INFORMATION LITERACY COMPETENCIES AND PROFICIENCIES OF UNDERGRADUATE STUDENTS AT THE KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY (KNUST)

by

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Exact wording of the title of the thesis as it appears on the electronic copy submitted for examination: **Information Literacy Competencies and Proficiencies of Undergraduate Students at The Kwame Nkrumah University of Science and Technology (KNUST).**

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

26/1/2024

SIGNATURE DATE

Edward Mensah Borteye

DEDICATION

I dedicate this thesis to my wife and children for their unceasing support, understanding, and motivation.

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ABSTRACT

This study investigated undergraduate students' information literacy competencies and proficiencies at the Kwame Nkrumah University of Science and Technology (KNUST). The study set out to ascertain the different understanding of information literacy, how they identify their information needs, locate, appraise, ethically and legally use information, and the problems they face in finding and using information efficiently and effectively. The study used Kuhlthau's Information Search Process (ISP) model, which was initiated in the 1980s, improved in the 1990s, and adapted by Kuhlthau, Heinström and Todd (2008) as its theoretical framework. The researcher reviewed pertinent literature relating to information literacy and relevant to this study.

The researcher adopted the case study method, which provides the opportunity to ask penetrating questions and captures the richness of organisational behaviour for this study. The qualitative approach, which employs the use of interviews for the collection of data, was used in this study. The population for this study was made up of undergraduate students of the Kwame Nkrumah University of Science and Technology. Quota sampling, a non-probability sampling technique, was employed in selecting respondents for the study from the sampled population. The population was seventy-eight thousand, and thirty-one (78 031), based on which a sample of seventy (70) participants was chosen. Thematic analysis was used to analyse the data collected from the study participants.

The findings of the study indicate that the participants understood information literacy differently. The participants were able to identify their information needs. The internet, library and librarians, and individuals were the sources of information for the participants. The participants understood information appraisal differently and could appraise information by the use of accuracy, authority, objectivity, currency, purpose, and appropriateness of the information. The participants understood ethical and legal use of information as the right use of information and citation of sources, which ultimately helps prevent plagiarism. Finally, several challenges militating against access and use of information were mentioned by the participants. The challenges hindering access to, and use of information indicates areas for improvement in supporting information literacy.

The study recommended information searching skills for the students, awareness creation for the library's resources, knowledge, preparedness, and willingness of librarians to teach information literacy, extension of library's opening hours and the improvement of information and communication technology infrastructure of the university to help resolve the challenges the students face in accessing and using information. The study contributed to knowledge through the development of an Information Literacy Competency Model for undergraduate students to help resolve the challenges students face when accessing and using information.

Keywords: Information literacy, information literacy skills, information literacy competencies, information literacy proficiencies, information searching skills, information use, undergraduate students, Kwame Nkrumah University of Science and Technology, KNUST

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LIST OF ABBREVIATIONS AND ACRONYMS

ACE	Ada College of Education
ALA	American Library Association
AU	Ashesi University
ACRL	Association of College & Research Libraries
ALIA	Australian Library and Information Association
CABE	College of Art and Built Environment
CANR	College of Agriculture and Natural Resources
CHEA	Council for Higher Education Accreditation
CILIP	Chartered Institute of Library and Information Professionals
COE	College of Engineering
COHS	College of Health Sciences
COHSS	College of Humanities and Social Sciences
COS	College of Science
ETS	Educational Testing Service
EFL	English as a Foreign Language
GIMPA	Ghana Institute of Management and Public Administration
GTEC	Ghana Tertiary Education Commission
ICT	Information Communication and Technology
ICT4AD	ICT for Accelerated Development
IDL	Institute of Distance Learning
IL	Information Literacy
ILI	Information Literacy Instruction
ILS	Information Literacy Skills

IFLA	International Federation of Library Associations and Institutions
ISP	Information Search Process
KNUST	Kwame Nkrumah University of Science and Technology
NCLIS	National Commission on Libraries and Information Science
NFIL	National Forum on Information Literacy
OPAC	Online Public Access Catalogue
SCONUL	Society of College, National and University Libraries
UDS	University for Development Studies
UG	University of Ghana
UCC	University of Cape Coast
UCOMS	University College of Management Studies
UNESCO	United Nations Education, Scientific, and Cultural Organisation
UNISA	University of South Africa

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Background

Information literacy is a necessary skill, and its importance cannot be underestimated. It allows students to become independent learners, thereby taking charge of their learning (American Library Association 2018) and becoming creative, analytical, and efficient thinkers. Indeed, such skills are not just necessary for students when they are completing their studies but are essential skills useful in all aspects of life, such as in school, at the workplace, at home, in society and beyond (Dalton 2013:31; Mfula, Maamba, Kamanga, Nyowani & Fashili 2018:1). Similarly, Bruce (2004:9) indicates that information literacy is crucial to the attainment of lifelong learning, and central to achieving both personal empowerment and economic development. The Australian Library and Information Association's "Statement on Information Literacy for all Australians" (2006) emphasises the usefulness of information literacy as a precondition for:

i. lifelong learning;
ii. the creation of new knowledge;
iii. acquisition of skills;
iv. personal, vocational, corporate, and organisational empowerment;
v. social inclusion;
vi. participative citizenship, and
vii. innovation and enterprise.

Over the years, academic libraries have championed and continue to champion the teaching and learning of information literacy. In the early 1980s, academic libraries were very involved in defining information literacy. A study by Saunders (2008:100) also points to librarians' involvement in championing information literacy. The author indicates that librarians are challenging institutions to adopt formal programmes for instructing and assessing information literacy concepts and reaching out to faculty to collaborate in these areas (Saunders 2008:100).

