-year students (31%), followed by male third-year students (21%). Amongst the female participants, the majority (15%) were first-year students.

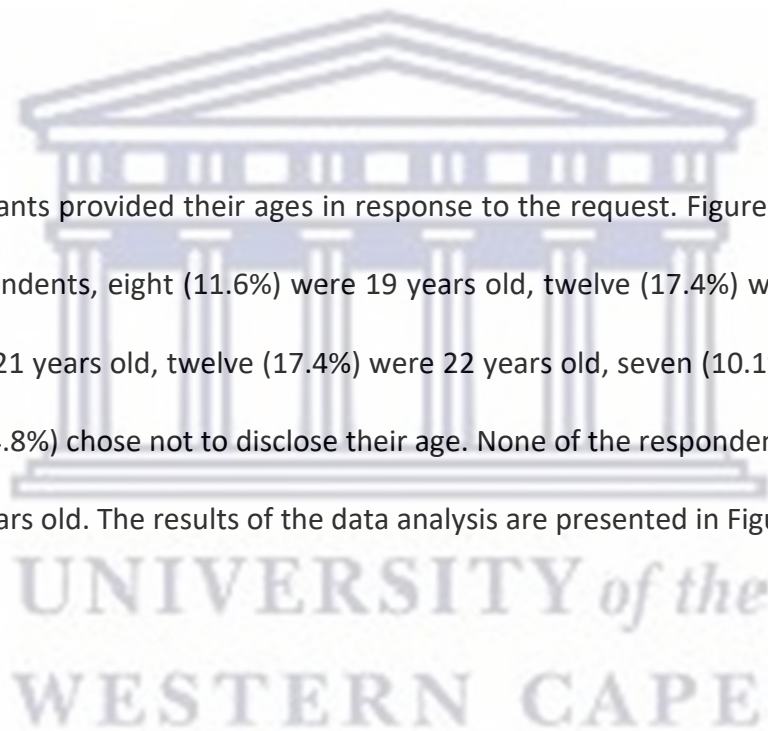
Table 5.1 presents the results of the analysis of the level of study and gender.

Table 5.1: Level of study and gender

Gender	ECP	1st level	2nd level	3rd level	4th level	Total
Male	9	5	14	5	12	45
%	13	8	31	21	18	67
Female	5	10	1	1	3	20
%	8	15	2	2	5	30
Other	0	0	1	0	1	2
%	0	0	2	0	2	3
Total	14	15	16	6	16	67

5.2.1.3 Age

Only 69 participants provided their ages in response to the request. Figure 5.1 displays that out of the respondents, eight (11.6%) were 19 years old, twelve (17.4%) were 20 years old, six (8.7%) were 21 years old, twelve (17.4%) were 22 years old, seven (10.1%) were 24 years old, while 24 (34.8%) chose not to disclose their age. None of the respondents indicated that they were 23 years old. The results of the data analysis are presented in Figure 5.3.



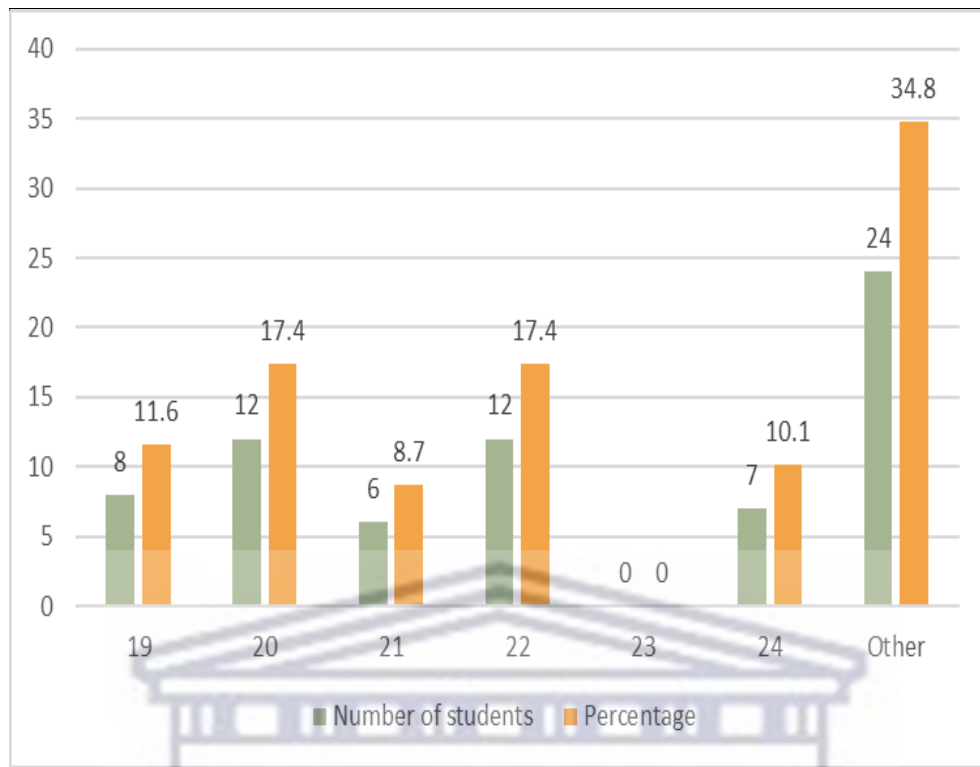


Figure 5.3: Age (N=69)

5.2.2 Information-seeking behaviour

The second section of the questionnaire aimed to examine the information-seeking behaviour of mechanical engineering students. It is noteworthy that all 74 participants responded to the questions in this section. The distribution of respondents across the different year levels was as follows: ECP (14), first year (16), second year (18), third year (7), and fourth year (19).

5.2.2.1 Motivation to seek information

The first question in the information-seeking behaviour section of the questionnaire asked participants what motivated them to seek information. The options provided included working on a research project, keeping themselves generally up to date, performing administrative tasks, and preparing for examinations. Of the 74 respondents, 56 indicated that they often sought information for research purposes, while 49 looked for information to

prepare for exams. Additionally, 36 students sought information to keep abreast of new information, and 21 sought information for administrative tasks. Figure 5.4 presents these results graphically.

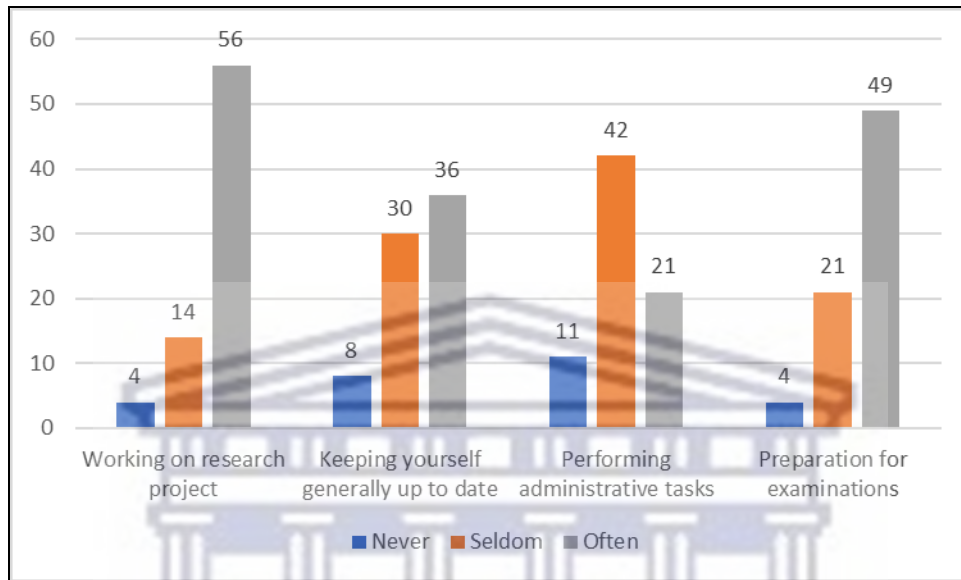


Figure 5.4: Motivation to seek information (N=74)

a) *Motivation to seek information by level of study*

Students' motivation to seek information might vary depending on their level of study. For example, students in their first year of study may have different motivations for seeking information than those in their final year. By identifying significant differences in motivation across different levels of study and identifying factors that cause them, educators and librarians can develop and provide tailored teaching and learning resources that meet students' needs and foster their success at each stage of their academic journey. For example, for first-year students who may be less familiar with academic research, educators and librarians can provide workshops on how to search for and evaluate sources. For final-year students who may be focused on final examinations, educators and librarians can help them manage their time effectively by setting priorities, breaking down tasks into manageable units

and interpreting exam questions. For graduate students who may be conducting research in highly specialised fields, librarians can offer one-on-one consultations to help students navigate complex databases and access relevant resources.

Table 5.2 presents a comparative analysis of student responses to determine whether students' motivation to seek information varies according to their level of study.

Table 5.2: Motivation to seek information per level of study(N=74)

Motivation factor	Never						Seldom						Often					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
Research project	0	0	0	0	4	4	5	3	2	2	2	14	9	13	16	5	13	56
%	0	0	0	0	5	5	7	4	3	3	3	38	12	18	22	7	18	76
Keeping up to date	0	0	2	2	4	8	6	8	5	3	8	30	8	8	11	2	7	36
%	0	0	3	3	5	11	8	11	7	4	11	41	11	11	15	3	9	49
Administrative tasks	2	1	2	3	3	11	6	10	9	3	14	42	6	5	7	1	2	21
%	3	1	3	4	4	15	8	13	12	4	19	57	8	7	9	1	3	28
Preparing for exams	0	0	1	1	2	4	4	4	3	4	6	21	10	12	14	2	11	49
%	0	0	1	1	3	5	5	5	4	5	8	28	14	16	19	3	15	66

5.2.2.2 *Tasks prompting information seeking*

The students were asked to list the kind of tasks which prompted them to seek information. This question was included in the questionnaire because the researcher was interested in gaining insights into the specific information needs of students in different contexts. This information would be used to inform the design of information resources and services tailored to the needs of students and to identify areas where students may need additional support or guidance in seeking information.

The responses received were analysed to identify patterns in the types of tasks that prompt students to seek information. This information can then be used to develop strategies for promoting information literacy and effective information-seeking behaviour amongst students.

Overall, understanding the tasks that prompt students to seek information was an important step in developing effective information resources and services that meet the needs of students and support their academic success.

The 74 responses received from the students at all levels of study are listed and themed in Table 5.3.

Table 5.3: Tasks prompting information seeking (N= 74)

THEME	RESPONSES
Assessments	Project and computer assessments Assessments Assessments Assignments, assessments and administrative
Assignments	Assignments Research for lab reports and assignments Assignments and studying for tests assignments and projects Projects and Assignments Academic assignments Project and assignments Research for lab reports and assignments Assignments Assignments Assignments Research assignments Assignments and Projects Subject chapters, assignments, and reports Assignments and exams Assignments, assessments and administrative Course-related books, assignments, projects Academic assignments, and acquiring knowledge, which is never taught in class
Examination	Exam papers Exams Assignments and exams Exam Exam papers and answers, research projects
(Research) Projects	project ideas Projects Research projects research, projects etc I seek information for investigations and projects Mostly projects Mostly research projects Project and computer assessments Projects projects and so on Project Assignments and projects Projects and also assignments Projects and assignments Research reports and projects Projects and research tasks Exam papers and answers, research for projects Projects that require a lot of information and calculations Projects, practicals etc. Practice problems and integrated projects Research tasks for development work Research
Tasks	Hands-on tasks For Research and theory-based tasks Practical task Research tasks for development work

	Projects and research tasks
Technology	Food for my scientific curiosity, information for designing technology that I find useful Information technology solution
Additional reading related to studies	How to better understand work and how to be more efficient at doing calculations Keeping up to date with schoolwork Further reading on topics Ask tutors and also google information
Other	Gaming Preparing meals Any troubleshooting Mechanics On manufacturing and making money

5.2.2.3 *Methods used to find information*

The students were asked to indicate the methods they used to find information because the researcher wanted to understand their information-seeking behaviour in terms of how they located information for their assignments and projects, for example.

To obtain this information, students were presented with a list of potential methods and asked to indicate which ones they used. The list included searching in published hard copy directories, searching in electronic databases, reading/skimming journals in the engineering field, obtaining reference recommendations from colleagues, using Google/Google Scholar, searching full-text electronic databases such as IEEE Xplore, and following references used various journal articles.

By asking students to identify the methods they use to find information, the researcher could gain insights into the tools and resources that are most used by students in their information-seeking processes. This information could then be used to tailor information resources and services to the specific needs of students and to develop strategies for promoting effective

information-seeking behaviour. Figure 5.5 presents the number of students who reported using each method to allow for easy comparison and analysis.

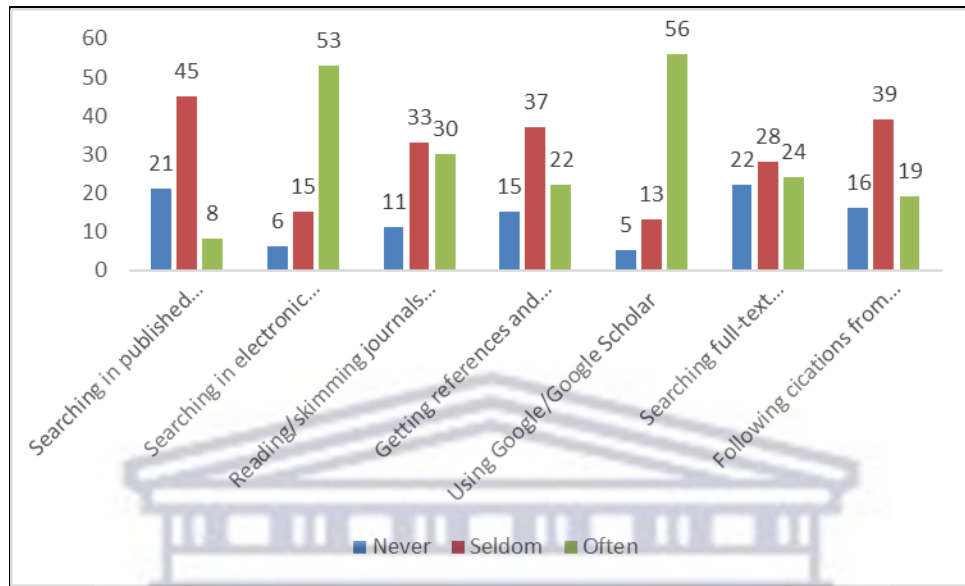


Figure 5.5: Methods of information seeking (N=74)

a) Methods of information seeking by level of study

The students' responses to the question on their methods of information seeking were analysed in terms of their level of study to determine whether their strategies differed based on their year level. By categorising the responses according to year level, the researcher could gain insights into how the information-seeking behaviour of students may change as they progress through their academic programme. This information could then be used to tailor information resources and services to the specific needs of students at different stages of their academic journey. For example, if the data showed that first-year students rely more heavily on general search engines like Google, while fourth-year students are more likely to use specialised databases like IEEE Xplore, this information could be used to develop targeted training and support programmes that help students to develop more effective information-seeking skills. Thus, the information obtained from this question could be used to identify

areas where students may need additional support or guidance in seeking information and to develop targeted strategies for promoting effective information-seeking behaviour amongst students. The results of the quantitative data analysis are reflected in Table 5.4.



Table 5.4: Methods of information seeking according to year of study (N=74)

Methods	Never						Seldom						Often					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
Directories	5	3	5	2	6	21	6	11	12	5	11	45	3	2	1	0	2	8
%	7	4	7	3	8	28	8	15	16	7	15	61	3	3	1	0	3	11
Databases	0	2	1	0	3	6	1	3	5	2	4	15	13	11	12	5	12	53
%	0	3	1	0	4	8	1	4	7	3	5	20	18	15	16	7	16	72
Engineering journals	2	3	1	0	5	11	4	7	10	2	10	33	8	6	7	5	4	30
%	3	4	1	0	7	15	5	9	14	3	14	45	11	8	9	7	5	41
Colleagues	3	4	3	0	5	15	7	7	11	5	7	37	4	5	4	2	7	22
%	4	5	4	0	7	20	9	9	15	7	9	50	5	7	5	3	9	30
Google/Scholar	1	1	0	1	2	5	1	4	5	0	3	13	12	11	13	6	14	56
%	1	1	0	1	3	7	1	5	7	0	4	18	16	15	18	8	19	76
Full-text databases	3	5	4	2	8	22	5	6	7	3	7	28	6	5	7	2	4	24
%	4	7	5	3	11	30	7	8	9	4	9	38	8	7	9	3	5	32
Citations	1	5	3	2	5	16	8	8	11	1	11	39	5	3	4	4	3	19
%	1	7	4	3	7	22	11	11	15	1	15	53	7	4	5	5	4	26

5.2.2.4 *Factors affecting finding information*

The researcher sought to understand the factors that affected students from seeking information. The question was asked because the researcher sought to identify the specific challenges that students face in seeking information to tailor support and interventions to improve their information-seeking skills. The options presented to the students aimed to elicit information on the common barriers that students face, including not knowing where to find information, not knowing how to use library resources, not knowing who the right person to talk to was, and not being sure of the kind of information needed.

The data gathered from the students' responses provided valuable insights into the specific challenges that students face in seeking information. The findings, as presented in Figure 5.6, indicated that a significant proportion of students struggle with not knowing where to find the information they need and how to use library resources effectively. The data also revealed that some students have difficulty identifying the right person to talk to and determining the kind of information needed.

Overall, the research aimed to improve students' information-seeking skills by identifying the specific challenges they face and developing interventions that address those challenges. The findings could be used to inform the development of targeted support programmes and resources that help students develop effective information-seeking strategies.

The data presented in Figure 5.6 indicated that out of the 74 respondents, 33 students seldom did not know where to find the information they need, while 26 students often faced this challenge, and 15 students never knew where to find the needed information. Similarly, 28 students indicated that they seldom knew how to use library resources, while 23 students often faced this challenge, and another 23 students never knew how to use library resources.

On the third option, 30 students seldom did not know who the right person to talk to was, while 27 students often did know who the right person to talk to was, and 17 students never knew who the right person to talk to is. Lastly, on the last option, 25 students indicated that they seldom were not sure of the kind of information needed, while 27 students often faced this challenge, and 22 students never faced this challenge. Figure 5.6 presents the results of the quantitative data analysis.

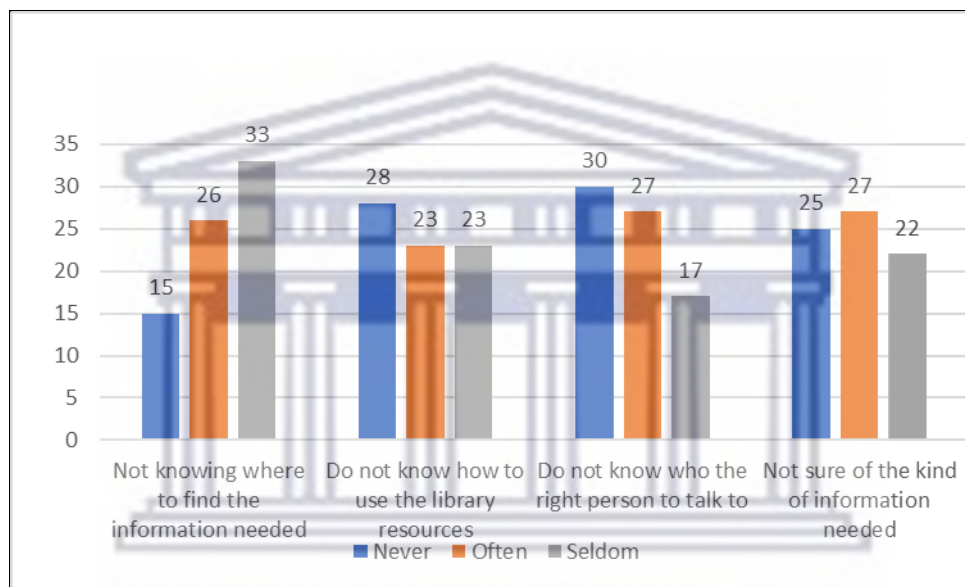


Figure 5.6: Factors affecting finding information (N=74)

a) Factors affecting finding information according to year of study

The results of the data analysis presented in Table 5.5 were conducted to examine whether the factors affecting the ability of students to find information differed based on their year levels. The purpose of this analysis was to provide insights into the challenges faced by students at different stages of their academic journey and to develop targeted interventions and resources to address them.