A study conducted by Julien, Gross and Latham (2018:189) on information literacy instructional practices in academic libraries in the USA revealed that there was a significant commitment to information literacy instruction, as well as a host of substantial challenges to success. Other studies, including those by Lai (2011), Fernández-Ramos (2019), and Guo and Huang (2021), have reported on the academic libraries' involvement in the teaching of information literacy in Canada, Mexico, and China, respectively.

From an African perspective, Jiyane and Onyancha (2010:11-18) report that information literacy programmes in South Africa are known under different names, such as library orientation, user education, computer training, and library catalogue training. Other studies by Baro and Zuokemefa (2011), Hart and Davids (2011), Baro, Seimode and Godfrey (2013), Kimani (2014), Abu-Fadil, Torrent and Grizzle (2016), Mugwisi (2016), Moyo and Mavodza (2016), Lwehabura (2018), Durodolu and Mojapelo (2020), and Moyo and Okemwa (2022) also reported on information literacy and the academic libraries' involvement in, amongst others Kenya, Nigeria, South Africa and Zimbabwe.

Information literacy is part of the Ghana Tertiary Education Commission's requirements for establishing tertiary institutions in Ghana. This is captured in Item 9 of the "Library Standards and Guidelines", which states, among other things, that "a tertiary institution library shall provide learning opportunities and resources that assist users in developing efficient and effective skills in finding, assessing, evaluating and organising information and becoming independent and lifelong learners" (Ghana Tertiary Education Commission 2021:15). This, therefore, means that all tertiary institutions in Ghana must have information literacy as part of the services provided to users. The available literature suggests that tertiary institutions in Ghana are, to some extent, complying with this requirement. The information literacy programmes that these universities offer have different names, including library orientation/instruction for freshmen/women, user education, and bibliographic instruction (Dorvlo & Dadzie 2016:18).

The Kwame Nkrumah University of Science and Technology (KNUST) Library, Ghana (now Prempeh II Library), like many other academic libraries, runs library orientation/induction for

first-year students and conducts training in the use of the library's resources for the library's user community (Ahenkorah-Marfo & Teye 2011:1). User education in the form of training in searching and using electronic resources was mainly targeted at continuing undergraduate and postgraduate students and was organised on an ad hoc basis. Based on the requests made by a teaching faculty, some training was also organised to assist their students in using the library's resources. However, the library realised that such training sessions were not making the needed impact since only a few students attended the orientation programmes. The few that did, could not fully grasp the content of the sessions. Therefore, the library decided to introduce information literacy as part of its services to prevent the challenges mentioned (Ahenkorah-Marfo & Teye 2011:21). However, immediately when the course started, some members of the teaching faculty opposed the course's introduction because the library was not a teaching department and could, therefore, not host a credit-bearing course. After several discussions with the library, the Department of Publishing took over the course to prevent this opposition.

Since the purpose of information literacy skills training is to ensure that students are information literate and can access and use information, the mentioned challenges would, in general, affect the information literacy skills of the students, leading to low usage of the library's resources and also defeat the purpose of lifelong learning.

1.2 Statement of the problem

The KNUST Library, just like other academic libraries, supports teaching, learning, and research by providing information resources and other services to faculty and students. These functions can be realised through information literacy teaching. Information literacy enables students to identify their information needs, where to locate it, and how to assess, use, and communicate it ethically (Chartered Institute of Library and Information Professionals 2015).

Due to Ghana's limited number of public libraries and the nature of the country's pre-tertiary school curriculum, which does not support information literacy, many undergraduate students admitted to KNUST are not information literate. Although KNUST has a well-stocked library with print and electronic resources, many undergraduate students cannot efficiently access,

evaluate, and utilise these resources in their academic work. Instead, these students rely on untrustworthy sources found on the internet to support their academic activities.

Observations made by the researcher through interactions with some of the undergraduate students during e-resource training sessions in the library show that students in KNUST face several challenges. These challenges include a lack of knowledge of available information resources, poor information searching skills, inadequate computers, poor and unreliable internet, poor information evaluation skills, and poor understanding of the ethics of using information. Earlier studies by Borteye, Teye and Asare-Kyire (2010:79-85), Ahenkorah-Marfo and Teye (2011:21), and Adjei, Frimpong and Dogbe (2021:2) which touched on some aspects of information literacy also identified some of these challenges. Therefore, the problem under investigation is the challenges undergraduate students face in finding and using information efficiently and effectively.

The absence of information literacy will seriously affect the students. The lack of information literacy will affect how they seek, evaluate, and use information and their capability to be independent learners and thinkers. Again, without the necessary competencies in research and problem-solving (Ananiadou & Claro 2009:9), information retrieval, and information technology, the students will find it difficult to enter the job market when they graduate.

Therefore, this study sought to investigate information literacy skills among undergraduate students of KNUST to identify the skills, competencies, and proficiencies they need to access and use information and make detailed recommendations for improving their information literacy skills.

1.3 Significance of the study

According to Creswell (2009:107), a study's significance conveys the problem's importance for different groups that may profit from reading and using the study. The significance, therefore, of this study is the following:

i. The study highlights the importance of information literacy skills in KNUST students' lives.
ii. The students need information literacy skills to determine their information needs, locate and access information resources, and evaluate them for their academic activities.

iii. The study's findings illuminate the strengths and weaknesses of information literacy skills of undergraduate students in KNUST and how librarians and faculty can help mitigate the weaknesses and improve upon the strengths identified.
iv. The findings will also assist the university and library management in formulating information literacy policies.
v. In addition, the study will hopefully engender cooperation and collaboration between faculty and the university library in providing information literacy skills training for undergraduate students.
vi. Finally, the study will add to the existing and growing body of African and developing world research on information literacy research and serve as a foundation for future research.

1.4 Aim of the study

This study aimed to investigate the information literacy skills, competencies, and proficiencies of undergraduate students at the Kwame Nkrumah University of Science and Technology (KNUST) in order to find ways to improve how the students search, access, evaluate, and utilise information resources to aid their academic work.

1.5 Objectives

The objectives of the study are:

i. To ascertain the different conceptions (understanding) of information literacy among undergraduate students of KNUST.
ii. To ascertain how undergraduate students of KNUST identify their information needs.
iii. To investigate how undergraduate students of KNUST locate information.
iv. To assess how undergraduate students of KNUST appraise the accessed information.

v. To establish whether undergraduate students of KNUST ethically and legally use information.
vi. To make recommendations for adopting and implementing information literacy training in KNUST to improve the information literacy skills of undergraduate students.

1.6 Research questions

To realise the above objectives, the study sought to address the following research questions:

i. What are the different understandings of "information literacy" by undergraduate students of KNUST?
ii. When do undergraduate students think they need information?
iii. What are the strategies, including using appropriate commands such as Boolean operators, truncation, and advanced search instructions for undergraduate students of KNUST to retrieve information?
iv. What are undergraduate students of KNUST's understanding of the terms "information appraisal" or "evaluation"?
v. What are undergraduate students' understanding of ethical and legal use of information?
vi. What problems do undergraduate students face in finding and using information in the library and on the Internet effectively and efficiently?
vii. How can one use the findings of this research to improve the information literacy skills of undergraduate students in KNUST?

Table 1.1 below summarises the relationship between the research objectives, research questions, population, and possible data sources.

Table 1.1: Research objectives, research questions, and sources of data

Objectives	Research Question	Population	Sources of Data
To ascertain the different conceptions of information literacy among undergraduate students of KNUST.	a. What are the different understandings of "information literacy" by undergraduate students of KNUST? b. Information literacy can be called many different things; what terms do undergraduate students use, and what terms, if any, are more meaningful to them?	Undergraduate students	Interview
To ascertain how undergraduate students of KNUST identify their information needs.	a. When do undergraduate students think they need information? b. Why do they use information?	Undergraduate students	Interview
To investigate how undergraduate students of KNUST locate information.	a.What are the strategies, including using appropriate commands such as Boolean operators, truncation, and advanced search instructions for undergraduate students of KNUST to retrieve information?	Undergraduate students	Interview and observation
To assess how undergraduate students of KNUST appraise the accessed information.	a. What are undergraduate students of KNUST's understanding of the terms "information appraisal" or "evaluation"? b. How do undergraduate students appraise/evaluate the information they access?	Undergraduate students	Interview
To establish whether undergraduate students of KNUST ethically and legally use information.	a. What are undergraduate students' understanding of ethical and legal use of information? b. How do undergraduate students ethically and legally use information? c. What are undergraduate students' understanding of plagiarism? d. What do undergraduate students do to avoid plagiarism?	Undergraduate students	Interview
To investigate the problems undergraduate students face in finding and using information effectively and efficiently	What problems do undergraduate students face in finding and using information in the library and on the Internet effectively and efficiently?	Undergraduate students	Interview and observation

1.7 Theoretical framework

According to Creswell (2009:51), a theory is an interrelated set of constructs formed into propositions, or hypotheses, that specifies the relationship among variables. He intimates further that "a theory might appear in a research study as an argument, a discussion, or a

rationale, and it helps to explain (or predict) phenomena that occur in the world" (Creswell 2009:51). According to Kuhlthau (2004:13), a theory "offers an articulation of underlying complexity that can be understood, discussed, and acted upon".

This study used Kuhlthau's Information Search Process (ISP) model, which was initiated in the 1980s, improved in the 1990s, and adapted by Kuhlthau, Heinström and Todd (2008) as its theoretical framework. The ISP model is very useful for this study. The researcher divided the model into three categories: initiation and identification, exploration and formulation, and collection and presentation. During the initiation and identification stage, the researcher investigated how students sought information to solve a problem and how they could select the topic to be studied. In the exploration and formulation stage, the investigation focused on how students analysed and accessed information for their studies. In the collection and presentation stage, the researcher investigated how the students appraised, integrated, synthesised, and used the information to satisfy their academic needs. Chapter Two provides a detailed discussion on this topic (see Chapter Six, section 6.8 for the application of the model in the study).

1.8 Definition of terms

This section presents the definition of key terms used in this study.

1.8.1 Literacy

Literacy is defined as the ability to read and write and, therefore, to come and understand the relation between spoken and written language (Vlieghe 2015:210). Literacy is also seen as the ability to identify, understand, interpret, create, communicate and compute, using digital, printed, and written materials associated with varying contexts (UNESCO Institute for Statistics 2023) – the definition adopted by this study.

1.8.2 Information literacy

Information literacy is a set of abilities requiring individuals to recognise when information is needed and have the ability to locate, evaluate, and use effectively the needed information

(American Library Association 2024). Information Literacy is defined as a set of abilities that enable individuals to recognise the need for information, locate it efficiently, evaluate its credibility, and effectively utilise it for various purposes (Naimpally, Ramachandran & Smith 2012). The researcher adopted the definition provided by the American Library Association.

1.8.3 Computer literacy

Computer literacy is the basic information and skills necessary to use computers (Ibrahim, Majeed & Jawad 2023:48). According to Velliaris and Breen (2016:19), a computer literate person understands the basic processes of computers and technology and can use those processes. The researcher adopted the definition provided by Velliaris and Breen.

1.8.4 Library literacy

Library literacy is defined as competence in the use of libraries and basic skills of finding information (Kuzmin & Parshakova 2013:82). Library literacy is the familiarity with library resources, services, and material organization (Liu, Zhang, Smith, Xu, Pillon & Guo 2020). For this study, the definition provided by Kuzmin and Parshakova was adopted.