By breaking down the responses according to year level, educators and librarians could gain a better understanding of the unique challenges faced by students at different levels. For example, first-year students may be more likely to struggle with finding information because they are new to the university environment, while fourth-year students may have more advanced research skills, but face challenges related to the complexity and depth of their research topics.

Identifying the specific challenges faced by students at different year levels can help educators and librarians develop targeted interventions and resources to address those challenges. For example, first-year students may benefit from introductory workshops on how to use library resources effectively, while fourth-year students may benefit from advanced research workshops focused on specific research. Table 5.5 presents the analysis to allow for easy comparison.

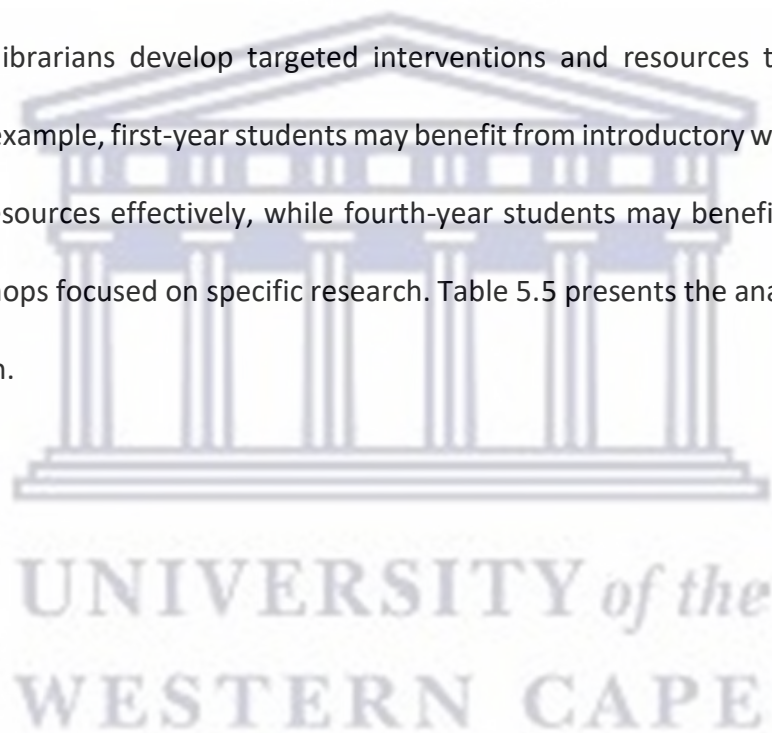


Table 5.5: Factors affecting finding information according to year of study (N=74)

Factors finding information	Never						Often						Seldom					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
Where to find	4	3	4	1	3	15	3	9	7	3	4	26	7	4	7	3	12	33
%	5	4	5	1	4	20	4	12	9	4	5	35	9	5	9	4	16	45
Using library resources	3	5	6	2	12	28	3	6	7	2	5	23	8	5	5	3	2	23
%	4	7	8	3	16	38	5	8	9	3	7	31	11	7	7	4	3	31
Right person to ask	7	7	8	4	4	30	5	4	7	3	8	27	2	5	3	0	7	17
%	9	9	11	5	5	41	7	5	9	4	11	36	3	7	4	0	9	23
Information needed	9	4	2	2	8	25	5	3	9	2	8	27	0	9	7	3	3	22
%	12	5	3	3	11	38	7	4	12	3	11	36	0	12	9	4	4	30

5.2.2.5 Awareness of needed information

Students were asked to indicate their level of awareness of needed information because the researcher wanted to identify any potential areas of improvement. The question asked participants to rate their level of awareness using three options: Sometimes, Often, and Always. The data collected from the responses were then analysed and presented in Figure 5.7 to show the distribution of responses amongst the participants.

By examining the percentages of students who answered "always," "sometimes," or "often," the researcher could determine the level of awareness of information amongst the participants. This information could be useful in guiding educators and librarians in identifying ways to improve student's access to and awareness of necessary information in the mechanical engineering field. For example, librarians could work closely with faculty members

to develop tailored instruction sessions and research guides that are specific to the course and assignment requirements. Additionally, librarians could offer one-on-one research consultations to students to help them identify and locate the information they need for their assignments. By providing personalised support, librarians can help students develop a better understanding of their information needs and improve their research skills. In addition, librarians could create targeted workshops or tutorials that address specific areas of difficulty for students, such as using library resources or identifying the right person to talk to.

Of the 69 mechanical engineering students who answered the question, 22 (31.9%) revealed that they were always aware of the information needed, 28 (40.6%) were sometimes aware and 19 (27.5%) were often aware of the needed information. These results are presented in Figure 5.7.

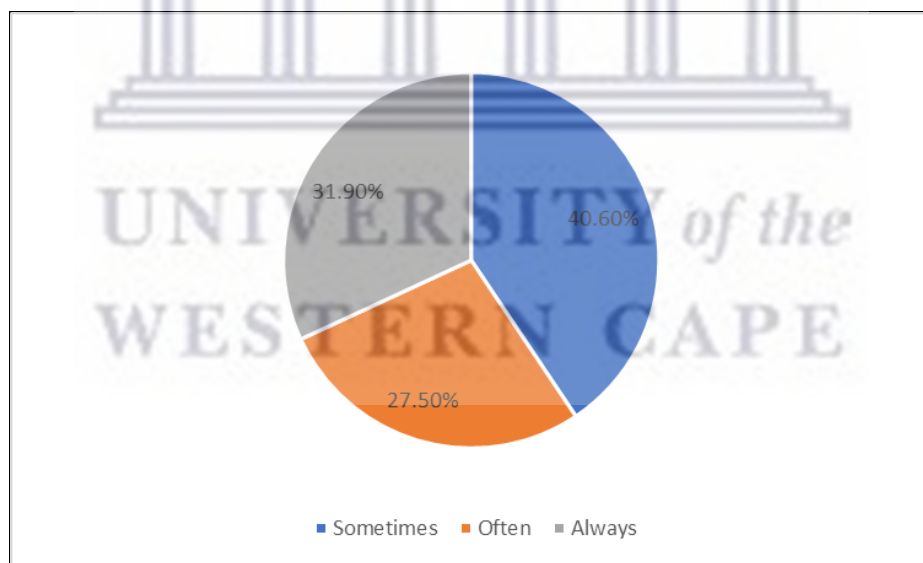


Figure 5.7: Awareness of needed information in percentages (N=69)

a) Awareness of needed information according to level of study

An analysis was conducted to examine whether there were differences in the student's awareness of needed information across different academic years. By comparing the results of the analysis of the participants' responses across different year levels, the study aimed to identify whether there are any specific challenges that students face in understanding what information they need at different stages of their academic journey. This information could be valuable for academic institutions and libraries to design targeted interventions and support programmes to assist students in knowing what resources they need to succeed in their studies.

For example, workshops could be tailored to specific levels of study and focus on developing skills for identifying and articulating research questions, developing effective search strategies, and evaluating sources for relevance and credibility. In addition, librarians could offer one-on-one consultations with students to help them identify and narrow down their research topics, develop effective search strategies, and guide on locating and evaluating sources. Librarians could also work with faculty to create research guides specifically tailored to individual courses or assignments. These guides could include recommended sources, search strategies, and tips for evaluating sources. The responses of the participants were categorised according to their academic year, the results are presented in Table 5.6.

Table 5.6: Awareness of information needed according to year of study (N=69)

	Sometimes						Often						Always					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
Awareness	5	9	7	4	3	28	4	3	4	1	7	19	5	3	6	2	6	22
%	7	13	10	6	4	41	5	4	5	1	10	28	7	4	9	3	9	32

5.2.2.6 Frequency of library usage

Students were asked to indicate how frequently they used the library by choosing either often, sometimes, or never. This question was asked to gather information on the usage patterns of the library by students. This information could be useful in understanding the demand for library services and resources, identifying areas for improvement, and making informed decisions regarding resource allocation and strategic planning.

For example, if a large percentage of students reported that they never used the library, it would be necessary to implement outreach programmes to promote the library's resources and services or to improve the usability of the library's website or physical space. Similarly, if students reported that they often used the library, it would be necessary to increase the library's opening hours, purchase more resources or make more study spaces available.

All 74 mechanical engineering students responded to this question. Figure 5.8 reflects that 45 (60.8%) sometimes used the library, 17 (23%) never used the library and 12 (16.2%) often used the library.

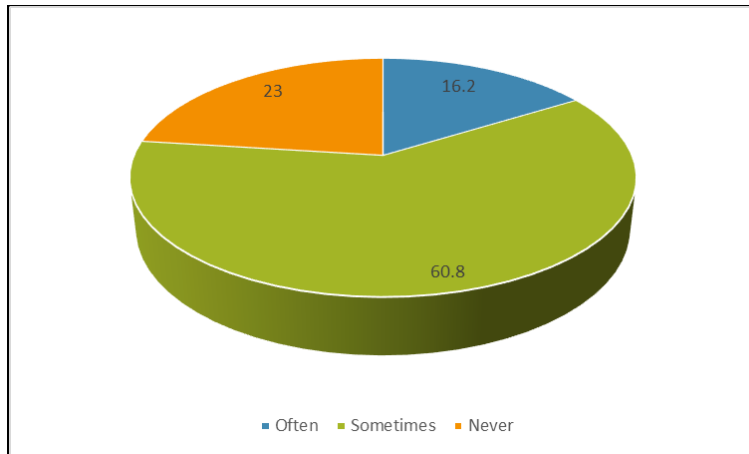


Figure 5.8: Library usage in percentages(N=74)

a) Library usage according to level of study

The data were further analysed to compare library usage across different levels of study to identify potential differences. By looking at the data in Table 5.7, academic institutions and libraries could gain insights into how often students from different year levels use the library. This information could be useful for designing targeted interventions and support programmes to promote library usage amongst students who may not be utilising library resources as frequently as they should be. Additionally, the data could help libraries and academic institutions to allocate resources effectively to meet the needs of different student populations. For example, if it is found that first-year students are not using the library as frequently as upper-level students, then library staff may need to provide more outreach and programming specifically aimed at first-year students to encourage them to use the library more frequently.

The data could also be used to inspire research into what influences students to use the library or other sources, how the use of mobile devices impacts students' library usage, the barriers to access and use of library resources for underrepresented student groups, the relationship between library usage and academic performance, the impact of the physical layout and

design of the library on student information behaviour and usage patterns, and the role does social influence. The responses of the participants were categorised according to their academic year, the results are presented in Table 5.7.

Table 5.7: Library usage according to year of study (N=74)

	Never						Sometimes						Often					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
Library usage	3	2	3	1	8	17	9	14	11	6	5	45	2	0	4	0	6	12
%	4	3	4	1	11	23	12	19	15	8	7	61	3	0	5	0	8	16

5.2.2.7: Keeping up with new developments

A question was asked to determine how students keep up to date with new developments and thus help academic institutions and libraries design interventions to assist students in staying current with relevant information. One potential intervention could be to offer workshops on how to use social media to access and share information related to their field. Another intervention could be to provide access to online discussion forums.

The respondents were given the following options to answer this question: Looking at the content's pages of printed journals in the library; looking at the contents pages of electronic journals; looking at the contents pages of new books in the library; looking at the contents pages of e-books; personal communication of with fellow students and discussions on social networks. Of the 74 students who responded to the question, most selected the option of

discussions on social media networks 49 (66%), whereas 47 (64%) chose the option of personal communications with fellow students. The results are summarised in Figure 5.9.

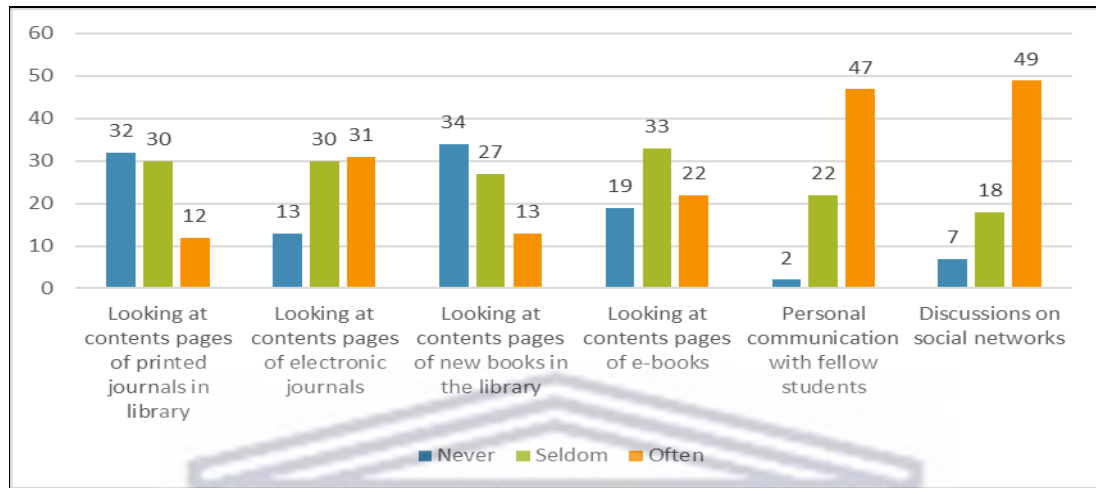


Figure 5.9: Keeping up with new developments (N=74)

a) Keeping up with new developments according to level of study

The responses to the question on keeping up with new developments were further analysed in terms of the level of study. The analysis was conducted to determine whether there was a difference in how students from different levels of study kept up with new developments in their field. This information could be useful for academic institutions and libraries to design targeted interventions and support programmes to assist students in staying up-to-date with the latest information in their field. For example, if it was found that first-year students primarily rely on social media to stay up to date, then the library or academic institution might consider offering workshops or resources on how to use social media for academic purposes. The responses of the participants were categorised according to their academic year, the results are presented in Table 5.8.

Table 5.8: Keeping up with new developments according to year of study (N=74)

New developments	Never							Seldom							Often						
	E	1	2	3	4	0	T	E	1	2	3	4	0	T	E	1	2	3	4	0	T
Contents pages of new journals %	6	8	5	3	6	4	3	2	6	9	4	8	1	3	5	2	2	0	3	0	1
	8	11	7	4	8	5	4	3	8	1	5	1	1	4	7	3	3	0	4	0	1
Contents pages of e-journals %	2	3	2	2	4	2	1	4	8	1	4	2	2	3	8	5	6	1	1	1	3
	3	4	3	3	5	3	1	5	1	1	5	3	3	4	1	7	8	1	1	1	4
Contents pages of new library books %	8	9	1	3	1	3	3	7	4	8	4	3	1	2	3	3	2	0	4	1	1
	1	12	1	4	1	4	4	9	5	1	5	4	1	3	4	4	3	0	5	1	1
Contents pages of new e-books %	2	3	6	2	6	3	1	8	7	8	3	6	1	3	4	6	3	2	6	1	2
	3	4	8	3	8	4	2	1	9	1	4	8	1	4	5	8	4	3	8	1	2
Communication with fellow students %	0	0	1	0	1	0	2	4	4	6	3	5	0	2	1	1	1	4	8	2	4
	0	0	1	0	1	0	3	5	5	8	4	7	0	3	1	1	1	5	1	3	6
Social networks %	0	1	1	0	3	2	7	1	5	3	1	7	1	1	1	9	1	6	7	2	4
	0	1	1	0	4	3	9	1	7	9	1	9	1	2	1	1	1	8	9	4	6



5.2.3 Library resource usage

The third section of the questionnaire dealt with library resource usage.

5.2.3.1 Print and electronic resources usage

A question was asked to understand the preferences of students in using different types of resources, namely printed, electronic, or both formats. This information could be useful for educators or librarians in deciding the types of resources to provide for students in different learning environments.

Interventions could involve increasing the availability of electronic resources, such as e-books, online journals, and databases, providing training on how to use electronic resources effectively, and promoting the use of electronic resources through various means such as advertisements, workshops, and tutorials. Additionally, educators could consider providing a combination of both printed and electronic resources to cater to the diverse preferences of students.

Based on the responses, 27 (36.5%) of the students preferred electronic resources, 36 (48.6%) preferred both electronic and printed resources and 11 (14.9%) preferred printed resources. This suggested that most students (85.1%) preferred to use electronic resources or a combination of both, highlighting the importance of providing access to electronic resources in educational settings. Figure 5.10 presents the results.

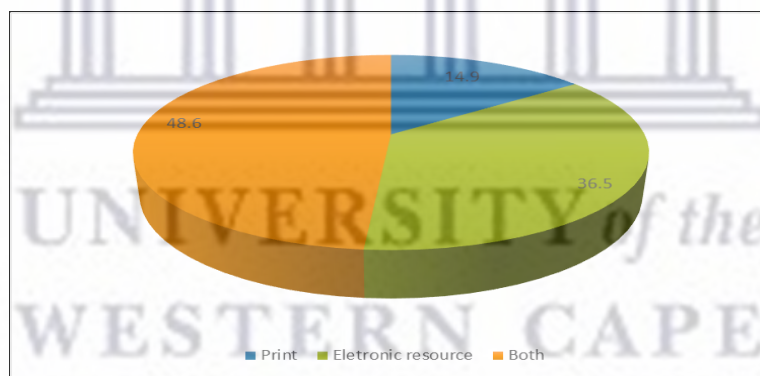


Figure 5.10: Resource use (N=74)

5.2.3.2 Mechanical engineering library collection

A question was asked to assess the perception of participants of the quality of the mechanical engineering library collection. This information could be useful for librarians or academic staff to identify areas that require improvement or enhancement to provide better resources to students. Interventions that could be implemented might include conducting a needs

assessment to identify areas that require improvement, increasing the budget for acquiring new resources, and providing training for librarians on how to improve the collection. Additionally, seeking feedback from students regularly can also help to identify gaps in the collection and tailor resources to the needs of students.

Based on the responses, most participants (41.9%) rated the collection as good, (20.3%) rated the collection excellent, while a significant proportion rated it as fair (31.1%), and a few rated it as poor (6.8%). These findings suggested that there was room for improvement in the collection, particularly for those who rated it as fair or poor. Figure 5.11 reflects the data.

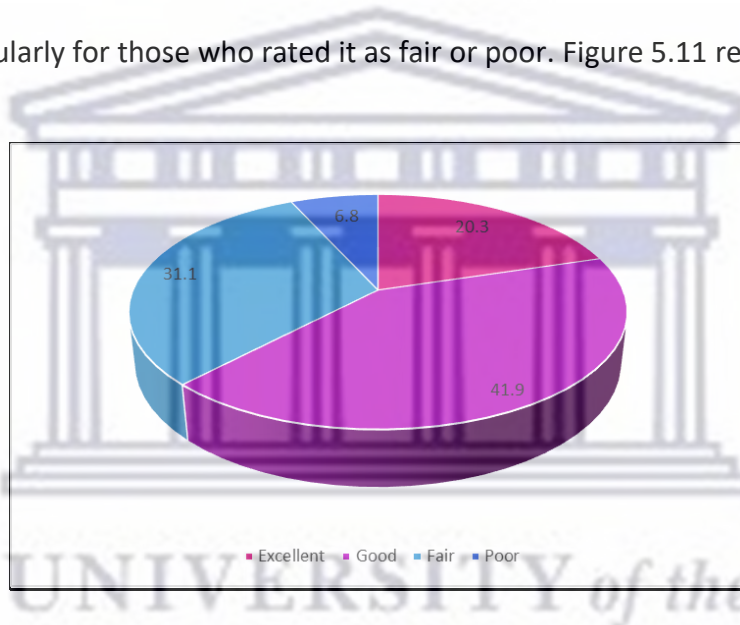


Figure. 5.11: Mechanical engineering library collection (N=74)

The evaluation of the library collection per year level were also determined. Results are summarised in Table 5.9.

Table 5.9 Mechanical engineering library collection according to year of study

Options	ECP	1st level	2nd level	3rd level	4th level	No response
Excellent	4	1	4	2	1	3
%	3	1	3	1	1	2
Good	5	7	6	2	9	0
%	4	5	4	1	7	0
Fair	4	5	5	2	6	1
%	3	4	4	1	4	1
Poor	0	2	1	1	0	1
%	0	1	1	1	0	1
Total	13	15	16	7	16	5
%	10	11	12	5	12	4

5.2.3.3 Database usage

A question was asked to gather information on the databases that students used to find information, as well as the frequency of their usage. This information could be useful for librarians or academic staff to identify which databases are most popular among students, and to make decisions on which databases to subscribe to or promote.