1.8.5 Information resources

Information resources refer to the teaching and learning materials that are accessible in various formats, such as print and electronic formats. Odintsov (2012) sees information resources "as the totality of information gained and accumulated in the development of science and practical activities of people for use in production, management, and everyday life". Information resources are considered to include websites and different information systems, including search systems, databases and databanks, hyperlinks or a distributed hypertext WWW system as a whole, many different programmes, electronic libraries, portals, as well as often traditional libraries, archives, museums, and their funds and collections (Berestova 2016:86). The researcher adopted the definition that relates to information resources as teaching and learning materials that are accessible in various formats.

1.8.6 Lifelong learning

Lifelong learning is the provision or use of formal and informal learning opportunities throughout people's lives to foster the continuous development and improvement of the knowledge and skills needed for employment and personal fulfilment (Dictionary.com n.d.). Lifelong learning comprises all phases of learning, from pre-school to post-retirement, and covers the whole spectrum of formal, non-formal, and informal learning (Laal 2011:470). The researcher adopted the definition provided by Dictionary.com.

1.8.7 Competency

Competency is described as a set of observable and measurable attributes or success factors required for individuals, for effective work performance (Wong 2020:100). Competency is defined as the individual's ability to use, apply and demonstrate a group of related awareness, knowledge, skills, and attitudes needed to perform, successfully and safely, all tasks and duties included in a specific occupation and which can be measured against well-accepted standards (levels) required in employment as well as assessed against provided evidences at work location (Wahba 2013:5). The researcher adopted the definition provided by Wahba.

1.8.8 Information literacy competency

According to Virkus (2012:24), information-related competencies are the skills, knowledge, attitudes, experience, attributes, and behaviour an individual needs to find, evaluate, and use information effectively. Information literacy competency "deals with a combination of knowledge, skills, and attitudes towards recognising when and why information is needed, where to find it, how to evaluate, manage and apply it, synthesize, use and communicate it ethically and legally" (Anunobi & Udem 2014:70). The definition provided by Virkus was adopted for this study.

1.8.9 Information literacy proficiency

Information literacy proficiency is the ability to do an efficient information search, think critically about information, choose a quality source of information, and use information to achieve certain goals (Sukmawati, Prajoko & Darmawan 2018:1-2). Wendekier (2015:10), on

the other hand, defines information literacy proficiency as a "mastery of information literacy knowledge and skills". The researcher adopted the definition provided by Sukmawati, Prajoko and Darmawan.

1.9 Brief literature review

This review is built on previous studies on information literacy in higher education worldwide and aligns with the study's objectives and the theoretical framework adopted (see Chapters Two and Three for more details).

Research conducted by Godbey and Dema (2017:8) in the US, Charalambous (2018:26) in Cyprus, and Fázik and Steinerová (2021:1) in Slovakia all reported on how participants perceive information literacy. It must be noted that information literacy is conceived or perceived differently in these studies. Meanwhile, Charalambous (2018:41), Phillips *et al.* (2019:45), and Kocevar-Weidinger *et al.* (2019:175) reported on the identification of the information needs of participants. In these studies, the students identified their information needs when they had assignments and project work to attend to and when they wanted to satisfy their curiosity and solve a problem.

Several other studies, including those by Asiedu, Plockey and Kordie (2020:16-17), Kocevar-Weidinger *et al* (2019:179), Phillips, Fosmire, Turner, Petersheim and Lu (2019:42), Robison, Fawley and Marshall (2020:4-6), and Charalambous (2018:32) investigated how undergraduate students search and locate information as well as the sources they use to access information. Studies on the information literacy skills of undergraduate students by, amongst others, Petermanec and Šebjan (2017:70-73), Simonsen, Sare and Bankston (2017:208), Godbey and Dema (2017:7), Bakermans and Plotke (2018:103), Bartol, Dolničar, Podgornik, Rodičc and Zoranović (2018:380), Kocevar-Weidinger *et al.* (2019:179), and Fázik and Steinerová (2021:8) have reported mixed results about the students' capabilities to assess information before using it critically. Meanwhile, research conducted by Godbey and Dema (2017), Bakermans and Plotke (2018), Bartol *et al.* (2018:380), Zulaiga and Omar (2018:7), Asiedu, Plockey and Kordie (2020:22), and Graves, LeMire and Anders (2021:8) investigated students'

ability or inability to ethically and legally use information. Finally, studies by Simonsen, Sare and Bankston (2017:208), Phillips *et al.* (2019), Zulaiga and Omar (2018:7-8), and (Robison, Fawley and Marshall (2020:4-5) have illuminated the challenges students face in accessing and using information.

This section summarised pertinent literature on information literacy in higher education worldwide and mentioned how students perceive information literacy, information sources, poor searching skills, difficulty in evaluating and using information properly, and other challenges they face in accessing and using information. All the mentioned studies emanate from countries such as Canada, Greece, Kenya, South Africa, and the United States. However, few studies have been done about students' information literacy skills in Ghana. Furthermore, research conducted in Ghana by, amongst others, Lamptey (2008), Anafo and Filson (2014), Afful-Arthur and Filson (2015), Dorvlo and Dadzie (2016), Agyekum, Ntiamoah-Sarpong and Arthur (2017), Yebowaah and Sanche (2021), Amegashie and Ankamah (2020), Ankamah, Gyesi and Anaman (2021), and Ozor and Toner (2022) tended to deal with students in universities whose programmes are primarily oriented towards the arts, humanities and social sciences. Therefore, to some extent, these studies did not consider the perspective of science and technology students. Furthermore, all the studies listed above were conducted in other regions in Ghana than Kumasi. An earlier study done at KNUST by Ahenkorah-Marfo and Teye (2011) narrated the experiences of the KNUST Library staff in trying to introduce information literacy course in the university. To the best of the researcher's knowledge, no study has been done about the information literacy skills of undergraduate students at KNUST. Additionally, no study has employed the method (qualitative) being used in this study to investigate how undergraduate students in KNUST access and use information. This study, therefore, looks at how students in a science and technology university like the KNUST seek, find, access, evaluate, and utilise information in their academic endeavours.