Interventions that could be implemented might include promoting the use of library subscription databases through workshops, tutorials, or training sessions, highlighting the benefits of using these databases, and improving the user interface of the databases to make them more user-friendly. Additionally, librarians could collaborate with faculty to incorporate the use of subscription databases into course assignments or assessments and to encourage students to use them more frequently.

Based on the responses, most students (45) reported using Google Scholar often, while the library subscription databases were not used as frequently. This suggested that students

preferred to use Google Scholar over the library subscription databases, which may have had implications for the budget allocation for subscription databases. Figure 5.12 presents the data.

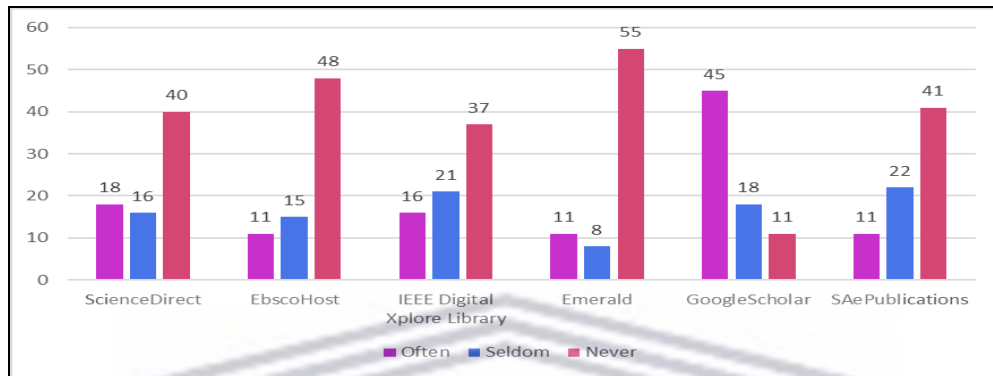


Figure 5.12: Database usage frequency (N=74)

a) Database usage frequency according to level of study

A question was asked to investigate whether database usage varied across different levels of study. This information could be useful for librarians and academic staff to design interventions that cater to the specific needs of students at different stages of their academic journey.

Interventions might include providing targeted training and support for students at different levels of study, based on the specific database usage patterns identified. For example, first-year students may benefit from workshops on basic database searching skills, while senior students may require more advanced training on how to use specific databases or how to conduct advanced searches. Moreover, promoting the use of databases through targeted marketing campaigns or incorporating the use of databases into course assignments or assessments could encourage students to use them more frequently.

The research results revealed that there is low database usage across all levels of study and there is not much variation in the pattern of database users across the different levels. Table 5.9 summarizes the findings.

Table 5.10: Database usage according to level of study (N=75)

Databases	Never						Seldom						Often					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
ScienceDirect	7	8	9	5	11	40	4	4	5	0	3	16	3	4	4	2	5	18
%	9	11	12	7	15	54	5	5	7	0	4	22	4	5	5	3	7	24
Ebscohost	8	11	11	6	12	48	4	3	3	1	4	15	2	2	4	0	3	11
%	11	15	15	8	16	65	5	4	4	1	5	20	3	3	5	0	4	15
IEEE Digital	7	10	10	4	6	37	7	4	4	1	5	21	0	2	4	2	8	16
%	9	14	14	5	8	50	9	5	5	1	7	28	0	3	5	3	11	22
Emerald	11	13	13	6	12	55	2	1	1	1	3	8	1	2	4	0	4	11
%	15	18	18	8	16	74	3	1	1	1	4	11	1	3	5	0	5	15
Googel Scholar	4	2	2	0	3	11	3	5	6	1	3	18	8	8	9	6	10	45
%	5	3	3	0	4	15	4	7	8	1	4	24	11	11	12	8	14	61
SAePublications	8	8	9	6	10	41	6	7	4	0	5	22	0	1	5	1	4	11
%	11	11	12	8	14	55	8	9	5	0	7	30	0	1	7	1	5	15

5.2.3.4 Library home page accessibility

A question was asked to determine whether students found it easy to access databases through the library website. This information could be useful for librarians and educators to improve the usability of the library website and to ensure that students have easy access to the resources they need.

Interventions to help students who had difficulty accessing databases through the library home page might improve the user interface and navigation of the website, providing clear and concise instructions on how to access and use databases, and providing training and support on how to use the library website effectively. Additionally, promoting the use of library resources through targeted marketing campaigns or incorporating the use of databases into course assignments or assessments can encourage students to use them more frequently. Finally, providing access to subject librarians who can provide individualised support and guidance to students could be beneficial.

Of the 72 responses received, 33 (45.8%) students found it easy, 26 (36.1%) were not sure and 13 (18.1%) found it difficult to access databases through the library website. Figure 5.13 presents the data.

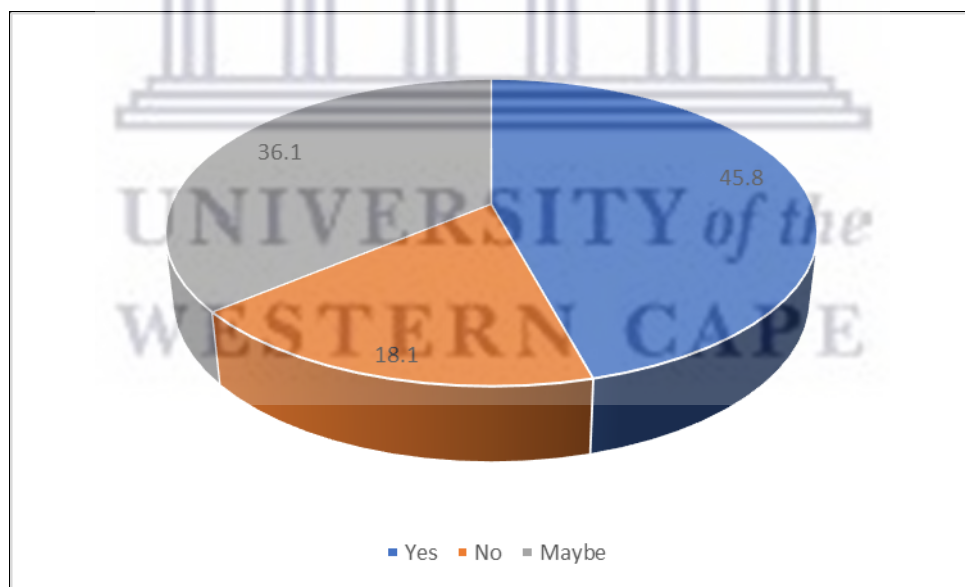


Figure 5.13: Library home page access (N=72)

5.2.3.5 Mechanical Engineering LibGuide usage

LibGuides are online research guides designed to assist library users with research tasks, navigating resources, and finding relevant information. They are created by librarians and can cover a wide range of topics, from general research skills to subject-specific guides for different academic disciplines. Students were asked about the Mechanical Engineering LibGuide usage to gain insights into the effectiveness of these library resources and identify areas where improvements or enhancements are needed to support student research and information-seeking behaviour.

Of the 72 responses received, 31 (43.1%) students were not sure whether they used the Engineering LibGuide, 21 (29.2%) acknowledged using it, while 20 (27.8%) never used the LibGuide. Figure 5.14 reflects the results.

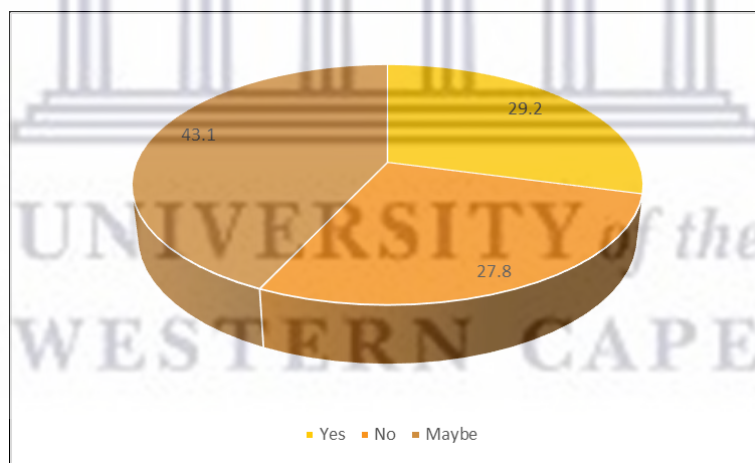


Figure 5.14: Mechanical Engineering LibGuide usage (N=72)

5.2.3.6 Information sources

A question was asked to gather data on the most frequently used types of information sources by students when searching for information related to their field of study. Interventions to improve the usage of reliable types of sources could involve promoting the use of journal

articles, conference papers and proceedings, and subject-specific databases through targeted outreach and training efforts. These types of sources are more reliable and provide more up-to-date information compared to other sources like Wikipedia or general books on mechanical engineering. Providing access to high-quality textbooks and reference materials would also ensure that students have access to authoritative information sources.

The sources often used were Google (90.5%), lecture notes (87.8%), websites (86.5%), personal notes (72.9%), textbooks (67.6%), online dictionaries (54.1%), general books on mechanical engineering (48.6%) and journal articles (40.5%). Not used often were conference proceedings and paper presentations, subject dictionaries, encyclopaedias, and blogs. Table 5.11 presents the results.

Table 5.11: Information sources (N=74)

Information Sources	Frequency			
	Often	Seldom	Never	Total
Journal articles	30	28	16	74
Textbooks	50	20	4	74
Conference attendants	6	23	45	74
Personal notes or files	54	13	7	74
Conference papers and proceedings	7	29	38	74
Lecture notes	65	8	1	74
General books on mechanical engineering	36	29	9	74
Subject encyclopaedia	18	31	25	74
Wikipedia	24	25	25	74
Subject dictionaries	14	33	27	74
Online dictionaries	40	21	13	74
Websites	64	7	3	74
Google	67	6	1	74
Blogs	15	26	33	74
Wikis and other social media	20	26	28	74

5.2.3.7 Information sources used for given assignments or projects

A question was asked to understand the sources that students use to complete their assignments or projects in the field of mechanical engineering, specifically in the subjects of fluid mechanics, mechanics of machines, mechanics, hydraulic machines, thermodynamics, mechanical engineering drawing, and communication studies. This information could help identify any gaps in the availability or accessibility of relevant materials and resources for students and could inform interventions to improve support for student learning and success.

Based on the responses reflected in Figure 5.15 and Table 5.11, some possible interventions that could address any gaps or issues identified might include providing more resources or support for students who are using less commonly accessed sources on their subjects. In addition, collaborating with faculty and instructors to ensure that assignments and projects are designed in ways that support student access to relevant materials and sources. Figure 5.15 and Table 5.12 present the results.

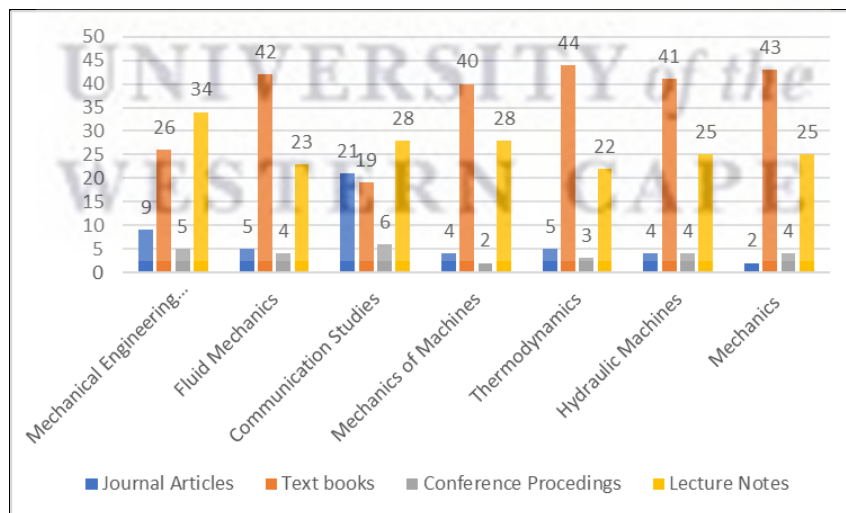


Figure 5.15: Information sources on specific subjects(N=74)

Table 5.12: Information sources used for assignments/projects

Assignments/Projects	Information sources used for assignments or projects			
	Journal articles	Textbooks	Conference proceedings	Lecture Notes
Mechanical Engineering Drawings	9	26	5	34
Fluid Mechanics	5	42	4	23
Communication Studies	29	19	6	8
Mechanics of machines	4	40	2	28
Thermodynamics	5	44	3	22
Hydraulic Machines	4	41	4	25
Mechanics	2	43	4	25
Total	58	255	28	165

5.2.3.8 Awareness of engineering e-journals

A question was asked to determine the level of awareness of engineering e-journals amongst students and whether there was a need to promote this. access to these resources and thus improve students' academic performance and research skills. Interventions to improve awareness if needed might be to provide more targeted communication to students about the availability and benefits of e-journals, such as through email newsletters, social media posts, or posters around the library. Another intervention could be to provide training sessions or workshops on how to search for and use e-journals.

Of the 74 students who answered the question, 33 (44.6%) students responded that they were aware, while 27 (36.5%) were not, and 14 (18.9%) students were not sure of the availability of engineering e-journals in the library. Figure 5.16 presents the results.

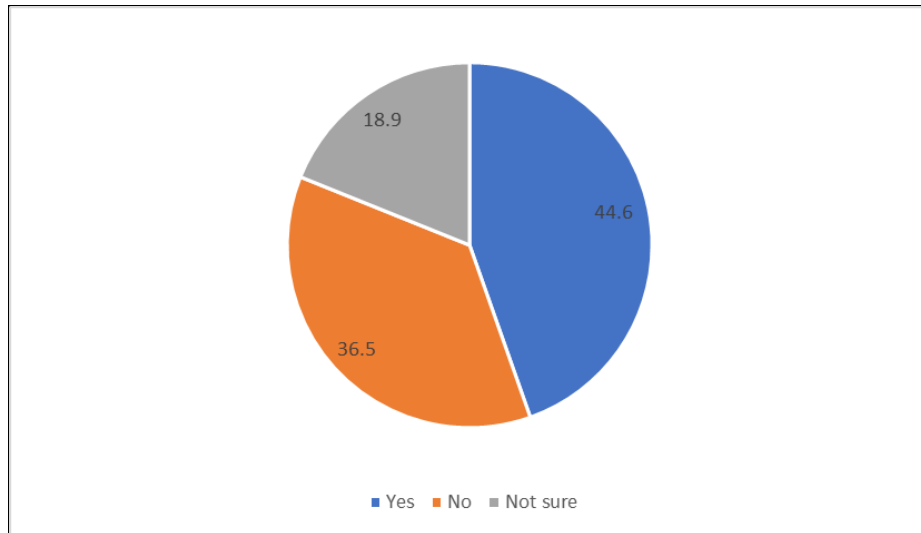


Figure 5.16: Awareness of e-journals (N=74)

5.2.3.9 Search tools usage

A question was asked to determine which search tools students using. were search tools for their academic work or research. This information would inform academics and librarians whether there might be a need for interventions to improve students' awareness and usage of multiple, varied search tools, including Google, Google Scholar databases, e-books, and the library catalogue to conduct comprehensive research and thus ensure that they are finding varied, relevant and reliable information for their academic work.

The results revealed that students mostly used Google (43; 58.1%) but also used Google Scholar (16; 21.6%), databases (7; 9.5%), e-books (5, 6.8%) and the library catalogue (3; 4.1%).

Figure 5.17 reflects the data.

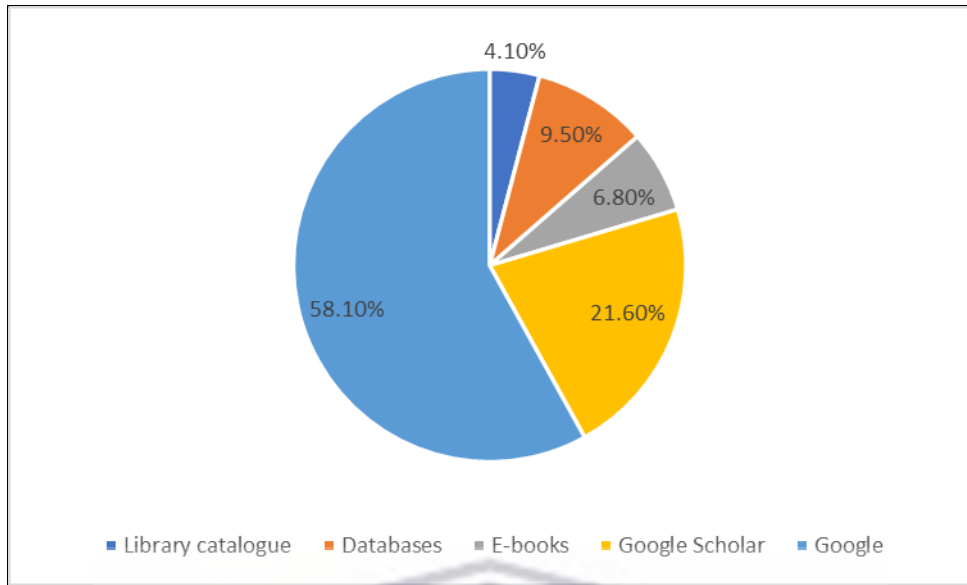


Figure 5.17: Search tools usage (N=74)

5.2.3.10 Reasons for use of selected information search tools

Participants were asked to state why they chose to use specific information search tools such as Google, Google Scholar, databases, or the library catalogue, as indicated in their answers to the previous question. This information could help the researcher gain insights into the factors that influence users' information-searching behaviour, which could inform interventions to improve search experiences. For example, interventions could be developed to improve users' awareness and usage of many alternative search tools for comprehensive and accurate results, as stated above. Additionally, if participants found some search tools difficult to use, researchers could consider developing more user-friendly interfaces that increase their discoverability and usability.

Table 5.13 presents the findings of the thematic analysis of the qualitative data in the form of the students' explanations, which were captured through this question.

Table 5.13: Reasons for using selected information search tools (N=74)

Themes	Sub-themes	Examples of students' statements
Google as a search tool	Relevance and reliability	<ul style="list-style-type: none"> • Google is always relevant to use • Google always gives answers I need • Rely upon Google • Google is never wrong • Google provide valid information • it gives me all the information I need • has everything I need
	Abundance of information	<ul style="list-style-type: none"> • Google gives a lot of information to choose on • Google always gives answers, easily accessible • That's why I usually get more information • More information about what I am looking for • Widest range
	Convenience and ease of use	<ul style="list-style-type: none"> • Google is free, fast and reliable • Google is easier. • Google is simple to navigate • Every website is there on Google • it's easy to use • Can copy and paste • easy • It is fairly simple to use. • it's just easier to scroll down and find keywords • easy to search • It easily accessible • easy to access • easy access • Easiest and wide range • It's easier
	Familiarity	<ul style="list-style-type: none"> • I trust Google a lot; has a lot of information that I lack • I'm used to Google so it is easier. • I stick to what I know, so I do not use other browsers, Besides Google or Duck Duck Go. • because it's the only tool I'm familiar with • I AM USED TO IT
	Exclusivity	<ul style="list-style-type: none"> • Never use other platforms. • This works better for me.
Google Scholar as a search tool	Validity of information	<ul style="list-style-type: none"> • Provides valid information
	Research methodology	<ul style="list-style-type: none"> • Because I studied to do so in research methodology • It's the one database that I have been told and exposed to when conducting research
	Efficiency and effectiveness	<ul style="list-style-type: none"> • Gives me information related to my search and helps me narrow my search • I use it in sequence until I find the exact relevancy • Google Scholar is simple to navigate.
E-books as a search tool	Accessible	<ul style="list-style-type: none"> • There's a search place on the university website library • I download them

Other search tools	Use of multiple search tools Limited access	<ul style="list-style-type: none"> • I use all of them, but I couldn't click all of them in the above question. • I only got one
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5.2.4 Evaluating retrieved information

The fourth section of the questionnaire asked questions about how retrieved information is evaluated.

5.2.4.1 Criteria used by students to evaluate information sources

An open-ended question required students to list the criteria they use to evaluate sources of information. The purpose of asking this question was to gain insights into their approach to assessing sources of information. By analysing the data provided through the students' responses, the researcher would be able to identify any gaps or areas where the students may need further support in developing their critical thinking skills and evaluating information sources. For example, if the analysis of the data revealed that students relied heavily on the popularity of a source or the ease of access to information, this could indicate a need to focus on helping them develop a more critical approach to using sources. Alternatively, if the students appeared to have a good understanding of how to evaluate sources but struggle with identifying relevant information, this could indicate a need to provide more guidance on how to formulate effective research questions and search strategies.

Insights gained through the analysis of the data might lead to interventions, such as providing instruction on how to evaluate information sources critically, including identifying biases and assessing the credibility, accuracy, reliability and relevance (CRAAP) of sources. Other interventions could be encouraging students to use a variety of sources and to consider multiple perspectives on a topic.

The findings of the thematic analysis of the qualitative data provided through the students' responses to the question are presented in Table 5.14.

Table 5.14: Criteria used by students to evaluate a source of information (N=74)

Theme	Examples of statements made by students
Theme 1: Students evaluate a source based on the visual elements	Look at pictures I check for pictures
Theme 2: Students assess a source based on its currency, relevance, authority, accuracy, and purpose (CRAAP)	I do a CRAAP test
Theme 3: Students verify the reliability of a source	Check reliability and contextual usefulness I make sure it is sourced and reference to make sure it is reliable
Theme 3: Students confirm the relevance of information from a source	I determine the most relevant and accurate information i search Google and read books of the relevant topic to confirm its validity. Reading through the work and assessing if it is relevant and suitable to the task at hand Check the information again and make sure that it is relevant to my topics By searching full text database
Theme 4: Students verify the currency of the information source	I check if it's accurate and up to date Check for the information's currency
Theme 4: Students determine the purpose behind the information source and whether there is any bias	Check for the information's purpose
Theme 5: Students check who is the author or publisher of the information, their credentials or qualifications	Identify which are professional and can be recited as fact
Theme 6: Students make sure the information is accurate and supported by evidence or sources.	I verify accuracy of information Look at the references Study it using internet Cross references Googling it 1st. Then using research papers for more detail. Looking at the content of the source. i try find other sources to confirm the information.

<p>Theme 7: Students analyse the references cited by the source</p>	<p>Try to find sources to confirm the information and make sure it is sourced and referenced to ensure its credibility." I keep a list of sources, evaluate them based on certain criteria, and use them to formulate a solution or answer questions." Referencing other sites makes things easier since there are a variety of resources to look at. It is important to find multiple sources and accurately state what information came from each source I cross-reference the information by noting down and referencing the sources</p>
<p>Theme 8: Students verify the source through cross-referencing</p>	<p>I verify the accuracy of information by cross-referencing it with other sources. I first Google it, then use research papers to get more detail and cross-reference the information. I try to find sources that can confirm the information. I look for references from other sites and cross-reference them. I compare different sources to see if the information is consistent. I read and compare the information against other sources. I ask fellow students and close lectures to get their opinions and cross-reference the information. I read through the information to familiarise myself with the content and cross-reference it. I check if there is more written about it in other books and cross-reference the information.</p>
<p>Theme 9: Miscellaneous criteria for evaluation of sources</p>	<p>The source appears to be of good quality. The user interface is user-friendly, and some sources provide well-summarized information. I haven't encountered this source before. All the information is available in the source. I can recall the information Different sources complement each other in providing comprehensive information.I often use the internet Its on the Internet</p>

5.2.4.2 Criteria usage to evaluate information

A question was asked about the criteria students used to evaluate the information they retrieved and to indicate the frequency of their use of the criteria of reliability, objectivity, relevance, accessibility, currency, credibility, authority; appropriateness; suitability, and website domain. Thus, the researcher sought to determine how students seek, evaluate, and use information to meet their information needs.

An understanding of possible gaps in this aspect of information behaviour in students could lead to interventions, such as training programmes or workshops to educate students on the importance of using formal criteria to evaluate retrieved information sources, the provision of guidance on how to use appropriate tools to identify and evaluate the quality of information sources, and the incorporation of these skills into classroom activities and assignments to ensure that students develop and practice them regularly. The results of the quantitative data provided through the students' responses to the question are presented in Figure 5.18.

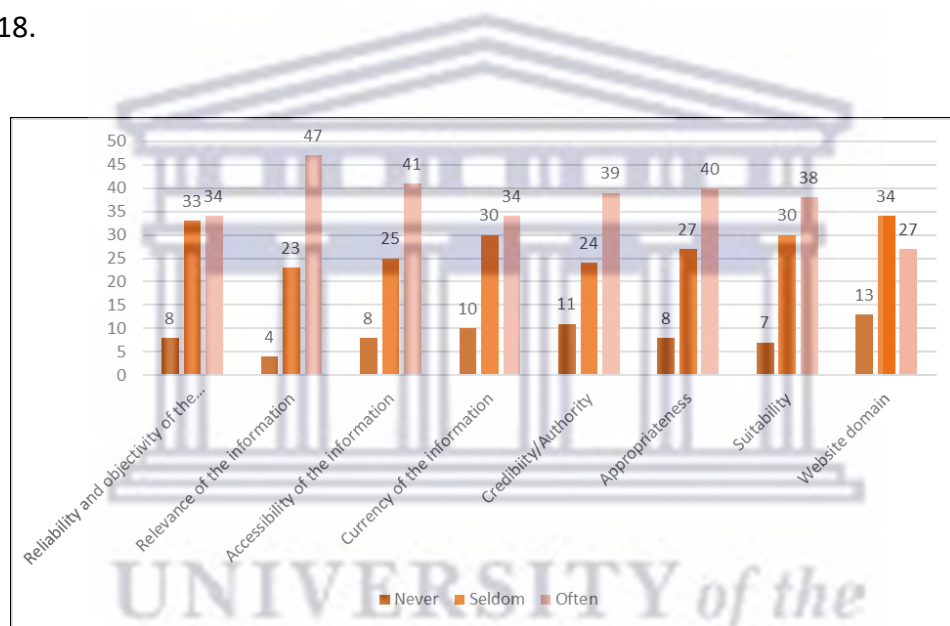


Figure 5.18: Criteria used to evaluate information

a) Criteria usage to evaluate information according to level of study

To determine whether there were differences in the use of criteria for evaluating information amongst students of different year levels, an analysis of the responses to the question was conducted. Thus, an attempt was made to identify any potential patterns or differences in how students of different year levels approach the evaluation of information. Understanding potential differences could help educators and institutions to tailor interventions that are appropriate for students at different levels of study. For example, students in lower levels of

study may benefit from more explicit instruction on how to evaluate sources, while those in higher levels may need more advanced training to develop their skills further. Moreover, students in higher levels of study may be expected to conduct more in-depth research compared to those in lower levels. They may, therefore, need to apply evaluation criteria more rigorously. In addition, students at higher levels of study may need to evaluate a broader range of sources and consider more complex issues when evaluating information.

Possible interventions to address any gaps identified through this analysis could include targeted training programmes or workshops for students in particular year levels who may be struggling with using formal criteria to evaluate information. Teachers and educators could also incorporate more explicit instruction on information evaluation skills into the curriculum to ensure that students across all year levels receive consistent guidance on these critical skills. Additionally, schools could invest in developing resources, such as guides or handbooks to assist students in using the criteria of reliability, objectivity, relevance, accessibility, currency, credibility, authority; appropriateness; suitability, and website domain when evaluating information. Additionally, the criteria used to evaluate information sources may vary. For example, scientific research may place more emphasis on objectivity and reliability, while humanities research may place more emphasis on authority and currency.

The results of the analysis of the quantitative data provided through the students' responses to the question in terms of level of study are presented in Table 5.15.

Table 5.15: Criteria to evaluate information according to year of study (N=74)

Criteria	Never						Seldom						Often					
	E	1	2	3	4	T	E	1	2	3	4	T	E	1	2	3	4	T
Reliability Objectivity %	1	2	2	1	2	8	8	5	6	3	11	33	6	9	10	3	6	34*
	1	3	3	1	3	11	11	7	8	4	15	44	8	12	13	4	8	45
Relevance %	0	1	0	2	1	4	6	5	5	4	3	23	8	10	13	1	15	47
	0	1	0	3	1	5	8	7	7	5	4	31	11	14	18	1	20	63
Accessibility %	1	2	1	3	1	8	4	7	6	2	6	25	9	7	11	2	12	41
	1	3	1	4	1	11	5	9	8	3	8	34	12	9	15	3	16	55
Currency %	3	3	2	1	1	10	6	6	7	3	8	30	5	7	9	3	10	34
	4	4	3	1	1	14	8	8	9	4	11	41	7	9	12	4	14	46
Credibility Authority %	5	3	2	1	0	11	4	6	5	3	6	24	5	7	11	3	13	39
	7	4	3	1	0	15	5	8	7	4	8	32	7	9	15	4	18	53
Appropriate- ness %	3	1	2	2	0	8	5	9	3	1	9	27	6	6	13	4	10	40*
	4	1	3	3	0	11	7	12	4	1	12	36	8	8	17	5	13	53
Suitability %	3	1	2	1	0	7	3	10	9	1	7	30	8	3	7	5	12	38*
	4	1	3	1	0	9	4	13	12	1	9	40	11	4	9	7	16	51
Website domain %	5	3	2	1	2	13	6	7	8	3	10	34	3	6	8	3	7	27
	7	4	3	1	3	18	8	9	11	4	14	46	4	8	11	4	9	36

5.2.5 Challenges faced in obtaining information

This section of the questionnaire aimed to determine challenges experienced by students in obtaining needed information.

5.2.5.1 Access challenges

Students were asked to identify the difficulties they faced when accessing information by choosing from a list of options: inadequate resources in academic libraries, a lack of access to library materials, poor library services, library rules or procedures, and other factors. This data was collected to identify possible areas for improvement in library services, to guide resource allocation, and to inform policy decisions related to library access.

Interventions that could be put in place to address any gaps might include improving library resources, through increased funding for library acquisitions, expanding access to electronic resources, or enhancing library spaces and facilities. In addition, training library staff to provide better support to students, developing new programmes or services to meet student needs, or improving communication and outreach efforts to ensure that students are aware of available resources and services. Reviewing library policies to ensure that they are clear, consistent, and user-friendly could also be an appropriate intervention. Conducting ongoing evaluation and feedback would also be valuable to evaluate the effectiveness of any interventions put in place and to gather feedback from students to ensure that their needs are being met and that library services and resources continue to evolve to meet changing needs over time.

Of the 74 participants 22 (29.7%) faced difficulties due to inadequate resources in the academic library, 30 (40.5%) due to a lack of access to library material, 17 (23%) due to library procedures and rules and 4 (5.4%) due to poor library service. Only 1 (1.4%) participant chose the “other” option but did not provide a reason. The results of the analysis of the quantitative data provided through the students’ responses to the question are presented in Figure 5.19.

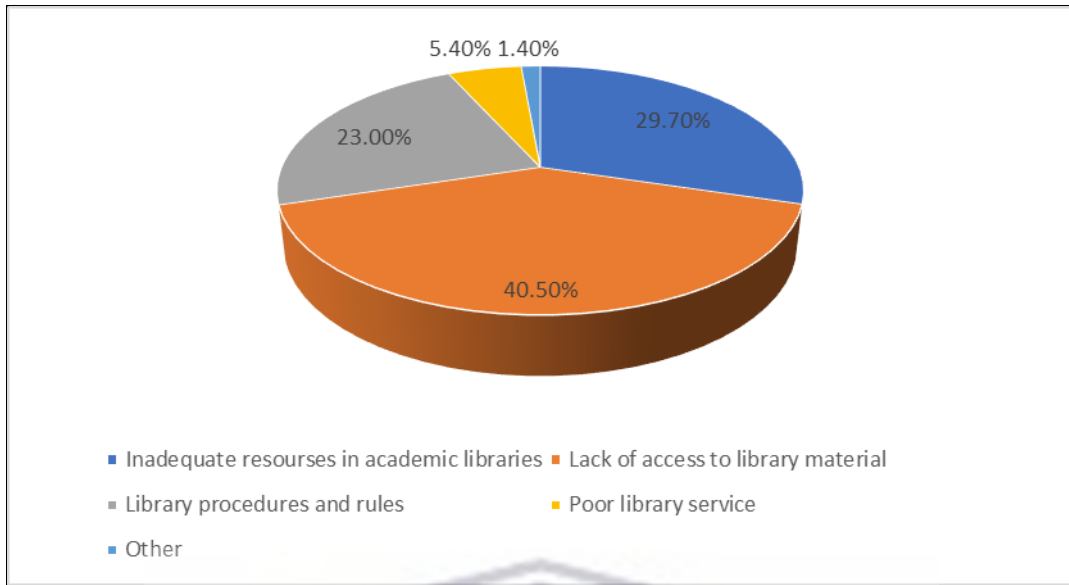


Figure 5.19: Access challenges (N=74)

5.2.5.2 *Reasons for access challenges*

An open-ended question was posed to identify reasons for challenges in accessing information at the academic library. The responses were thematically analysed, thereby allowing for a deeper exploration of their experiences and perspectives on this topic, which could lead to interventions if needed. For example, if students cited inadequate resources as a challenge, interventions could include increasing the availability of print and electronic materials, enhancing library spaces and facilities, or increasing funding for library acquisitions. If students cited poor library services as a challenge, interventions could include training library staff to provide better support to students, developing new programmes or services to meet student needs for information literacy skills or providing individualised support to help students navigate the library. The thematic findings of the analysis of the qualitative data provided through the students' responses to the question are presented in Table 5.16.

Table 5.16: Reasons for access challenges (N=74)

Themes	Sub-themes	Examples of statements made
Theme 1: COVID-19 prevented access	1 COVID-19 restrictions making it difficult to access the library 2 Library closures due to the pandemic 3 Limited library hours that do not accommodate students' schedules or preferences 4 Infrequent use of the library by some students, potentially due to the pandemic 5 Reduced access to physical materials, such as books, due to the pandemic	1 "COVID-19 makes it difficult to access the library resources that I need for my research." 2 "Unfortunately, the library is closed due to the pandemic, which is frustrating for students who rely on it for their academic work." 3 "The library's working hours are minimal, and they do not open at night, which can be inconvenient for students who prefer working on their school work at night." 4 "Due to the pandemic, there is no access to physical books, and this has made it difficult for me to conduct research and complete assignments." 5 "Although I do not use the library often, the pandemic has made it even more challenging to access its resources when I need them."
Theme 2: Not enough relevant sources	1 Library lacks the information needed or does not have recommended books or textbooks 2 Shortage of resources or not enough resources available 3 Old versions of books that are not relevant to new topics covered in class 4 Some books are not available in the library 5 Difficulty in finding specific information, leading to a need to search for alternative resources	1 "We are just not adequately well aware of how to seek information, and sometimes the library lacks the information we need." 2 "Sometimes very busy and lack of resources" 3 "Library has old versions and no recommended books or textbooks." 4 "There are books which are not in the library." 5 "Sometimes I can browse for an hour looking for information, only to find that it is not the exact information I am looking for, so I opt for other resources" .
Theme 3: Not library literate	1 Difficulty in finding resources 2 Inability to use the library 3 A lack of understanding of materials 4 Complicated information organisation	1 "Sometimes I cannot find the textbook I need in the online library." 2 "I struggle to use the library." 3 "... not understanding the concepts." 4 "The arrangement of information makes it quite difficult".
Theme 4: A lack of search skills	1 Difficulty in finding resources 2 Unable to search for information	1 "We are just not adequately well aware of how to seek information, and sometimes the library lacks the information we need." 2 "... not knowing how to search for information."
Theme 5: Library busy	1 Shortage of resources 2 Library staff fully occupied	1 "... sometimes very busy and lack of resources." 2 "... sometimes they are busy."
Theme 6: Inadequate library service	1 Inadequate collection management 2 Poor service delivery	1 "They try to keep everything at a good point but I do not find what is required." 2 "Poor service."

Theme 7: Resources not available	1 Shortage of resources 2 Librarians make an effort to assist	1 "Fewer materials, when the book you looking for is already taken by someone." 2 "Librarians try to help by all means but books already taken by another student."
Theme 8: Short loans	1 Textbooks unavailable because on short loan	1 "Books I need are on short loan."
Theme 9: Library rules	1 Restricted library access due to student card issues 2 Restricted access to certain information due to clearance issues 3 Limited library hours designated for student use 4 The predominance of library rules and regulations	1 "When student card not up to date library access is not allowed." 2 "I'm currently doing a project and every time I reach a relevant article. They say I do not have the clearance to access this information." 3 "Libraries have hours for students to use ... " 4 "There are rules to follow."
Theme 10: Library opening times	1 Limited time for searching for information 2 Library hours may not suit students' work schedules	1 "Library closes early." 2 " ... library does not open at night prefer studying at night."
Theme 11: Time management	1. Students do not plan for library use	1 "...limited time to use the library."
Theme 12: Stay far from library	1 Students do not live close to campus 2 Students do not always come to campus	1 "Based far from library" 2 "Not at CPUT often."
Theme 13: Do not use the library	1. Access resources without going to the university library 2 Internet access easier from home	1 "I don't usually go to the library." 2 "I have ... Google have the internet to myself."
Theme 13: Do not like the library	1 Prefer not to use the library	1 "None (challenges) because do like the library."
Theme 14: Uninformed	1 Never heard about the library 2. Ignorant of the library's location 3. No understanding of how the library can facilitate finding information for research or gaining knowledge on a particular topic-	1 "No one told me about library." 2 "Do not know where the library is." 3 "I am unaware of the information that I need to get from the library."

5.2.6 Role of the subject librarian

This fifth part of the questionnaire sought to find out the role of the subject librarians in helping students with their information needs

5.2.6.1 People approached for information

A question sought to determine whom the students approached when seeking information. The students were given the following options: classmates, lecturer and librarian. This question is important in a study on information behaviour because it can lead to insights into the sources of information that students rely on and the quality of the information they receive. By identifying gaps in the students' information-seeking behaviour, interventions can be developed to improve their access to quality information.

For example, if most students indicated that they relied on their classmates for information, this could suggest that they were not aware of or comfortable approaching the librarian for assistance. In this case, interventions such as one-on-one consultations with librarians could be implemented to increase students' awareness of the resources available to them and to improve their information-seeking skills. Similarly, if students indicate that they rarely approach their lecturer for information, interventions could be developed, such as office hours, online discussion forums, or classroom activities that encourage students to engage with their instructors and seek out their expertise. Table 5.17 indicates the results of the quantitative data analysis and shows that most students rely on classmates for information.

Table 5.17: People approached for information

Options	Frequency			
	Often	Seldom	Never	Total
Classmates	56	14	4	74
Lecturer	27	38	9	74
Librarian	9	18	47	74

5.2.6.2 Meeting subject librarians

A question was asked whether mechanical the engineering students had met their subject librarians, which would reveal insights into the level of awareness and utilisation of this resource. If a significant number of students indicated that they had not met the mechanical engineering subject librarians, interventions could be implemented, such as workshops, orientations, and promotional events that highlight subject librarians and their expertise. In addition, the library could develop collaborative partnerships with the mechanical engineering department to increase the visibility of the subject librarians and their role in supporting students' academic success.

All 74 students responded to this question with 57 (77%) acknowledging that they had never met the subject librarians and only seventeen (23%) students know where to find the subject librarians. The results of the analysis of the quantitative data provided through the students' responses to the question are presented in Figure 5.20.