1.10 Research methodology

A research methodology details how research is carried out, including the theoretical and philosophical assumptions upon which research is based and the implications of these

assumptions for the method adopted (Saunders, Lewis & Thornhill 2007:602) (see Chapter Four for more details).

1.10.1 Research paradigm

All research is guided by a set of beliefs and assumptions known as worldviews (Creswell 2009:6) and paradigms (Neuman 2014:96). A paradigm is a general organising framework for theory and research that includes basic assumptions, key issues, models of quality research, and methods for seeking answers (Neuman 2014:96).

This study adopted constructivism, or interpretivism, which is inclined towards qualitative studies. The reliance on the participants' views of the situation being studied, and the use of open-ended questions and environments (Creswell & Creswell 2018:8; Slevitch 2011:78) informed the choice of this paradigm. This paradigm, therefore, influenced the choice of the research approach for this study (see Chapter Four, section 4.2 for more details).

1.10.2 Research approach

Three approaches can be adopted when conducting research. These approaches are quantitative, qualitative, and mixed-methods (Creswell & Creswell 2018:3). Quantitative research entails the testing of objective theories by analysing the relationship among variables (Creswell & Creswell 2018:4). On the other hand, qualitative research allows the researcher to explore and understand the meanings individuals or groups give to a social or human problem (Creswell & Creswell 2018:4). Mixed-methods research is an approach to inquiry that combines both qualitative and quantitative forms (Creswell & Creswell 2018:4).

The qualitative approach was used in this study because it seeks answers to questions by examining various social settings and the individuals who inhabit these settings (Berg & Lune 2011:8). The approach allowed for the collection of data on various issues concerning information literacy, opinions, attitudes, and behaviour of undergraduate students of KNUST (see Chapter Four, section 4.3 for more details).

1.10.3 Research design

Research designs are plans and procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis (Creswell & Creswell 2018:3). According to Creswell and Creswell (2018:3), selecting a research design also depends on the nature of the research problem or the issue being addressed, the researchers' personal experiences, and the audiences for the study. The case study method was used for this study. (see Chapter Four, section 4.4 for more details).

1.10.4 Population

In terms of research, the population refers to a group of persons (or institutions, events, or other subjects of study) the researcher wants to describe or about which they want to make generalisations (Taylor 2012:1030). This study's population was undergraduate students at Kwame Nkrumah University of Science and Technology. These students share common characteristics in searching, accessing, and using information (see Chapter Four, section 4.5 for more details).

1.10.5 Sampling

A sample is a selected small collection of cases or units that creates features of interest in a larger collection of cases, called the population (Neuman 2014:246-247). A non-probability method of sampling was used in this study. Non-probability sampling is the sampling technique primarily employed in qualitative studies (Daniel 2014:12). Convenience and quota sampling was employed in this study. The researcher selected ten representatives conveniently from each of the colleges in the University, to form the sample size for this study. This brought the sample size of this study to 70 (see Chapter Four, section 4.6 for more details).

1.10.6 Data collection instruments

Instruments such as questionnaires, interviews and observations (and others) can be used to collect data in research. This study employed semi-structured interviews and observation as data collection instruments in line with the qualitative research approach. According to Johnson

and Christensen (2008:203), an interview is a data collection instrument in which an interviewer asks an interviewee questions.

A semi-structured interview technique was used, which allowed the respondents to answer the same questions. The researcher pretested the interview schedule on five undergraduate students in a private university in Kumasi before it was used for the study. The researcher compiled a list of questions in line with the study's objectives. A digital voice recorder was used to record the interviews. Areas such as the conception of information literacy, identification of information needs, location of information, appraisal of information, ethical and legal use of information, and problems associated with finding and using information effectively and efficiently were covered in the interview (see Appendix A for the interview schedule). The other data collection instrument used in this study was observation, which was used to supplement the data collected through interviews (see Chapter Four, section 4.7 for more details).

1.11 Data analysis

Data collected in any research must be interpreted to give meaning to the raw data. Since this research employed a qualitative design, the data collected was analysed qualitatively. The researcher used thematic analysis to analyse the data collected from the study participants. The research results were placed or classified under themes or groups and analysed thematically. The analysis was based on the research objectives of this study and the theoretical framework adopted (see Chapter Four, section 4.9 for more details).

1.12 Reliability and validity

Reliability and validity are central concerns in all research (Neuman 2014:211). Reliability and validity are particularly important for the case study method because of its dependence on data produced from limited or particular samples. The two terms are, therefore, crucial for this study due to the limited number of participants (see Chapter Four, section 4.8 for more details).

1.13 Scope and limitations of the study

Scope refers to the boundaries within which a research project will be carried out. On the other hand, limitations represent weaknesses within the study that may influence the outcomes and conclusions of the research (Ross & Bibler Zaidi 2019). The scope of this study is limited to undergraduate students of the Kwame Nkrumah University of Science and Technology. Therefore, postgraduate students in the university were excluded from this study. The researcher's challenge was time and dealing with the impact of Covid-19. It was challenging to interview the students due to the researcher's work schedules, the students' lecture schedules, and the impact of Covid-19. These challenges were, however, resolved after studying the students' timetable and explaining the rationale and the need for them to participate in the study.