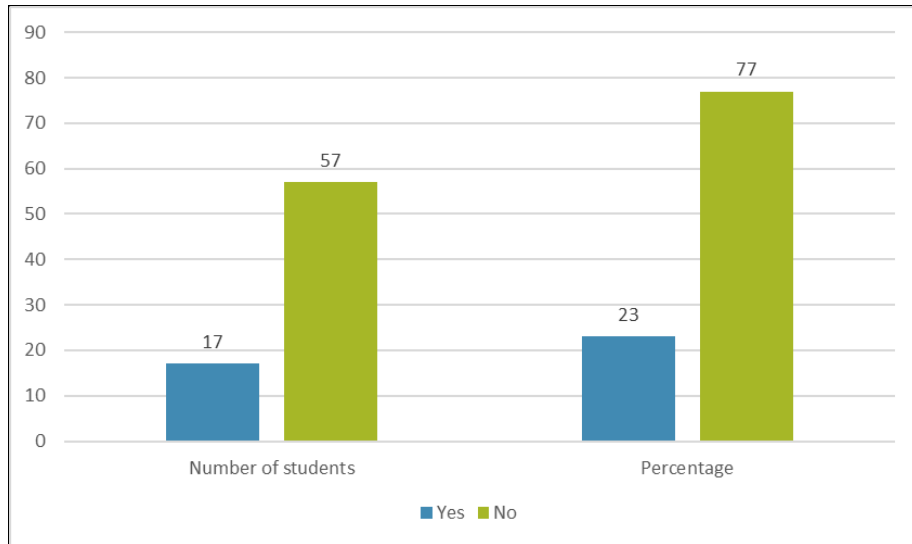


Figure 5.20: Meeting subject librarians (N=74)

5.2.6.3 Locating subject librarians

As a follow-up question, students were requested to indicate whether they knew where to find their subject librarians. Asking this question could lead to additional insights into their level of awareness and utilisation of library resources. If a significant number of students indicated that they are not sure where to find their subject librarians, interventions could be implemented, such as the library providing maps and signage throughout the library to help students locate the subject librarians' offices.

The library could develop and promote online resources that provide students with directions to the subject librarians' offices. In addition, the library could place staff members at strategic locations throughout the library to show students where to go.

5.2.6.4 *The importance of the subject librarians in information searching*

The participants in the study were asked to indicate how important they perceived the assistance of subject librarians to be when searching for information. They were presented with a set of response options, including "not important", "important", "very important", and "other", and were asked to choose one of these options to indicate their level of perceived importance regarding the role of subject librarians in information seeking.

This question was crucial to understanding the level of awareness and utilisation of subject librarians amongst the participants. If gaps were perceived, interventions could include the library could conduct awareness campaigns to educate students about the role of subject librarians in assisting with information seeking.

This could include creating posters, distributing flyers, and making announcements during classes and orientation programmes. In addition, the library could collaborate with the academic department to integrate subject librarians into the curriculum by inviting librarians to participate in classes and assignments to help students identify and use appropriate information resources. In addition, the library could set up feedback mechanisms to assess students' experiences with subject librarians' services. This could include surveys, focus groups, and one-on-one consultations to gather feedback and suggestions for improvement.

Out of the 74 students who participated in the study, 23 (31.1%) considered subject librarians "very important", 37 (50%) considered them "important", and thirteen (17.6%) considered them "not important". Only one (1.4%) student selected the "other" option but did not explain this choice. The results of the analysis of the quantitative data provided through the students' responses to the question are presented in Figure 5.21.

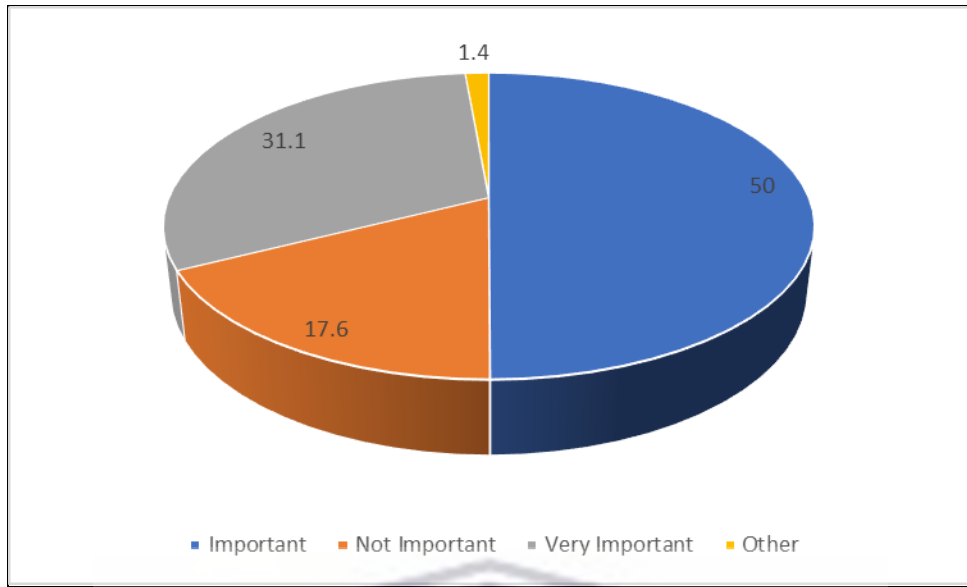


Figure 5.21: Importance of subject librarians (N=74)

5.2.6.5 *Students' perceptions of subject librarian skills*

The students were asked to share their opinion on whether the subject librarians possess the necessary skills to support their information needs. They were provided with three response options, including "yes", "no", and "maybe", and were asked to choose one of these options to indicate their perceptions.

This question would lead to insights into students' confidence in using subject librarians. Moreover, if students perceived that subject librarian lacked the skills to support their information needs, the library could provide targeted training to librarians in the areas where they were perceived to be lacking.

All 74 participants responded to this question, with most indicating that they perceived subject librarians to be skilled (40.5%), followed by "may be skilled" (51.4%), and a small percentage of students indicating that they perceived librarians to not be skilled (8.1%). The

results of the analysis of the quantitative data provided through the students' responses to the question are presented in Figure 5.22.

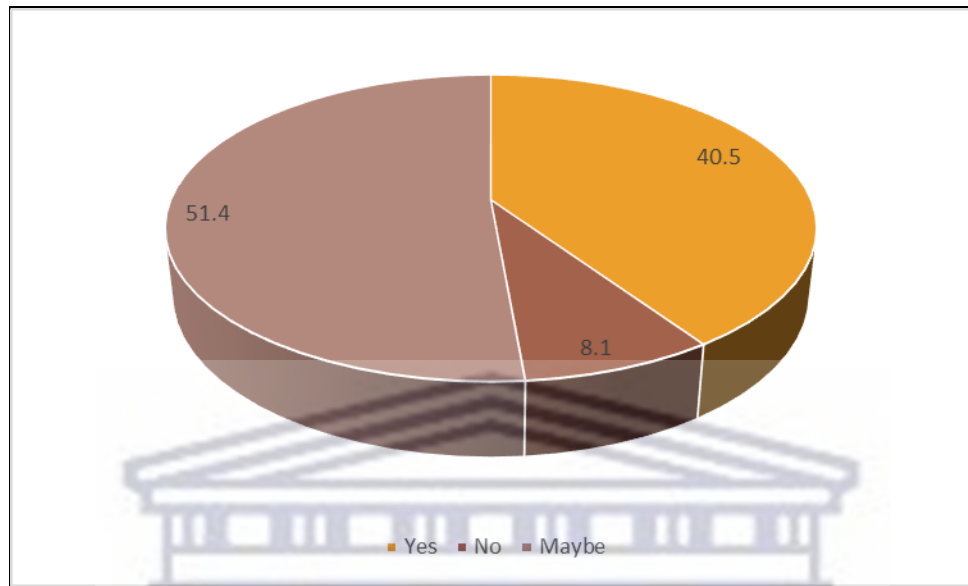


Figure 5.22: Students' perceptions of subject librarians' skills (N=74)

5.2.6.6 *Desired services from subject librarians*

The participants were asked to provide feedback on the services they would like the subject librarians to offer. They were presented with several options, including one-on-one training, class visits, library workshops, facilitation of information access, encounters with librarians, and year-long information literacy training. The question was asked to gain insights into the expectations and needs of students regarding the services offered by the subject librarian.

Interventions that could be implemented based on the students' responses would include increasing or decreasing the services mentioned in the question to meet the students' needs, encouraging student engagement with subject librarians' services, and ultimately supporting their academic success.

If students indicated that they had few encounters with subject librarians, the library could develop outreach programmes to increase student awareness of the services offered by them. This could involve visiting classrooms to provide information about the subject librarians' services, collaborating with faculty to integrate subject librarians' services into course curricula, and promoting subject librarians' services through various communication channels.

Figure 5.23 shows that students preferred library workshops (31.1%), one-on-one training (20.3%), class visits (21.6%), facilitation of information access (13.5%) and year-long information literacy training (10.8%). Only 1 (1.4%) student select the option "little encounter with a subject librarian".

The results of the analysis of the quantitative data provided through the students' responses to the question are presented in Figure 5.23.

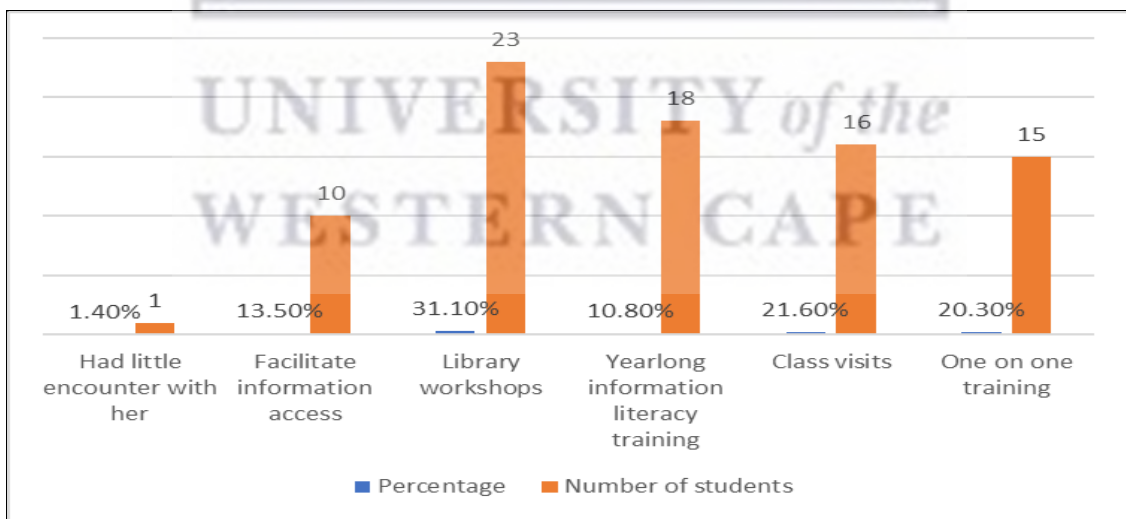


Figure 5.23: Subject librarians' Services (N=74)

5.2.7 Information literacy training

This section of the questionnaire aimed to determine whether students had received information literacy training and the reasons for receiving or not receiving it.

5.2.7.1 Information literacy training received by students

Students were asked about the information literacy training they received, specifically if they received one-on-one training from an information specialist or scheduled library training. The options provided for the frequency of the training were "often", "seldom", and "never".

This was asked to determine the level of exposure students had to information literacy training and to identify any gaps in their utilisation or availability of it. Interventions that could be implemented based on the responses might include increasing the availability and accessibility of information literacy training programmes, modifying the content and format of training to meet student needs, and promoting awareness and participation in programmes to encourage student academic success.

Out of the 74 participants, only four (4) students reported receiving one-on-one training from an information specialist often, eleven (11) students reported receiving it seldom, and 59 students reported never receiving it. When it came to scheduled information literacy training, 6 students reported attending often, nineteen (19) students reported attending seldom, and 49 students reported never attending any scheduled library training.

The results of the analysis of the quantitative data provided through the students' responses to the question are presented in Figure 5.24.

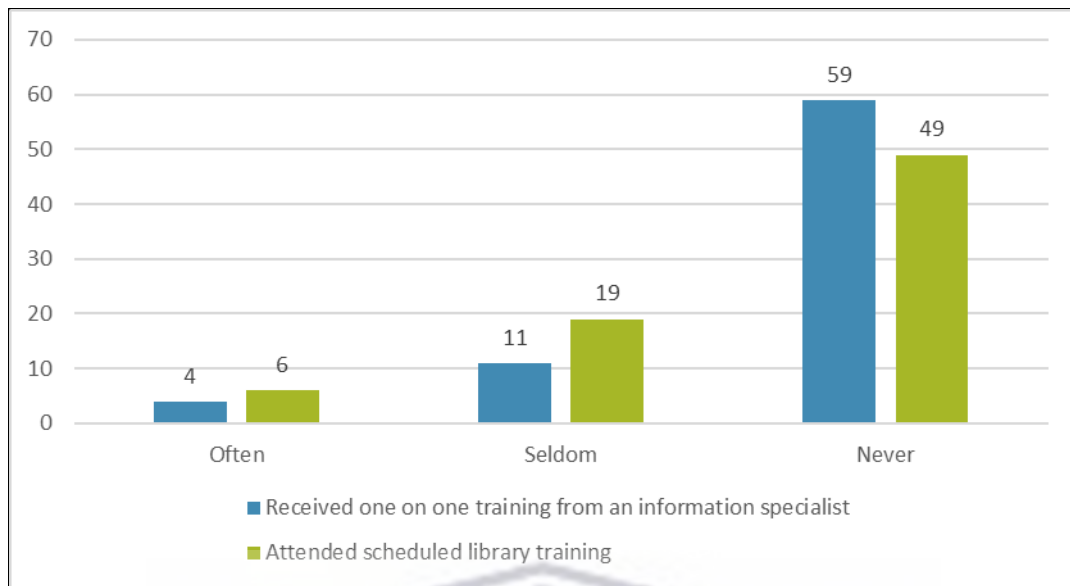


Figure 5.24: Information literacy training received by students (N=74)

5.2.7.2 *Reasons for receiving or not receiving information literacy training*

Students were asked to explain the reasons for them receiving or not receiving information literacy training. The question was asked to gain insights into how academics and librarians could develop strategies to increase the number of students who receive information literacy training, improve the relevance of the training, and address any misconceptions that students may have about the importance of information literacy skills.

Possible interventions could include increasing the availability of information literacy training programmes, highlighting the benefits of the training to students, and customising the training to meet the specific needs of different groups of students. Additionally, there may be a need to review the effectiveness of the current information literacy training programmes and make necessary changes to address any gaps or deficiencies identified.

Other interventions could be to create a campaign to promote the importance of information literacy training and its benefits to students using various media channels, including social

media, posters, flyers, and emails, to reach a wider audience. In addition, collaboration with instructors would be useful, thereby integrating information literacy training into the curriculum and even making information literacy training a mandatory part of courses.

Making information literacy training sessions interactive and engaging by using real-life examples and case studies would demonstrate the importance of information literacy skills. Incorporating hands-on activities and group discussions would encourage active participation. Moreover, making online resources available to students, including tutorials, videos, and interactive modules that cover information literacy topics would encourage them to be engaged in information literacy training. These resources should be easily accessible and available 24/7 to students. Customised information literacy training to meet the unique needs of different student groups would also ensure that all students have the opportunity to develop their information literacy skills.

The analysis of the qualitative data revealed that of the 74 participants, 9 attributed their lack of information literacy training to COVID-19, while 8 acknowledged being aware of the training but did not attend owing to reasons such as time constraints, a lack of data, or finding it uninteresting. Furthermore, 7 students cited not visiting the physical library as a reason for not receiving information literacy training. These students may not have been aware of the formal information literacy education programme or may have associated information literacy only with the physical academic library.

The results of the thematic analysis of the qualitative data provided through the students' responses to the question are presented in Table 5.18.

Table 5.18: Reasons for receiving or not receiving information literacy training (N=74)

Themes	Sub-themes (reasons)	Examples of statements
Theme 1: Some training	<ol style="list-style-type: none"> 1 Only training through the communication skills module 2 Library workshop 3 Limited duration of course component 4 Computer lab in the library 	<ol style="list-style-type: none"> 1 "... only received one training in July in Communication module." 2 "... had only one library workshop." 3 "...only done in first year." 4 "There is computer lab in the library ... the guy who works there will help you with the computer ... explain everything."
Theme 2: Students aware of training but did not attend	<ol style="list-style-type: none"> 1 A lack of time 2 Negative perception of training 3 Work-related conflicts 4 Other priorities 	<ol style="list-style-type: none"> 1 "... been very busy." 2 "It's a drag." 3 "...work!" 4 "I have limited data so only use it to attend classes."
Theme 3: Not aware of training	<ol style="list-style-type: none"> 1 Not informed 2 No invitation 	<ol style="list-style-type: none"> 1 "I have not received information telling me about library training." 2 "I never received any invite of both."
Theme 4: No interaction	<ol style="list-style-type: none"> 1 COVID-19 limited communication 2 	<ol style="list-style-type: none"> 1 "COVID!!!" 2 "A lack of interaction between library and department."
Theme 5: Students did not go to library	<ol style="list-style-type: none"> 1 A lack of experience with libraries 2 Infrequent use of libraries 	<ol style="list-style-type: none"> 1 "I have never been or used the library," 2 "... because I don't visit library as often as I should."
Theme 6: No library use during COVID-19	<ol style="list-style-type: none"> 1 Library closed 2 Could not go to campus 	<ol style="list-style-type: none"> 1 "... library closed in last twelve months." 2 "... not on campus."
Other	<ol style="list-style-type: none"> 1 On-the-job training prevented attendance 	<ol style="list-style-type: none"> 1 "...doing my in-service training."

5.2.8 Desired changes in the academic library

This section of the questionnaire was designed to gather information about the changes that participants would like to see in the academic library, with a specific focus on the mechanical engineering section. Participants were asked to provide suggestions regarding the improvements they would like to see in the library's offerings and services. This question was asked to assess the needs and expectations of the library users, which could lead to action plans for improvements. The results of the thematic analysis of the qualitative data provided through the students' responses to the question are presented in Table 5.19

Table 5.19: Desired changes in the academic library (N=72)

Themes	Sub-themes	Examples of statements
Theme 1: Access to information	1 Digital resources and access 2 Physical resources and arrangement 3 Staff and service	1 "...more online resources like textbooks to be made available for students." 2 "... arrangement of textbooks"; "more textbooks to be issued to students." 3 "...more informed librarian and some people who are more willing to serve the clients."
Theme 2: Operating hours	1 Library hours and accessibility 2 Time management and scheduling	1 "... for it to be open 24 hours a day." 2 "Time slots and make easy to access book s... "
Theme 3: Librarians	1 Improving service/ interaction with librarians 2 Teaching and guiding students	1 "Increase interaction and availability of the subject librarian." 2 "Guiding students on how to access information, specify what they seek in the library."
Theme 4: Ergonomic	1 Comfort 2 Workplace ergonomics 3 Temperature control 4 Space utilisation	1 "More aircon and softer chairs" 2 "Air conditioners/more computers" 3 "Aircons" 4 "Extending more study areas the need only shows during exams month"
Theme 5: Other	1 A lack of knowledge/awareness: 2 Perceived lack of need: Everything is fine 3 Staff's approach	1 "I have no idea hence I have not been there." 2 "No everything seems fine." 3 "Approach from the staff"

5.3 Interview data

This section provides the findings of the analysis of the data gathered through interviews conducted with two engineering subject librarians via email owing to the outbreak of the COVID-19 pandemic. To ensure the anonymity of the respondents, no demographic data was collected from the subject librarians.

5.3.1 Interview questions

This section presents the data obtained through the responses provided by the subject librarians to the questions emailed to them. Both subject librarians answered the questions, which are presented with the responses in Table 5.20.

Table 5.20: Emailed interview questions and responses

Questions	Responses
How long have you been working as a librarian?	"13 years" "11 years"
Do you have a passion for this job? Yes/No? If your answer is No please give reasons.	"Yes" "Yes"
What type of requests do you receive daily?	"Academic related requests" "Academic and research related requests."
Do you get requests via emails or personal? Yes/ No	"Yes" "Yes"
What type of information resource do you always recommend for an engineering student? Please give reasons for your answer.	"Hard copies books, E-Books, Databases, articles from journals so that they use a variety of sources to be able to have relevant information for their needs." "Books and articles because they are relevant to their needs."
Which information resource do you think students feel comfortable using? (a) Online resources (b) Print (c) Both	"Both" "Both"
What do you do when a student is not quite sure of the topic?	"I do topic analysis breakdown the topic find keywords, broader terms and narrower terms build search strategies." "I do reference interviews, try to break down the topic and refer the student to relevant sources."
Do you keep records of complex requests? Why?	"Number of complex requests are recorded on stats database for quality assurance." "Number of complex requests are recorded on stats database for quality assurance."
When do you get a lot of requests from the students?	"During academic periods" "During academic periods"
Do you think mechanical engineering students know where to locate information in the library?	"Yes they do" "Yes"
What are the common requests you receive daily?	"Requests for assignment and project purposes" "Requests for assignment purposes"
What are the common problems that you know have been encountered by students in their information seeking process?	"First experience of the library and processes, Unfamiliar with library resources" "Not knowing how to use information by using various sources of information. Misunderstanding their research questions."