1.14 Ethical considerations

Research ethics is a set of guidelines that assist researchers in conducting research so that it is done justly without harming anybody (Hickey 2018:8). Therefore, ethical behaviour in research is critical, especially when the research involves human subjects.

To ensure the integrity of this study, the ethical guidelines and standards such as respect for persons, beneficence, justice, inclusiveness, informed consent of participants, no coercion, autonomy, veracity, privacy and confidentiality, and the awareness of risks and benefits involved in research (Hickey 2018:12-13; UNISA 2016:11) were adhered to by the researcher (see Chapter Four, section 4.10 for more details).

1.15 Originality

Originality means something "created personally by a particular artist, writer, musician, etc; not a copy; not dependent on other people's ideas; inventive or novel: a subtle and original thinker" (Stevenson 2011). Cryer (2006:192) puts forth that originality in research is achieved under the following conditions: originality in tools, techniques, and procedures; originality in exploring the unknown/unexplored; originality in exploring the unanticipated; originality in

data; originality in the transfer of mode or place of use; originality in byproducts; originality in the experience; and originality as "potentially publishable". Similarly, (Guetzkow, Lamont and Mallard (2004:191) see originality "as using a new approach, method, or data, studying a new topic and doing research in an understudied area, as well as producing new theories and findings."

The originality of this is seen in the development of an Information Literacy Competency Model for undergraduates. This contribution to the body of knowledge in Information Science will help improve the students' information literacy skills.

The originality of this study also lies in the method used. As pointed out by Cryer (2006:192) and Guetzkow *et al.* (2004:191), originality can achieved in methods. The use of interviews and observation in the data collection in this study, which has not been used before by any study in Ghana to study the information literacy competencies of undergraduate students, makes this study and the results original.

Furthermore, this study is original because of the data used. Cryer (2006:192) indicates that a study can achieve originality by collecting original data. This study collected original data about how the students conceive information literacy and search, access and use information to meet their needs.

Finally, this research qualifies as original because it meets the "potentially publishable" criteria by (Cryer 2006:192). The study's outcomes will be published as articles in reputed journals that are widely distributed for people to access and use.

1.16 Outline of the study

The study is presented in seven chapters. Chapter One covered the background of the study. Chapter Two presents theoretical frameworks pertaining to information literacy and the framework adopted in this study. The chapter also explains the meaning and purpose of a theoretical framework.

Chapter Three reviews the existing literature on information literacy. The chapter presents previous research on information literacy, which explains the nature of the problem and its relevance to the study, but also shows how the present study differs from previous studies.

Chapter Four addresses the research methodology adopted for this study. It looks at research approaches in general and then specifically at the research approach and design adopted for this study. The chapter also presents the study's population, sampling and sample size, data collection methods, reliability and validity, data analysis, and ethical considerations.

Chapter Five presents the findings of the study. The findings are presented based on the objectives of the study. It focuses on the conceptions of information literacy, identification of information needs, location of information, appraisal of information, ethical and legal use, and problems associated with finding and using information.

The discussions and interpretation of the findings are addressed in Chapter Six. The discussion and interpretation of results align with the research objectives, and the discussion ends with a solution to the problem investigated.

Chapter Seven presents the summary, conclusions drawn from the study, and recommendations.

1.17 Summary

This chapter presented the background of the study, the problem investigated, research objectives and questions which is aimed to address the problem. Summaries of the study's theoretical framework, literature that supports this study, methodology to be employed, the significance of the study, ethical considerations and originality were addressed. The next chapter presents the theoretical framework adopted for this study.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 Introduction

In this chapter, the theoretical framework that supports this study is addressed. The chapter begins by explaining the meaning and purpose of a theoretical framework and discussing existing models and theories related to information literacy. It is followed by a discussion of the framework adopted for this study.

According to Creswell (2009:51), a theory is an interrelated set of constructs formed into propositions, or hypotheses, that specify the relationship among variables. He intimates further that "a theory might appear in a research study as an argument, a discussion, or a rationale, and it helps to explain (or predict) phenomena that occur in the world". Kuhlthau (2004:13) posits that a theory "offers an articulation of underlying complexity that can be understood, discussed, and acted upon".

Grant and Osanloo (2014:12) argue that a theoretical framework functions as the structure and support for the justification of the study, the problem statement, the purpose, the significance, and the research questions. The theoretical framework offers a foundation for the literature review and, most crucially, the methods and data analysis (Grant & Osanloo 2014:12). Some models and theories related to information literacy are discussed below.

2.2 Information literacy models and theories

Several models and frameworks have been used to study information literacy. These models and standards are used to communicate the character of information literacy, curriculum design and evaluation, staff development, and student assessment (Bruce 2004). In Bruce's (2004) estimation, these models also reveal the richness of the information literacy experience. Among these models are Doyle's attributes of an information literate person, the seven faces of information literacy (Bruce 1997), the Society of College, National and University Libraries' (SCONUL) seven pillars of information literacy (Bent & Stubbings 2011), the second edition of the Australian and New Zealand information literacy framework (Bundy 2004) (which was initially based on the Association of College & Research Libraries'(ACRL) standards) and

Kuhlthau, Heinström, and Todd's (2008) information search process, which is the model adopted for this study. These information literacy models are essential in teaching, learning, and becoming information literate. They clarify in depth what is expected from students or individuals to achieve information literacy competencies.

2.3 Doyle's attributes of an information literate person

Doyle's attributes of the information literate person result from a Delphi study, in which a group of professionals deliberated and agreed upon features related to information literacy (Bruce 2004). Even though Doyle's attributes might appear outdated, the researcher believes they are still crucial for this study. According to Bruce (2004), learning to become information literate involves developing and showing these attributes. It must be noted that Doyle's attributes are linear and as such does not make provision for an iterative activity.