5.3.2 Follow up virtual interviews

Follow-up interviews were conducted separately with each subject librarian via Microsoft Teams. The virtual interviews were recorded and transcribed, and the data from these interviews were captured and organised thematically in Table 5.21.

Table 5.21: Virtual interviews

Follow-up questions	Responses
Except for the academic and research related questions. Which other requests do you get from library users?	"How to use the photocopier" "How does the Dewey Decimal Classification system work?" "When will the library open again?" "How many books can one take out of the library?" "How to use the virtual library" "How to book an appointment for a library training?" "How to book a space at the RISC?"
Besides receiving requests via emails and personal, which other way of receiving requests have you experience since the COVID-19 pandemic.	"Ask Us"* *A virtual reference service that allows users to submit questions and receive assistance from library staff through a chat or messaging platform
Do students embrace Ask Us?	"The pandemic struck immediately after the library has rolled out the Ask Us application." "Students did embrace the application because they get to interact with their Subject librarians with the live chat. It was useful during hard lockdown."
The type of information resource recommended during lockdown? Give reasons for your answer.	"Since students did not have access to the printed version the electronic information was recommended." "The library tried to order more e-books and provide journal articles."
Why do subject librarians keep records of complex queries?	"Not to reinvent the wheel more especially the frequently asked questions."
How do you determine the students know where to find information in the library?	"Subject librarians keep stats of requests, but they do not get much requests on the location of information in the library." "Subject librarians conduct surveys about their services they provide to students"

5.4 Chapter summary

The COVID-19 pandemic presented various challenges for the study, including the closure of campuses and technical issues related to Internet access. As a result, not all students were able to complete the questionnaire, leading to a low response rate. Despite these limitations,

the study led to valuable insights into the information behaviour of students, drawing from both the completed questionnaires and the interviews with librarians.

In this chapter, the data were presented in various formats, including text, graphics, and tables, providing a comprehensive picture of the results and findings of the analyses of the quantitative and qualitative data, respectively.

Overall, the data gathered in the study shed light on the information needs, information-seeking behaviours, and preferences of students in the context of a rapidly changing information landscape. The results highlighted the importance of providing diverse and accessible information resources, as well as tailored training and support to assist students in navigating resources effectively. The combined dataset allowed for a more nuanced analysis of the research findings, revealing important insights and patterns that emerged from the data analysis. The integration of both datasets also helped to triangulate the results, increasing the validity and reliability of the study's findings, and strengthening the study's conclusions.

The findings suggested that the role of librarians in facilitating access to information and supporting student learning remains crucial, even as technology continues to shape how students engage with information.

The next chapter will build upon this data and offer an interpretation of the results, highlighting key themes and trends and discussing their implications for the provision of library services and resources.

CHAPTER 6

INTERPRETATION AND DISCUSSION OF RESULTS AND FINDINGS

6.1 Introduction

The previous chapter provided a detailed account of the data collected from the online questionnaire and interviews. In this chapter, the research builds on that data by interpreting and discussing the quantitative results and qualitative findings. The interpretation is guided and informed by the Model of Information Seeking of Professionals (Leckie et al., 1996), as well as insights from the literature review. Through this analysis, the researcher aims to deepen understanding of the information needs, behaviour, and preferences of students, and to identify key themes and trends that have emerged from the data analysis. The interpretation will provide a rich and nuanced perspective on the data and will offer insights into how the results and findings of the analysis can inform the design and delivery of library services and resources.

6.2 Demographic data

This section provides an interpretation and discussion of the demographic information of the participants in the study, although owing to privacy concerns, the ages and genders of the subject librarians are not disclosed.

The sample for the questionnaire consisted of registered mechanical engineering students from the ECP to the fourth-year level. The majority of participants (64%) were male and aged between 20 to 22 years old. The percentage of female participants in the first-year level was 7%, while male participants represented 14% of the sample. For the ECP, female participants were also 7%, while males were 9%. In the second level, male participants were substantially

more (19%) than females (1%). Third-level male participants were 8%, and female participants were 1%. The fourth-year level of study also had more male participants (16%) than female participants (4%). The remaining participants did not disclose their gender and level of study. These results were consistent with the trend of female underrepresentation in the engineering field, as noted in previous studies by Dommermuth and Roberts (2022) and Jayanthi and Saravanan (2013).

It is important to note that due to the small sample size, the findings and results may not be representative of the entire population of mechanical engineering students. Nonetheless, they provide insight into the gender and age distribution of the participants and may be useful in understanding information behaviour patterns and needs of mechanical engineering students.

It is noteworthy that a significant percentage of participants (38%) did not feel comfortable disclosing their age. Age is a crucial factor that can influence the information-seeking behaviour of engineering students, as per Leckie et al.'s (1996) Model of Information Seeking Behavior of Professionals, which assumes that the maturity of students can have an impact on their information needs.

Interestingly, second-year students accounted for the largest proportion (23%) of participants, followed closely by fourth-year students (22%). This did not align with the distribution of registered students in Table 4.1, which shows that the highest number of students were registered in the third level (398), followed by level one (368), level two (324), ECP (139), and level four (116). One possible explanation for this discrepancy could be that some students may have dropped out due to various reasons, such as difficulty coping with online learning, heavy workload, financial challenges, limited Internet access, and data

constraints. This result is consistent with a study conducted in South Africa by Mseleku (2020, p.590), which also identified connectivity as a significant barrier to students' learning and teaching.

6.3 Information seeking

Four areas of the information-seeking behaviour of mechanical engineering students were investigated. These are interpreted and discussed below.

6.3.1 Motivation to seek information

According to the research results, a large percentage of mechanical engineering students (32%) often sought information for research purposes, while others sought information to prepare for exams (26%) or to stay up to date with new information (21%). The results also showed that second-level students (14%) and fourth-level students (14%) were more motivated to seek information when working on projects compared to first level (16%), ECP (12%), and third-level (5%) students. These results suggest that engineering students require academic information to complete their assignments and projects, leading them to often search for information to conduct research. These results were consistent with those of previous research, such as that of Nadzir et al. (2015) who also found that most undergraduate students sought information to finish research projects.

The results also aligned with Leckie et al.'s (1996) prediction that engineers search for information to complete tasks, while engineering students search information related to their academic tasks which related to their future work roles. One of the subject librarians confirmed in an interview that requests for help with projects and assignments were frequently received, indicating that this result was accurate.

It is important to note that the results may have been influenced by challenges due to the COVID-19 pandemic, such as online learning and teaching, limited access to the Internet, and data. These challenges could have affected the students' motivation to seek information. However, the results suggest that academic information is essential for mechanical engineering students to complete their assignments and projects, and librarians can play a crucial role in assisting them.

6.3.2 Tasks prompting information seeking

When asked about what prompts them to seek information, the students provided a variety of reasons. However, based on the previous question, it was expected that most students (56%) looked for information for assignments and research projects. This was confirmed by both subject librarians who stated that students tend to search for information after receiving assignments and projects to complete.

Tasks requiring discipline and subject-specific information align with Hertzum and Simonsen's (2019) suggestion that tasks arise from professional work and prompt information seeking. This is consistent with Leckie et al.'s (1996) observation that tasks are associated with the professional roles of information seekers and that tasks often prompt information-seeking to complete them.

6.3.3 Methods to find information

When asked about their preferred strategies for gathering information, most students (56%) listed Google or Google Scholar as their go-to source. Electronic databases were also a popular choice among 53% of students. Specifically, students in the ECP (18%) and fourth year of study (16%) relied heavily on Google/Google Scholar to find information, while these same groups

(ECP at 8% and fourth year at 9%) used databases more extensively compared to students at other levels of study.

Several scholars (Nadzir et al., 2015) have reported the widespread use of Google by students to find information, which is consistent with the findings of El Maamiry (2016). El Maamiry discusses the impact of information technology on students' information behaviour and suggests that undergraduate students, who have grown up with the Internet and social media, may believe that they can complete academic work by relying solely on these sources. This preference for easily accessible and up-to-date information sources is in line with the findings of Steinerova and Susol (2005), who found that the average user prefers well-arranged and easily accessible information sources. Similarly, Daniels (2018, p.147) observes that despite the availability of high-quality resources in libraries, many students prefer the immediacy and currency of the information provided by other platforms such as search engines, social media, and websites.

6.3.4 Finding information

The results revealed that a significant proportion of mechanical engineering students (33%) struggled to find the information they needed, while 28% struggled with using library resources. Additionally, 30% of students rarely knew who to turn to for help with information needs and 27% were often unsure about what information they needed to complete academic tasks. Interestingly, the impact of COVID-19 on physical library access did not appear to significantly affect the level of difficulty students experienced in finding information, with similar percentages across different levels of study.

Subject librarians confirmed that engineering students generally struggle with using library resources and retrieval tools. This is in line with research by Hagiwara et al. (2022), which found that master's engineering students often lack the experience to use different information sources. Other studies have also highlighted a general lack of awareness among students about specific online information sources (Dumebi, 2017; Silas & Greenidge, 2020).

Studies have shown that students who receive multiple library instruction sessions and information literacy education tend to have better information-seeking skills and self-efficacy (Kadir et al., 2018; Tang & Tseng, 2017). However, Howlader and Islam (2019) have noted poor information-seeking skills amongst undergraduate students, leading to reliance on class lectures and social media for academic work.

The Model of Information Seeking of Professionals (Leckie et al., 1996) predicts that certain factors such as familiarity, trust, and accessibility of information sources can influence the path of information seeking. While librarians have been identified as important in developing students' information literacy, the closure of physical academic libraries during the COVID-19 pandemic led to increased reliance on e-books and e-journals, and many students may not have been aware of alternative online resources or how to access them.

Overall, the results suggest that there is a need for increased support for engineering students in effectively accessing and using library resources, as well as more comprehensive information literacy education.

6.3.5 Awareness of information needed

Although 33% of the mechanical engineering students did not know where to find the information they needed, 31.9% were always aware of the necessary information. The results

also revealed that second-year students had a higher percentage of students who reported being sometimes aware of the necessary information compared to other year levels. This suggests that they received library training before the COVID-19 outbreak, which could have contributed to their higher level of information awareness.

Both subject librarians frequently experienced that students misunderstand the research problem and the information needed to solve it. Nadzir et al. (2015) stated that information-seeking behaviour is the process by which individuals identify their information needs, search for information, and use the information found to support their work. If students cannot identify the required information, the search process will be ineffective, and they will not have acquired information literacy skills. The Model of Information Seeking of Professionals (Leckie et al., 1996) emphasises the importance of information awareness in information seeking. Engineering students must first realise the need for information, identify the required information, and then seek it.

6.3.6 Frequency of library usage

In comparison with the small proportion twelve (16.2%) who used the library, a large number seventeen (23%) of mechanical engineering students never did, and 45 (60.8%) sometimes use the library. The main reasons for not using the academic library were cited as being off-campus and the physical library being closed due to the pandemic. Studies have shown that engineering students visit the library for purposes other than academic work, such as reading newspapers and magazines.

To increase library usage, scholars have recommended initiatives, such as enhancing awareness of library collections and services, creating a separate library website with easy

access to needed information, and having librarians play an active and visible role on campus. Limited time on campus due to the pandemic also hindered ECP and first-year students' ability to explore the physical academic library. This was indicative of the students' lack of information literacy skills, as students who were information literate would have been able to access and retrieve academic information via the library's catalogue and databases. Students who used the online library reported using it for research, downloading e-books, and discovering necessary information. Some mechanical engineering students preferred utilising the physical library before COVID-19 due to its air conditioning, comfortable studying environment, and space to review notes and complete academic tasks.

6.3.7 Keeping up with new developments

Approximately half of the students (49%) reported frequently discussing current events on social media, which is in line with findings from previous studies (Amiri et al., 2022 & Olaimat et al., 2021) indicating that students relied on the Internet, social media, and mass media to obtain information about COVID-19 and related topics.

6.3.8 Concluding remarks

The responses to all the questions in the information-seeking section of the questionnaire revealed the following factors affecting information seeking amongst mechanical engineering students:

- Not knowing where to find the information needed
- Not knowing how to use information resources
- Not knowing the right person to talk to
- Not knowing what kind of information is required

- Not aware of library resources
- Not library literate
- Not information literate
- Use of mostly Google to search for information
- Use of social media to keep up to date
- Not having access to the library due to COVID-19
- Not aware of information literacy training
- Never having been to the library
- Staying far from the library
- Early closing of the library

6.4 Library resource usage

This section interprets and discusses the results and findings of the analysis of the data on undergraduate mechanical engineering students' library usage. It takes into account the possibility that senior students may have responded based on their physical library usage pre-pandemic, while ECP and first-year students may have relied more on online library services owing to the COVID-19 pandemic. However, Nelson and Tugwell (2022) note that the information-seeking patterns and behaviours of undergraduate students during the pandemic did not change significantly. Students still preferred the channels that required the least effort and relied on lecture notes to complete their assignments.

6.4.1 Print and electronic resources usage

Almost half (48.6%) of the mechanical engineering students used both printed and electronic resources, while 36.5% used only electronic resources and 14.9% used only printed resources,

according to the subject librarians and the students themselves. Previous studies by Komissarov and Murray (2016) and Nadzir et al. (2015) found that undergraduates preferred electronic materials and placed a high value on e-resources, such as library subscription databases, the library catalogue, and the library website. Three studies on engineering students in India in 2019 by Ganapathy and Jayabal, Reddy and Reddy, as well as Poongodi and Sarangapani found that e-books, e-journals, e-theses, and databases were the most commonly used e-resources. However, Ramaiah and Shimray (2018) and Chinnasamy (2016) found that most engineering students preferred printed sources, possibly due to limited Internet access or a lack of instruction on effectively finding and using information.

6.4.2 Mechanical engineering library collection

Most mechanical engineering students (98%) rated the library collection as either fair or good, indicating satisfaction with the resources available. This finding is consistent with previous studies by Ramaiah and Shimray (2018), Manjula (2017), and Patra (2016) that also showed high levels of satisfaction amongst engineering students with library collections. Reddy and Reddy (2019, p. 184) and Jayanthi and Saravanan (2013, p. 75) found that female engineering students were more satisfied with e-resource facilities than male students. However, other studies on user satisfaction (Busayo & Akinyede, 2020; Chinnasamy, 2016) revealed student dissatisfaction with the relevance and currency of collections.

6.4.3 Database usage

Students majoring in mechanical engineering primarily use the Emerald database (55%) while using EbscoHost (48%). This was consistent with the findings of Komissarov and Murray (2016), who noted that students value library subscription databases. However, other studies,

such as those conducted by Howlader and Islam (2019), Tang and Tseng (2017), El Maamiry (2016), and Lacovic (2014), reported low skills in using library catalogues and/or databases to find information. The ease of access and use of information sources, as per the Model of Information Behavior of Professionals (Leckie et al., 1996), influences information seeking.

6.4.4 Library home page accessibility

Contrary to the subject librarians claiming that mechanical engineering students required more training on how to use various library resources, including databases, many students (45.8%) acknowledged easily accessing databases from the library's home page, thereby proving that they could navigate the library page, 26 (36.1%) were not sure and thirteen (18.1%) found it difficult to access the library page. The effective organisation of the information might have been the reason for the high usage of databases from the library's home page. This corresponded with the results of studies conducted by Komissarov and Murray (2016) and Steinerova and Susol (2005), who discovered that the average user prefers easily accessible and well-organised information.

6.4.5 Mechanical engineering Libguide usage

The low usage of the Mechanical Engineering LibGuide (29.2%) suggests that students may not have been aware of its existence or value or may have been unsure of how to use it. However, in contrast, Becker et al. (2021) reported that most students at the Cape Peninsula University of Technology in South Africa were aware of and used LibGuides as an information source for academic assignments during COVID-19. Although the subject librarians were not asked about the LibGuides during the interviews, it can be assumed that the LibGuides must be kept up-to-date and integrated with the library's resources.

6.4.6 Concluding remarks

In the interviews, the subject librarians stated that they recommended a variety of information sources, including printed books, e-books, databases, and journal articles to ensure that students consult various sources to verify information and hear the voices of different authors. However, the questionnaire results revealed that students often relied on Google, lecture notes, websites, personal notes, textbooks, online dictionaries, general books on mechanical engineering, and journal articles for their research, while conference proceedings, subject dictionaries and encyclopaedias, and blogs were rarely used.

These results and findings were consistent with those of previous studies, which showed that students tended to rely heavily on Google and social media platforms for their research, but may have had difficulty accessing relevant full-text e-books and peer-reviewed journal articles. The Model of Information Seeking by Professionals (Leckie et al., 1996) suggests that information sources are a key factor influencing information-seeking behaviour. Despite the quality and currency of information, students in the study found enough, relevant information using Google.

6.4.7 Use of information sources for projects and assignments

This section interprets and discusses the results and findings of the analysis of the data on the information sources utilised by mechanical engineering students in completing assignments and projects. The research results indicated that students primarily relied on textbooks in major subjects such as Thermodynamics (44%), Mechanics (43%), Fluid mechanics (42%), Hydraulic Machines (41%), and Machine Mechanics (40%). These results are consistent with those of the studies by Arumugam et al. (2015, p.469) and Kakai et al. (2004), which revealed that most engineering students used subject-related textbooks and utilised the college library

because it contained information not found elsewhere. The easy accessibility of textbooks could also explain their high usage. Furthermore, Leckie et al. (1996) found that characteristics, such as ease of access and cost of finding information influenced students' information-seeking behaviour, further supporting the preference for textbooks amongst mechanical engineering students.

6.4.8 Engineering e-journals awareness

The research results revealed that only 44.6% of the participants are aware of the availability of engineering e-journals in the library. Most students either reported being unaware (36.5%) or unsure (18.9%) about the availability of e-journals through the academic library, indicating a lack of utilisation of journal articles and a potential lack of awareness of the importance of subject journals for accessing quality, current, and scholarly information. This trend was consistent with the findings of Mohan et al. (2021), who similarly noted that many students struggle with accessing e-journals. However, in contrast, Chaputula and Matula (2018) found that most Malawian students used their smartphones to access e-books, e-journals, websites, and library catalogues.

6.4.9 Search tools

Most students (58.1%) utilised Google as their primary search engine for information, with Google Scholar being the second most popular option (21.6%). Participants cited Google's accessibility, ease of use, wealth of knowledge, constant availability of answers, and simplicity of navigation as reasons for its widespread use. This aligned with Bak et al.'s (2022) findings that university students in Denmark also preferred using Google to find and understand health-related information. The ease of access to information sources, such as Google is

consistent with the Model of Information Behaviour of Professionals, which emphasises the importance of easily accessible sources in gathering the required information.

6.4.10 Concluding remarks

The results and findings revealed that mechanical engineering students used both printed and electronic resources, with high usage of databases. In addition, the subject librarians confirmed that students expressed satisfaction with the library materials available. However, students needed to utilise a variety of sources to find sufficient and relevant information for their assignments and projects. Therefore, there was a need for more training and guidance on how to use the library resources effectively.

The results and findings highlighted the importance of library resources and the role of subject librarians in supporting mechanical engineering students in their information-seeking behaviour. By providing adequate training and guidance, students can enhance their research skills and improve their academic performance.

6.5 Evaluating retrieved information

This section interprets and discusses the results and findings of the analysis of the data on the mechanical engineering students' evaluation of retrieved information. According to Lewis (2018), resource evaluation is an essential aspect of information literacy education in higher learning institutions, as information cannot be accepted and used without using the CRAAP test criteria.

6.5.1 Criteria used to evaluate information

The participants were aware of these criteria used for evaluating information sources, although the results revealed that relevance was the criteria used by most students (47%) to evaluate information. Relevance was followed by accessibility (41%), which corresponded to Leckie et al.'s (1996) finding that the accessibility of resources is one of the major characteristics for ensuring smooth information seeking. Other criteria used by the participants in the current study were credibility and authority (39%), reliability and objectivity (34%) and currency (34%). The fact that the participants used criteria to evaluate retrieved information demonstrates that they did not use the information at face value.

Participants also indicated that when evaluating information, they cross-referenced it. Some students visited various websites to double-check the facts and references, read and compare sources, and see if there were any other sources on the same topic. Students stated that they looked for sources that confirmed the information and sought clarification from fellow students and lecturers.