In a study titled "Information literacy in an information society: a concept for the information age", Doyle (1994:3) mentions that to be information literate, one must first appreciate that credible information engenders intelligent decision-making. Intelligent decisions can only be made when there is information. Therefore, Doyle's second attribute calls for the recognition of an information need (Doyle 1994:3). Without this desire for information, nothing much can be achieved.

Doyle's third attribute dwells on the formulation of questions based on one's information needs (Doyle 1994:3). The questions will make it possible for one to be focused on the search for the correct information needed to solve a problem. Solving the problem at hand will require one to identify the correct information sources. Subsequently, Doyle's fourth attribute requires the identification of potential sources of information by the information literate person (Doyle 1994:3). Such an identification will go a long way in helping the information literate person achieve their goals. In Doyle's estimation, the fifth attribute of an information literate person is the development of successful search strategies (Doyle 1994:3). Since there are several sources of information, a solid search strategy is necessary to collect the correct information to solve a problem. The information literate person, therefore, must be able to search properly for the needed information at all times to address the problems at hand.

After a successful search, the information literate person should be able to access the information, especially if it is computer-based. Doyle's sixth attribute, therefore, requires the information literate person to be literate in using computers and other technologies (Doyle 1994:3). The seventh attribute of an information literate person is the evaluation of information (Doyle 1994:3). Since there may be credibility issues with some information especially those that can be accessed online, all information that is downloaded must be critically evaluated. This will help the information literate person select the information required to address a particular task. According to Doyle's eight attributes, the information literate person must also be able to organise information for practical application after evaluation (Doyle 1994:3). This will assist in integrating the new information into an existing body of knowledge.

Doyle's last attribute requires an information literate person to be able to use information in critical thinking and problem-solving (Doyle 1994:3). The quest for information is to address a problem, but in doing so, the information literate person must also develop critical thinking skills that they will be applying in their day to day activities. Doyle's attributes of an information literate person is illustrated below in Figure 2.1.

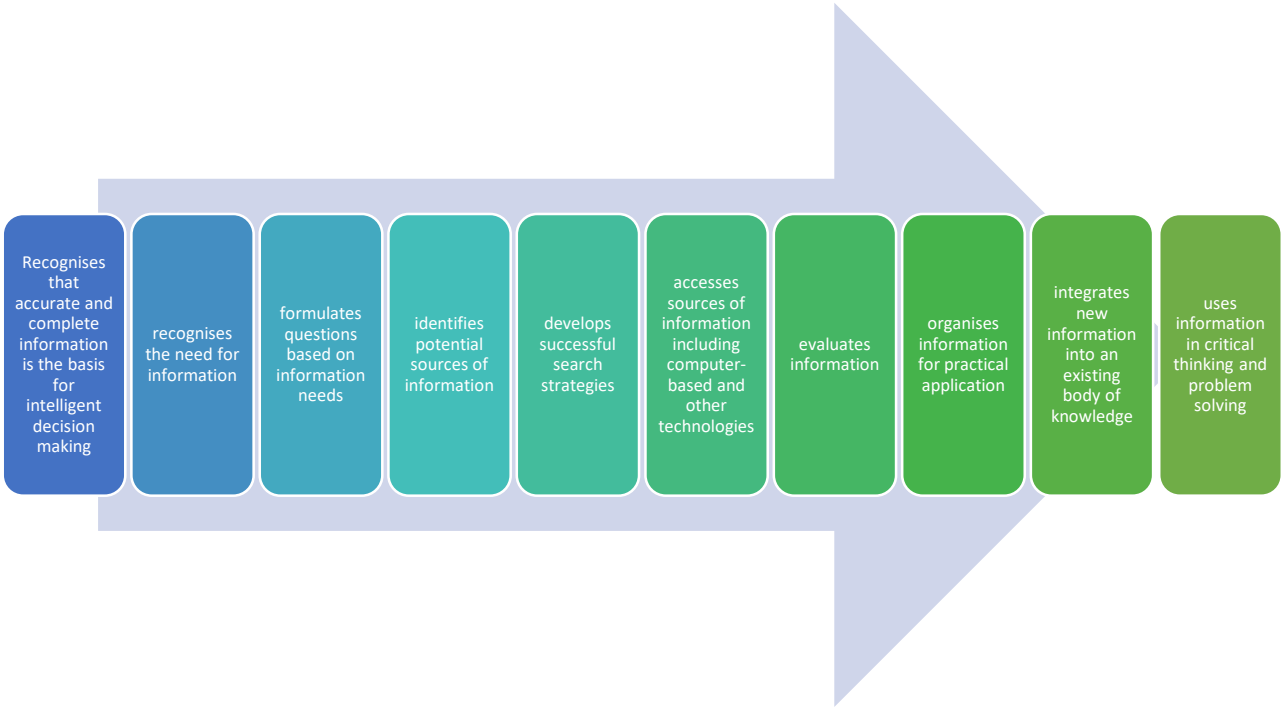


Figure 2.1: Doyle's attribute of an information literate person (Doyle 1994)

2.4 The seven faces of information literacy

Bruce's seven faces of information literacy model evolved through a phenomenographic study of differences in the experience of information users (Bruce 2000:215). In this model, learning to become information literate entails "becoming aware of the different ways of experiencing information use through engaging in relevant information practices (Bruce 2000:215). The model provides directions for educators and may be useful in community settings. The seven faces featured in the model are:

i. the IT experience,
ii. the information sources experience,
iii. the information process experience,
iv. the information control experience,
v. the knowledge experience,
vi. the knowledge extension, and
vii. the wisdom experience.