Both subject librarians, however, believed that students struggled to use retrieved information owing to uncertainty about whether the information retrieved was relevant. This was in line with the results of the studies by Talikka et al. (2018), Dlamini (2014) and Ali et al. (2009) reflecting that student lack the necessary skills for evaluating and interpreting information, especially Internet information, never verify the trustworthiness of information and need information literacy education to find high-quality information.

6.5.2 Concluding remarks

The results and findings suggested that mechanical engineering students placed a high priority on the relevance of information when evaluating its usefulness for their research projects. This aligned with the field whereby precision and accuracy are crucial, and irrelevant information can lead to errors and inefficiencies in design and production.

The study also revealed that the students knew the CRAAP test criteria, a widely recognised framework for evaluating information sources. This was a positive sign, indicating that students were aware of the importance of assessing information and were equipped with a practical tool to do so.

The results and findings also revealed areas for improvement, however. For instance, while students were aware of the importance of assessing information sources, they tended to focus on surface-level indicators, such as the author's credentials and the publication date. They were less likely to dig deeper into the content of the source and evaluate the arguments and evidence presented.

To address this gap, educators and librarians should incorporate explicit training on critical thinking and information literacy skills into the curriculum. This could include activities, such as evaluating a range of sources on a given topic, comparing, and contrasting conflicting viewpoints, and analysing the bias and assumptions underlying arguments.

6.6 Challenges in obtaining needed information

This section interprets and discusses the results and findings of the analysis of the data on the challenges experienced by mechanical engineering students in locating, accessing, and retrieving needed information.

6.6.1 Access challenges

The study found that a significant percentage of students faced difficulties accessing library resources, with 43.1% finding it easy, 34.7% unsure, and 22.2% not knowing how to access them. Inexperience with library resources seemed to be the main cause of this problem, especially amongst ECP and first-year students who had not been fully exposed to library orientation and information literacy education owing to COVID-19 restrictions. Nevertheless, Nelson and Tugwell (2022) found that undergraduate students did not change their information-seeking patterns during the pandemic and continued to use the channels that require the least effort, relying on lecture notes to complete assignments. Huang et al.'s study (2021) confirmed that most students were satisfied with the information services offered by the academic library during the pandemic and recognised their importance.

Bashorun et al. (2021) found in their study that although most distance learners acknowledged library support services, they were not able to utilise library resources and services effectively. Moreover, owing to the pandemic and the closure of the physical library, 40.3% of students in the current study believed that they did not have access to library resources, indicating a lack of information literacy as they were unaware that they could access e-resources without visiting the physical library. Students also reported not receiving sufficient training in how to use library resources effectively or search for needed information.

Some studies have, however, shown that certain groups of students possess strong digital literacy skills and can easily find necessary information through search engines and official websites (Bak et al. ,2022; Apuke and Iyendo, 2018; Dumebi, 2017; Ganapathy and Jayabal, 2019; Khan and Ahmed, 2016). Several South African studies have shown that students from disadvantaged areas with limited access to public or school libraries often struggle with using library resources (King, 2007; Mseleku, 2020; Nel, 2015).

6.6.2 Reasons for access challenges

Participants attributed challenges accessing library resources to the library's closure due to the COVID-19 pandemic. However, the subject librarians maintained that students lacked training and familiarity with online library resources, as well as access to printed materials, resulting in difficulty using online resources exacerbated by a lack of data.

Studies by Barrot et al. (2021), Mehta and Wang (2020), and Mseleku (2020) reported various challenges experienced by students during the pandemic, including financial difficulties, limited access to academic information and resources, connectivity issues due to a lack of data or Internet access, slow response times, and a lack of skills in effectively utilising e-resources. In rural areas, students also faced challenges because of electricity shortages and no Internet access (Mseleku, 2020, p.593; Poongodi & Sarangapani, 2019, p.77; Reddy & Reddy, 2019, p.184).

6.6.3 Concluding remarks

The mechanical engineering students in the study faced various challenges when locating, accessing, and retrieving needed information. These challenges were often exacerbated by the COVID-19 pandemic, which resulted in the closure of physical libraries and limited access

to academic resources. Furthermore, students may have lacked the necessary training and skills to utilise online resources, and they may have faced Internet connectivity issues and other technological barriers.

To address these challenges, academic institutions should prioritise information literacy education and training for students, particularly in light of the increased reliance on digital resources. Additionally, institutions should work to provide equitable access to technology and resources for all students, including those in rural areas and with financial difficulties. By addressing these challenges, academic institutions could support the academic success of mechanical engineering students and ensure that they have access to the resources they need to thrive.

6.7 The role of subject librarians

This section interprets and discusses the results and findings of the analysis of the data on the role of the subject librarian in assisting students with their information-seeking.

6.7.1 People approached for information

Only 12.16% of the mechanical engineering students frequently sought assistance from subject librarians for their information needs, with the majority consulting their classmates (25.4%) or lecturers (12.16%). In the interviews, both subject librarians noted a decline in student engagement with them during the pandemic, with limited contact being made.

This trend was consistent with Lacovic's (2014) international study, which found that most students sought academic information by consulting their professors, peers, and librarians. Similarly, Baro et al.'s (2010) study on Nigerian undergraduate students found that human resources were the most frequently consulted for academic information. Du Preez and

Fourie's (2010) South African study revealed that engineers relied heavily on colleagues, personal files, and personal knowledge and experience for information, while Moore and Singley's (2019) study on doctoral students found that the discovery of resources was heavily influenced by people.

These findings suggest that academic institutions should emphasise the importance of utilising subject librarians for information needs and provide appropriate training to students on how to engage with them. Additionally, institutions should encourage collaboration amongst peers and faculty members to foster a culture of information sharing and support. By doing so, students can enhance their information literacy skills and improve their academic performance.

6.7.2 Meeting and locating subject librarians

Most of the students (77%) had never met subject librarians and did not know where to find them, which may have been because of limited visits to the physical library before the pandemic and the closure of the physical library during COVID-19. As a result, librarians had shifted their focus to using social media platforms, websites, and emails for current awareness and electronic delivery of information. However, Alabi and Sani (2021) found that the majority of librarians in Kogi State, Nigeria, were still able to assist users with queries and provide current awareness and selective information to special patrons during the pandemic. Somi and De Jager (2005) emphasised the importance of academic libraries making subject librarians' services known to students, particularly first-year students, by providing orientation sessions to library offerings. Increasing the visibility of subject librarians to students may encourage more consultation with them.

6.7.3 The importance of subject librarians in information searching

Although 50% of the students acknowledged not knowing where to find subject librarians, they believed that subject librarians played a critical role in effective information searching. They stated that subject librarians help in finding information without spending a lot of time in the library, and they knew how to locate resources containing the needed information. The subject librarians' importance in assisting students was thus confirmed, as they help students in analysing their research topics, determining their exact information needs through reference interviews, and locating relevant sources. However, it is concerning that 17% of the participants rated subject librarians as unimportant.

6.7.4 Skills of subject librarians in supporting information searching

Most students (51.4%) believed that subject librarians could assist with searching for information, while 40.5% indicated that they had already received help from subject librarians with information searching. However, 8.1% of students felt that subject librarians lacked the skills necessary for effective information searching. However, in the interviews, the subject librarians confirmed that they often encountered students who were unsure of the topics they needed to discuss or work on, requiring the subject librarians to undertake topic analysis and construct search strategies to provide relevant information, thereby indicating their skills.

Liman et al. (2017) identified competencies required by academic librarians, including knowledge and skills in using technology and the Internet to provide effective library services. As proven by Johnson and Howard (2019) and Chaputula and Matula (2018), students are increasingly accessing library services through their smartphones, searching for, and accessing e-books, e-journals, and websites, as well as using the library catalogue and communicating with librarians.

6.7.5 Subject librarians' services

The preferred format of subject librarian services was found to be library workshops, according to 31.1% of students, followed by class visits (21.6%) and one-on-one training (20.3%). A small number of students (13.5%) indicated a need for assistance in accessing information and an even smaller percentage (10.8%) expressed interest in year-long information literacy training. This suggests that students prefer proactive outreach from librarians rather than long-term training programmes.

Several studies have examined the role of academic librarians during COVID-19. Ashiq et al. (2022) and Alabi and Sani (2021) found that librarians were primarily expected to provide assistance with queries and deliver electronic resources. In contrast, Bashorun et al.'s (2021) study reported that student satisfaction with library support was low and library services were inadequate. However, Dube and Jacobs (2022) found that distance learners in Gauteng, South Africa, rated library support services as extensive and librarians used a range of technologies, from email to artificial intelligence (AI) to deliver services.

6.7.6 Concluding remarks

Based on the results and findings, subject librarians play a crucial role in assisting students in to search for information. The preference for workshops indicates that students value the opportunity to learn in a group setting where they can engage in discussions and ask questions. However, it is important to note that some students also require individual attention, hence the need for one-on-one training. The fact that some students indicated the need for information literacy training for the whole academic year highlights the importance of subject librarians being available to assist students throughout their academic journey.

It is also evident that the role of subject librarians has evolved in the wake of the COVID-19 pandemic. With the closure of physical libraries, subject librarians had to rely on the electronic delivery of information and the use of social media platforms to engage with users. Despite the challenges, studies have shown that subject librarians have been able to adapt and continue providing valuable support to users. Academic libraries need to continue embracing new technologies and finding innovative ways to provide services to their users.

Overall, subject librarians have a critical role to play in ensuring that students are equipped with the necessary skills to search for information. Academic libraries need to invest in the training and development of subject librarians to ensure that they have the knowledge and skills required to meet the evolving needs of users.

6.8 Information literacy training

This section presents an interpretation and discussion of the results and findings of the analysis of data on participants' information literacy training. Several studies, including those of Moyo and Mavodza (2016), Jiyane and Oyancha (2010), and King (2007), have highlighted the need for information literacy education amongst South African students, who often have limited access to technologies and libraries due to underdeveloped education systems.

At the institution where the study was conducted, first-year students are required to participate in a year-long information literacy programme that is integrated into the Communication module and other subjects. The programme focuses on teaching students search strategies, information sources, retrieval tools, evaluating information, copyright, plagiarism, and referencing. In response to the COVID-19 pandemic, these initiatives were delivered virtually.

6.8.1 The information literacy training received

According to the survey results, 59% of students did not receive one-on-one information literacy training from specialists, and 49% did not attend any scheduled training sessions. Many students cited the physical closure of the library as the reason for their absence, indicating a lack of awareness that virtual workshops, videos, and tutorials were offered during the pandemic. Both subject librarians reported that as a result of this lack of exposure to information literacy training, many students struggled with information literacy skills and required assistance to complete their assignments.

Ashiq et al. (2022) note that academic library services had to be transformed during the COVID-19 pandemic, with alternative tools needed for effective communication. In addition, students from China and Italy recognised the importance of effective support from academic libraries for remote learning (Zhou, 2022). Furthermore, Soltani and Nikou's (2020) study found that international students with insufficient information literacy skills at Finnish universities faced more challenges, particularly at the beginning of their studies.

6.8.2 Reasons for receiving or not receiving information literacy training

Only 12 students received information literacy training, with some attending workshops or online classes offered by the library staff or embedded in the Communication module, while others received training from the computer lab assistant. The majority of students provided various reasons for not attending training, with some not being aware of the training opportunities, others blaming COVID-19 and a few not visiting the physical library. Of concern is that 8 students were aware of the training but did not attend owing to a lack of time or interest, indicating a lack of regard for the importance of information literacy skills in academic work.

Research by Liu (2021), Gowri and Padma (2018), and Ali et al. (2010) found that while most engineering students had some information literacy skills, they were not fully information literate and required ongoing information literacy education. Similarly, Dommermuth and Roberts (2022), Koler-Povh and Turk (2020), and Talikka et al. (2018) confirm that information literacy education enables engineering students to develop discipline-specific practices, evaluate information, use advanced search strategies, and reference correctly.

Barrot et al. (2021), Guo and Huang (2021), and Martzoukou (2020) identified challenges in offering information literacy training during the COVID-19 pandemic, with academic libraries adapting as best they could. However, catch-up education might have been necessary when students return to campus.

6.8.3 *Format of information literacy training*

When asked about their preferred format for information literacy training, 31.1% of the mechanical engineering students indicated a preference for library workshops, 20.3% preferred one-on-one training, and 21.6% preferred class visits. The two subject librarians confirmed that all mechanical engineering students were provided with opportunities for information literacy training, including the formal information literacy programme, individual training, library tutorials, and regular workshops. However, previous research by Chisango (2012) suggests that stand-alone information literacy initiatives may not be effective if students do not perceive their importance, and that follow-up or continuous education throughout their studies is needed. According to Davids (2009) and Davids and Omar (2018), information literacy interventions are only successful if they are allotted enough time, followed up for long-term evaluation, and if students demonstrate interest by attending all sessions and assessments.

6.8.4 Concluding remarks

The COVID-19 pandemic drastically changed the landscape of education, and information literacy training was no exception. As a result of the pandemic, many students were unable to participate in traditional in-person information literacy education initiatives and had to resort to online resources, such as virtual workshops, videos, and online tutorials. Although these initiatives were available, a significant number of students did not attend them due to various reasons, such as not being aware of them or not having time.

According to the subject librarians, the lack of exposure to information literacy training initiatives resulted in a considerable number of students not mastering information literacy skills. This was concerning, as information literacy skills are essential for academic success and professional development. To ensure that students are adequately equipped with the necessary information literacy skills, academic libraries must adapt and provide innovative solutions for information literacy training during challenging times.

It is vital to address the reasons why students might not attend training and find solutions to increase their participation, such as incentivising attendance or integrating information literacy into the curriculum. By doing so, academic libraries can empower students with information literacy skills, enabling them to navigate the ever-evolving information landscape and achieve academic and professional success.

6.9 Change in the library

This section interprets and discusses the data on students' suggestions for improving the library.

6.9.1 Suggestions

The most common suggestion was the need to extend the library opening hours to cater to the students' needs. This suggestion was followed by a request for better access to e-resources and improvements to the library space, such as comfortable chairs and air conditioning. Another important suggestion was the need for more visible library staff who could assist students and provide them with training on library usage.

The importance of library staff was further highlighted by studies conducted during the COVID-19 pandemic. According to Alabi and Sani (2021) and Mohan et al. (2021), librarians played a critical role in assisting users with queries, providing specialised information to special patrons, and helping students navigate digital resources and access needed information. These studies emphasise the importance of library staff in providing essential services to students, especially during a crisis like the COVID-19 pandemic.

6.10 Chapter summary

This chapter interpreted and discussed the quantitative results and qualitative findings presented in Chapter 5. Despite the low response rate, the study was able to identify trends in the information behaviour of mechanical engineering students. The results and findings indicated that the Faculty of Engineering Department of Mechanical Engineering is mostly composed of male students, and although most participants did not disclose their age, those who did ranged from 19 to 24 years old. The majority of the students sought information when working on research projects or preparing for examinations, while only a few looked for academic information to stay up to date with new developments in the field.

Students primarily used social media platforms to stay informed and communicate with their peers, missing out on critical information from experts in their field. Google was the most

common tool used to find information, with few students utilising full-text engineering databases or visiting the physical or virtual library. Therefore, it is recommended that the library and its services are marketed more effectively to students. Furthermore, subject librarians should update and promote the Mechanical Engineering LibGuide to ensure students can use it effectively.

Students relied heavily on lecture notes, Google, and websites for information and would thus have benefitted from using prescribed field texts to become more familiar with the field of mechanical engineering. Thus, it can be concluded that the mechanical engineering students in the study lacked proper training on how to search for information and use various library resources. Subject librarians confirmed that the students were unfamiliar with library resources and often misinterpreted research problems, leading to difficulty in conducting information searches.

The following chapter will conclude the thesis and make recommendations based on the research results and findings.



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CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter concludes the study by answering the research questions, drawing conclusions, making recommendations, and pointing to further research to strengthen the findings. The following questions are answered:

- 1 What motivated mechanical engineering students in the study to seek information?
- 2 What types of information did mechanical engineering students in the study need for academic purposes?
- 3 How did mechanical engineering students in the study locate information to complete their academic tasks?
- 4 How did mechanical engineering students evaluate the located information?
- 5 What were the differences in the information behaviour of the different levels of students?
- 6 What role can librarians play to render an effective library service to mechanical engineering students?

7.2 Answers to research questions

In order to conclude the study, the research questions will be answered based on the data collected and findings presented.

7.2.1 *Motivation for seeking information*

The primary reason the students in the study sought information was to complete academic tasks, such as assignments and research projects. Additionally, many students sought

information to prepare for exams and stay current with new developments in their field. However, it was less common for students to seek information for administrative tasks. Overall, it can be concluded that the main motivation for the mechanical engineering students in the study was to seek information to support their academic pursuits.

7.2.2 Types of information needed

Thermodynamics is a core area in mechanical engineering that is of great interest to students in this field. According to the findings of the study, thermodynamics information sources are mostly used for projects and assignments. It involves calculating fuel efficiency in engines, as well as concepts related to mechanics, hydraulic machines, and mechanics of machines. As a result, mechanical engineering students place a high value on information related to thermodynamics.

7.2.3 Locating information

Most mechanical engineering students relied on lecture and personal notes for information, with only a small number frequently utilising the physical or virtual academic library. Many students reported difficulty using the library and preferred to use easily accessible resources, such as class notes, peers, and Google or Google Scholar for information. Furthermore, many students had not met the subject librarians and found it challenging to retrieve and utilise information from multiple sources. Subject librarians confirmed that students were often unfamiliar with the library's resources, making it difficult for them to understand research topics and determine what information was needed and how and where to find it.

7.2.4 Evaluation of information

Most mechanical engineering students were familiar with the CRAAP test and used it to evaluate retrieved information. The relevance criterion was most commonly used when evaluating information. Students also indicated using cross-referencing to verify the accuracy of the information and determine its credibility.

7.2.5 Differences in information behaviour of different levels

ECP and first-year students had limited time on campus before the COVID-19 pandemic forced the closure of the campus and the physical library and thus they had little experience using the academic library. Despite this, they were still asked to complete the questionnaire, and the results and findings were interpreted and discussed accordingly.

Most of the participants were second-year students, followed by fourth-year, first-year, ECP and third-year students, with male participants outnumbering female participants. Mechanical engineering students, primarily in their second year of study, were motivated to seek information for research projects, followed by students in their first and fourth years of study. Fourth-year students frequently used Google/Google Scholar to find information, followed by second-year students.

Not knowing where to find information was revealed to affect students' information seeking, with fourth-year students more aware of where to find information than ECP and second-year students. First- and second-year students were occasionally aware of the necessary information.

The study found that students at all levels of study used social media and communicated with their peers for information. Additionally, it was revealed that students at all levels of study

rarely used databases to find information, but fourth-year students preferred using Google Scholar as a source of information. Second-year students relied on the appropriateness of the information to complete their academic work when evaluating information, followed by accessibility.

The research results and findings of the data gathered from the different levels of student participants led to the conclusion that compared to the other student levels, fourth-year students exhibited a higher level of awareness of their information needs and possessed the skills to find and evaluate information.

7.2.6 The role of librarians

In the study, while subject librarians offered a range of services, including information literacy education, the research results revealed that few mechanical engineering students attended these sessions. The COVID-19 pandemic further complicated the problem, as financial difficulties, data and connectivity issues, a problematic electricity supply, and mental health challenges made it challenging for the students to attend online information literacy lectures, workshops, or tutorials.

As a result, the subject librarians needed to assist the students in analysing and clarifying the subject of their assignments or research projects, determining the information they required and creating effective search strategies to locate it. They also assisted students in locating relevant information resources, evaluating and referencing retrieved information, and photocopying relevant information.

Subject librarians also helped students in locating printed books in the library and locating and downloading e-books and journal articles from subject databases and library loans.

Additionally, the Ask Us application enabled subject librarians to provide virtual library services by answering questions and providing information based on queries. However, continuous individual education would have been necessary for students to keep up with these skills.

7.3 Applying the Model of Information Seeking

The section discusses how the model of Information Seeking for Professionals by Leckie et al. (1996) served as the theoretical framework for the study. Although the model is concerned with professionals, it provided insights into the information-seeking behaviour of mechanical engineering students in terms of factors, such as motivation to seek information, types of information, locating and evaluating it, different information behaviour depending on different levels, and the role of subject librarians.

The study's findings revealed that many mechanical engineering students were not aware of various information sources and relied heavily on Google as their primary source. However, subject librarians encouraged students to explore other information resources. This finding was significant because it highlighted the importance of training and education in helping students develop comprehensive research skills.

The problems of access to information in physical libraries caused by the COVID-19 pandemic indicated that subject librarians must in future offer digital literacy training, promoting the use of various information sources and tools. According to Ali et al. (2010), digital information literacy is critical in 21st-century literacies. Students need this literacy to cope with the challenges of further education and future professions. Leckie et al.'s (1996) model highlights the significance of information access in shaping information-seeking behaviour. Therefore, improved access to digital information can enhance information-seeking behaviour.

7.4 Significance of the study

Although the researcher expected that a higher number of students would indicate using the library's resources, the study still had a significant impact on the discipline of mechanical engineering. The study provided valuable advice on useful information resources for students in this field, which can improve their research and academic performance.

The researcher hopes that this study will increase awareness of the resources and services offered by the library, particularly the subject librarians. These specialised librarians can provide targeted support and guidance to students in specific academic fields, such as mechanical engineering. By highlighting the importance of subject librarians and the services they offer, the study may encourage more students to utilise the library's resources and seek support from these knowledgeable professionals.

Overall, while the study did not yield the expected results in terms of the number of students using the library's resources, it might still have a positive impact on the discipline of mechanical engineering and can help students in this field to access the information and support they need to succeed in their academic pursuits.

7.5 Recommendations

The recommendations provided in this section are based on the results and findings of the study and are aimed at addressing the low usage of the library's resources and improving awareness of the academic library services amongst students in the Department of Mechanical Engineering.

Firstly, it is recommended that the library raises awareness of its services at the department and departmental committee meetings. Librarians can visit lectures and conduct workshops

to teach students about discipline-specific library resources. This will help to increase students' understanding of the library's resources and how they can benefit their academic work.

Secondly, librarians should work in cooperation with the institution's management to ensure that all students are aware of information literacy education initiatives and receive appropriate training. This is crucial, as students who are not familiar with how to access and use the library's resources may not utilise them to their full potential. Therefore, all students must receive training on how to navigate the library's resources to optimise their academic performance.

Thirdly, it is suggested that social media platforms such as Facebook and Twitter can be effective tools for marketing the library. El Maamiry (2016) notes that undergraduate students are exposed to the Internet and social media from a young age and may believe that they can access academic work through social networks. Hence, librarians should leverage social media platforms to make themselves and their services more visible to students. By doing so, students can easily find information about the library and contact subject librarians for assistance.

In summary, the recommendations made in this study are aimed at improving the usage of the library's resources and increasing awareness of the academic library service amongst students in the Department of Mechanical Engineering. It is recommended that librarians actively market the library's resources through workshops, social media platforms, and collaborations with the institution's management to ensure that all students receive adequate training and support to optimise their academic performance.

7.6 Future research

There are several potential areas for future research on the topic of the study. Some suggestions for future research are as follows:

Investigating the reasons behind the low usage of the library's resources amongst students in the Department of Mechanical Engineering. Further research could be conducted to explore the factors that contribute to this low usage, such as students' perception of the relevance of library resources to their academic work or their lack of awareness of available resources.

Examining the impact of information literacy education initiatives on the use of the library's resources by students in the Department of Mechanical Engineering. Future research could investigate the effectiveness of different information literacy education strategies and their impact on students' ability to find and use relevant information in their academic work.

Comparing the usage of the library's resources between different departments or faculties within the institution. Such research could explore how the availability and accessibility of the library's resources differ across academic disciplines and identify potential factors that contribute to differences in usage patterns.

Investigating the impact of subject librarian support on students' academic performance. Future research could further explore the role of subject librarians in providing specialised support to students in specific academic fields, such as mechanical engineering, and examine the impact of this support on students' academic success.

Exploring the potential of emerging technologies, such as AI and machine learning, in improving access to and use of the library's resources. Future research could investigate the potential of these technologies in automating certain aspects of library services, such as

personalised recommendation systems and their impact on students' ability to find and use relevant information.

7.7 Conclusion

In conclusion, the study aimed to explore the information-seeking behaviour of Mechanical Engineering students in a higher education institution and to identify factors that may influence their use of the library's resources. The findings of the study indicated that there was a low usage of the library's resources amongst mechanical engineering students, and several factors may have contributed to this, including a lack of awareness of available resources and insufficient training in information literacy skills.

Based on these findings, several recommendations were made, including raising awareness of the library's services and resources to the department, conducting workshops to teach discipline-specific library resources, ensuring that all students receive information literacy training, and utilising social media platforms to market the library's resources and make them more visible to students.

The study provided valuable insights into the information behaviour of mechanical engineering students and highlighted the need for more targeted efforts to raise awareness of the library's resources and services and to provide information literacy training. Future research in this field could explore these issues further, investigating the factors that contribute to low library usage amongst students and the impact of interventions aimed at increasing awareness and improving information literacy skills. Overall, the study underscored the importance of the library in supporting the academic success of mechanical engineering students and the need for continued efforts to ensure that students are equipped with the skills and knowledge necessary to access and use available resources effectively.

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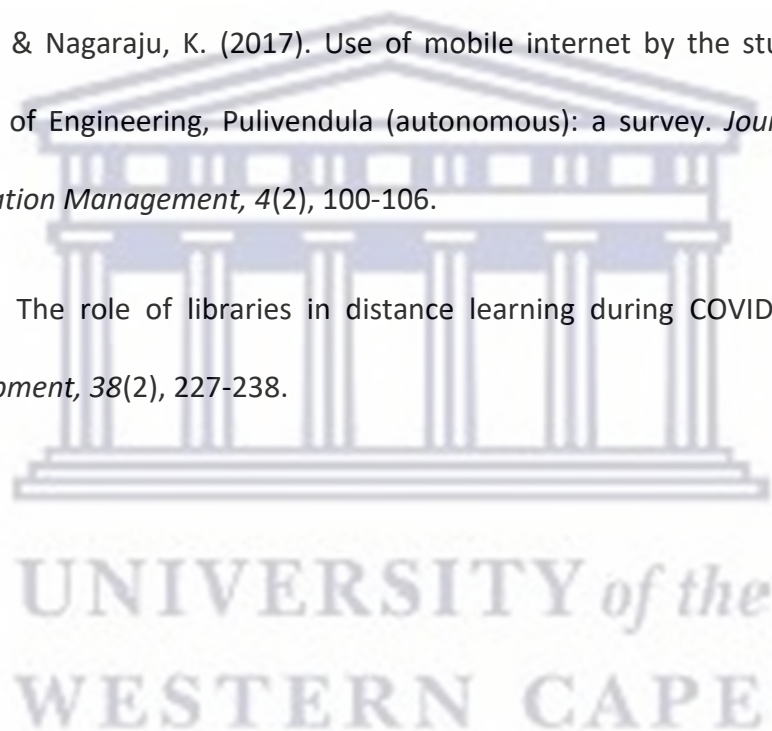
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APPENDICES

APPENDIX A: ETHICS CLEARANCE (UWC)



OFFICE OF THE DIRECTOR: RESEARCH
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25 March 2019

Ms F Dibakoane
Library and Information Sciences
Faculty of Arts

Ethics Reference Number: HS19/1/8

Project Title: Information behaviour of mechanical engineering students at Cape Peninsula University of Technology: The role of the CPUT library in providing needed information.

Approval Period: 18 March 2019 – 18 March 2020

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

A handwritten signature in black ink that reads 'Josias'.

*Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape*

HSSREC REGISTRATION NUMBER - 130416-049

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

Appendix B: Permission to conduct research



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Tel: 021-959 6242

6 August 2021

Ms Faith Dibakoane (CPUT staff no 30097036)
MLIS Student
Library and Information Sciences
Faculty of Arts and Humanities
University of the Western Cape

Dear Ms Dibakoane

RE: PERMISSION TO CONDUCT RESEARCH AT CPUT

The Institutional Ethics Committee received your application entitled: *"Information behaviour mechanical engineering students at an Institution and the role of the Library"* together with the dossier of supporting documents.

Faculty Ethics Committee Approval Date: 5 August 2021

Faculty Ethics Committee Approval Reference No: 2021FEBEREC-ST-12

Permission is herewith granted for you to do research at the Cape Peninsula University of Technology.

Wishing you the best in your study.

Sincerely

A handwritten signature in black ink, appearing to read "D Phaho".

Dr D Phaho
Deputy Vice-Chancellor: Research, Technology Innovation &
Partnerships Cape Peninsula University of Technology

Appendix C: Consent forms



University of the Western Cape

Consent Form - Librarians (Interviews)

Title of Study: Information behaviour of mechanical engineering students at Cape Peninsula University of Technology and the role of the CPUT library in providing their information needs.

Principal researcher: Faith Dibakoane

Please initial box

1 I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project.

2 I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline (If I wish to withdraw I may contact the lead researcher at any time)

3 I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research.

4 I agree to have the interview audio-recorded.

5 I agree that the data collected from me may be used in future research.

6 I agree to take part in the above research project.

[Since this is a sample form, you do not need to get it signed for ethics clearance. It will have to be signed when you do your interviews.]



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Name of Participant (or legal representative):

Name of person taking consent (If different from lead researcher):

Date:

Consent given for:

Date:

Signature of Participant (or legal representative):

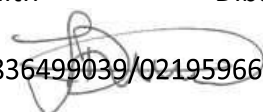
Signature of person taking consent:


Lead Researcher


Date:

Signature: _____

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only. [Enter full names and contact details in the blocks below.

Researcher: Faith Dibakoane 0836499039/0219596649  dibakoanef@cput.ac.za

Supervisor: Dr Lizette King 0219592535  lking@uwc.ac.za

HOD: Prof Sandy Zinn 0219592137  szinn@uwc.ac.za
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Consent Form – Students (questionnaires)

University of the Western Cape

Project: Information behaviour of mechanical engineering students at Cape Peninsula University of Technology and the role of the CPUT library in providing their information needs.

Researcher: Faith Dibakoane

Please initial box

1 I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project.

2 I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. (If I wish to withdraw I may contact the lead researcher at any time)

3 I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research.

4 I agree that the data collected from me may be used in future research.

5 I agree to take part in the above research project.

[Since this is a sample form, you do not need to get it signed for ethics clearance. It will have to be signed when you do your interviews.]

Name of Participant: _____

Date: _____ Signature: _____

(or legal representative)

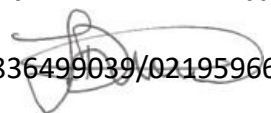
Name of person taking consent (if different from lead researcher):

_____ Date: _____ Signature: _____

Lead Researcher: _____ Date: _____ Signature: _____


(To be signed and dated in presence of the participant)

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:
Faith Dibakoane
0836499039/0219596649

dibakoanef@cput.ac.za

Supervisor: Dr Lizette King
0219592535

lking@uwc.ac.za

HOD:
Prof Sandy Zinn 0219592137

szinn@uwc.ac.za

Appendix D: Information letter

Questionnaire



Faith Dibakoane
To: 222612274@mycpu.ac.za



Mon 19/Sep/22 10:18

Good morning student,

Dear student,

I trust this email finds you well and safe.

I'm doing my Master's Degree in Library and Information Science at the University of the Western Cape. My topic is "Information seeking behaviour of Mechanical Engineering students at a South African Institution of Higher Education and the role of the academic library in providing in their information needs". Please note that your identity will always remain anonymous.

Kindly complete the online questionnaire that you will find on the link below.

[Mechanical Engineering Questionnaire](#)

Your cooperation will be highly appreciated.

Regards

Faith



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Appendix E: Questionnaire

QUESTIONNAIRE FOR MECHANICAL ENGINEERING STUDENTS FOR RESEARCH ON THE INFORMATION BEHAVIOUR OF MECHANICAL ENGINEERING STUDENTS AT A TERTIARY INSTITUTION AND THE ROLE OF THE LIBRARY

Dear student

I am doing my master's degree in Library and Information Science (MLIS) under the supervision of Dr Lizette King at the University of the Western Cape. I request you to fill in the questionnaire* and return it. The information provided by you will be kept confidential and used for academic purposes only. Please note that if you complete the form you give consent to partake in the study.

Thanking you

Faith Dibakoane MLIS student in Library and Information Science UWC.



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QUESTIONNAIRE

Questions marked with an * require answering

Demographics

1. What is your gender? *

Mark only one option

(Female); (Male); (Prefer not to say)

2. What is your age? *

Mark only one option.

(19); (20); (21);(24); (Other)

3. What is your level of study?

Mark only one option

(1st level); (2nd level); (3rd level); (ECP)

Information seeking

4 What motivates you to seek information? *

	NEVER	SELDOM	OFTEN
Working on research project			
Keeping yourself up to date			
Performing administrative tasks			
Preparation for exams			

5. For what kind of tasks do you always seek information? *

6. How often do you use each of the following methods to find information for your assignments or projects? Mark only one option per row *

	NEVER	SELDOM	OFTEN
Searching in published hard-copy directories			
Searching in electronic databases			
Reading/skimming journals in the engineering field			
Using Google/Google Scholar			
Getting references and recommendations from colleagues			
Searching full-text electronic databases (e.g. IEEE Xplore)			
Following citations from other journal articles			

Information use

7 What factors affect you when seeking information? Mark only one option per row*

	NEVER	SELDOM	OFTEN
Not knowing where to find the information			
Not knowing how to use the library resources			
Not knowing the right person to talk to			
Not being sure of the kind of information needed			

8. Are you aware of the information needed? Mark only one option.*

(Sometimes); (Often); (Always)

8.1 Please give reasons for your answer.*

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9. How often do you use the library? Mark only one option.*

(Sometimes); (Often); (Never)

9.1. Please state reason(s) for your answer.*

10. How do you keep up to date with new developments and information in your field?

Mark only one option per row *

	NEVER	SELDOM	OFTEN
Looking at contents pages of printed journals			
Looking at contents pages of electronic journals			
Looking at contents pages of new books in the library			
Looking at contents pages of e-books			
Personal communication with fellow			
Discussions on social networks			

11. Do you prefer to use print or electronic resources? Mark only one option. *

(Print); (Electronic resource); (Both)

11.1 Please give reasons for your answer*

12. Do you regard the mechanical engineering library collection as (Mark only one option).*

(Excellent); (Good); (Fair); (Poor)

12.1 Please supply reasons for your answer.*

13. Which of the following databases do you use the most to find full text journal articles?

Mark only one option per row*

	NEVER	SELDOM	OFTEN
ScienceDirect			
Ebscohost			
IEEE Digital Xplore Library			
Emerald			
Google Scholar			
SAePublications			

13.1. Do you find it easy to access the library page to use the databases? Mark only one option.*

(Yes); (No); (Maybe)

14. Do you find it easy to use the Mechanical Engineering LibGuide? Mark only one option.*

(Yes); (No); (Maybe)

14.1. Give reason(s) for your answer.*

15. Please indicate which of the following information sources you use the most. Mark only one option per row *

	NEVER	SELDOM	OFTEN
Journal articles			
Text books			
Conference proceedings			
Conferences paper presentation			
Personal notes/files			
Lecture notes			
General books on mechanical engineering			
Subject encyclopaedias			
Wikipedia			
Subject dictionaries			
Online dictionaries			
Websites			
Google			
Wikis and social media			
Blogs			

16. How do you go about evaluating the retrieved information?*

17. Do you use the following criteria to evaluate retrieved information? Mark all that apply.*

	NEVER	SELDOM	OFTEN
Reliability of the information			
Objectivity of the information			
Relevance of the information			
Accessibility of the information			
Currency of the information			
Credibility of the information			
Authority of the information			
Appropriateness of the information			
Suitability of the information			
Website domain of the information			

18. Do you find it easy to access library resources? Mark only one option.*

(Yes); (No); (Maybe)

The role of the information specialist (librarian)

Do you contact the following when unsure where to find information:

	NEVER	SELDOM	OFTEN
Classmates			
Lecturer			
Librarian			

20. Have you met your subject librarian? Mark only one option.*

(Yes); (No)

20.1. If your answer is NO, do you know where to find him/her (Subject Librarian)*

21. Please indicate below how you view the relative importance of your Subject Librarian in information search. Mark only one option.*

(Important); (Not important); (Very important

21.1. Please give reasons for your answer*



22. In your opinion, do you think the subject librarians are adequately skilled for supporting your information needs? Mark only one option.*

(Yes); (No); (Maybe)

23 Which services you would like your Subject Librarians to offer? Mark only one option.*

(One-on-one training); (Class visits); (Year-long information literacy training); (Library workshops); (Facilitated information access)

24. What are the difficulties you face in obtaining the required information and keeping up with advances in your field? Mark only one option *

(Inadequate resources in the academic library); (Lack of access to library material); (Poor library services); (Library rules/procedures)

24.1. Please give reasons for your answer. *

25. Are you aware of the availability of engineering e-journals (electronic journals) in your library? Mark only one option *

(Yes); (No); (Not sure)

26. Which information search tools do you use to get access to the document you need?

Check all that apply *

(Search [Primo] Catalogue); (Databases); (E-books); (Google Scholar); (Google)

26.1 Give reasons for your choices *

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27. On average how many times in the past twelve months did you perform the following actions? Mark only one option per row*

	NEVER	SELDOM	OFTEN
Received on-one-training in information literacy			
Attended scheduled library training session from an information specialist			

27.1. Please give reasons for your answer*

28. If you were to be given an assignment or a project to discuss, which of the listed sources would you use to find information? Mark only one option per row*

	Conference proceedings/ presentation	Books	Journal articles	Lecture notes
Mechanical engineering				
Fluid mechanics				
Communication studies				
Mechanics of machines				
Thermodynamics				
Hydraulic machines				
Mechanical engineering drawing				

28.1. Give reasons for your answers *

29. What would you like see changing in the library?*



Appendix F: Interview schedule

**INTERVIEW QUESTIONS FOR SUBJECT LIBRARIANS FOR RESEARCH ON THE INFORMATION
BEHAVIOUR OF MECHANICAL ENGINEERING STUDENTS AT A TERTIARY INSTITUTION
AND THE ROLE OF THE LIBRARY**

Dear Colleague

I'm doing my master's degree in Library and Information Science (MLIS) under the supervision of Dr Lizette King at the University of the Western Cape. I request you to respond to the questions, which will be followed up in a virtual interview. Please return the information provided by you, which will be kept confidential and used for academic purposes only.

Thanking you

Faith Dibakoane

MLIS student in Library and Information Science at UWC

Demographic information

1 Please indicate the following:

Email address

Institution.....

Designation.....

Branch.....

Gender.....

2 How long have you been working as a librarian?

.....

3 Do you have a passion for this job? If your answer is "No" please give reasons.

.....

4 What type of requests do you receive daily from students?

.....

5 Do you receive requests via email or personal consultation?

.....

6 What type of information resources do you recommend to engineering students? Please give reasons for your answer.

.....

.....

.....

7 Which information resource do you think students feel comfortable using? (a) Online resources

(b) Print (c) Both

8 How often do students approach you personally for advice on their projects? (a) Always (b)

Seldom (c) Almost (d) Mostly

9. What do you do when a student is not quite sure of a topic?

.....
.....

10 Do you keep records of complex requests? Why?

.....
.....

11 When do you receive a lot of requests from the students?

.....

12. Do you think mechanical engineering students know where to locate information in the library?

.....
.....

13 What common requests do you receive daily?

.....
.....

14. What are some common challenges that students face when seeking information?

Appendix G: Editor's declaration



DR MAUREEN LILIAN KLOS
PROFESSIONAL EDITOR
BA; STD; BEd (*cum laude*); MEd (*cum laude*); DEd
Registered with the SAPEG (reg. no. KLO004)
maureenklos@gmail.com

EDITOR'S DECLARATION

I,

DR MAUREEN LILIAN KLOS,

Being the holder of the following qualifications:

BA; STD; BEd (*cum laude*); MEd (*cum laude*); DEd

Hereby certify that I am the English language editor of the following document:

**INFORMATION BEHAVIOUR OF MECHANICAL ENGINEERING STUDENTS AT
A SOUTH AFRICAN INSTITUTION OF HIGHER EDUCATION AND THE ROLE OF
THE ACADEMIC LIBRARY IN MEETING THEIR INFORMATION NEEDS**

by

Faith Dibakoane

9244714

I hereby certify that I have edited the language, formatting and referencing in the above-mentioned document in their entirety. However, I assume no responsibility or liability for any post-editing changes, errors or omissions.

17 April 2023