The first face is the IT experience face, where information literacy, according to Bruce (1998:29), is seen as using information technology (IT) for information retrieval and communication. IT enables information access and personal networking (Bruce 1997; Bruce 1998:29). Technology is crucial for the user to stay informed and handle information successfully. In this experience, information literate people are seen as successful IT users (Bruce 1998:29).

The second face is the experience or conception of information sources. In this face, information literacy is perceived as looking for information (Bruce 1997; Bruce 1998:30) and the experience is seen in terms of knowledge of information sources and an ability to retrieve these information sources (Bruce 1998:31). This face stresses an individual's knowledge of sources, and their content and structure (Bruce 1998:31). According to Bruce (1998:31) knowing what is needed is a unique characteristic of this face which leads to the use of phrases such as "knowing what you want" or "knowing what they want". The ability to independently use available sources to retrieve information and the readiness to use an intermediary is emphasised in this face (Bruce 1998:31).

The third face is the information process experience. In this face, information literacy is perceived as effecting a process (Bruce 1998:32). The information process refers to the plans people employ when they experience the absence of knowledge (Bruce 1998:32). This face is characterised by the identification of a knowledge gap, the execution of information processes and making a decision (Bruce 1997; Bruce 1998:32).

The fourth face is the information control experience. In this face, information literacy is perceived as controlling information (Bruce 1997; Bruce 1998:33). Bruce (1998:33) argues that information control, in this situation, is about storing information in a way that guarantees stress-free retrieval. In this face, the brain, mechanical devices such as filing cabinets, electronic devices, and bibliographic software are used as forms of information control (Bruce 1998:34).

The fifth face is the knowledge construction experience. In this face, information literacy is perceived as constructing a personal knowledge base in a new area of interest (Bruce 1997; Bruce 1998:35). Bruce (1998:35) explains that this experience brings together information seeking and critical analysis, resulting in the creation of a knowledge base. Thus, critical analysis, a vital part of knowledge creation, is an important aspect of using information (Bruce 1998:35).

The sixth face is the knowledge extension experience, where information literacy is perceived as working with knowledge and personal viewpoints in such a way that new insights can be obtained (Bruce 1997; Bruce 1998:36). The focal element in this face is an ability for insight, which leads to the creation of new ideas (Bruce 1998:36). Bruce (1998:36) explains the meaning underlying the experience as an improved knowledge base together with creative insight, producing novel solutions. Creativity is, therefore, about how insights are gained through working with knowledge and personal viewpoints (Bruce 1998:36). In this face, ideas are the outcome, and intuition is a contributing factor to effective information use (Bruce 1998:37).

The seventh face is the wisdom experience. This final face perceives information literacy as using information prudently for the benefit of others (Bruce 1997; Bruce 1998:37). Bruce (1998:37) sees wisdom as a quality employed in using information in various situations, such

as exercising judgement or doing research. The use of information is subjected to the "beliefs, values and attitudes" of human beings and not on technology (Bruce 1998:37). The use of personal values, attitudes, and beliefs makes it possible to place information in a bigger context and thus perceiving as part of a broader experience (Bruce 1998:38). The features of Bruce's seven faces of information literacy is illustrated in Table 2.1 below.

Table 2.1: Bruce's seven faces of information literacy (Bruce 2000)

First face	The IT experience	IT is used for information awareness. IT helps users to stay informed/to communicate a social experience-not individual. It is dependent on expertise within a group.
Second face	The info-sources experience	Knowledge of information sources. Independence to use available sources to access information. The assistance of intermediaries is emphasised. Personal skills are valued.
Third face	The info-process experience	It is linked to problem-solving and decision-making.
Fourth face	The info-control experience	It involves recognising relevant information and managing that information. It makes connections between information, projects, and people. It shows the interconnectedness between information and parts of projects.
Fifth face	The knowledge construction experience	It emphasises learning. It involves developing personal perspective with knowledge gained. It is dependent on critical thinking.

Sixth face	The knowledge extension experience	It involves personal knowledge, experience, and creative insight. Mysterious experience develops new knowledge/approaches to tasks.
Seventh face	The wisdom experience	It involves personal quality, values, and ethics combined with knowledge. Information is used for the benefit of others.

2.5 SCONUL's Seven Pillars of Information Literacy

The Society of College, National and University Libraries (SCONUL) Working Group on Information Literacy introduced the Seven Pillars of Information Literacy as a model for information literacy through a position paper in 1999, which was revised in 2011 (SCONUL Advisory Committee on Information Literacy, 1999; Bent & Stubbings 2011:2). This model has been accepted by librarians and teachers all over the world as a way of assisting them in presenting information skills to their learners. The model is perceived as a three-dimensional round "building", established in an information landscape that consists of the information world as it is seen by an individual at that time (Bent & Stubbings 2011:4). The round nature of the model shows that becoming information literate is not a linear process, and a person can develop within the several pillars concurrently and independently (Bent & Stubbings 2011:4; Dalton 2013:32; Anunobi & Udem 2014:71). The seven pillars of information literacy are:

i. identifying a personal need for information;
ii. assessing current knowledge and identification of gaps;
iii. constructing strategies for locating information and data;
iv. locating and accessing the necessary information and data;
v. reviewing the research process, and comparing and evaluating the information and data;
vi. organising information professionally and ethically; and
vii. applying the knowledge gained through the presentation of the results of their research, synthesising new and old information and data to create new knowledge, and

disseminating it in a variety of ways (SCONUL Advisory Committee on & Information Literacy 1999:6; Bent & Stubbings 2011:5-11; Anunobi & Udem 2014:71).

SCONUL's Seven Pillars of Information Literacy are illustrated in Figure 2.2 below.

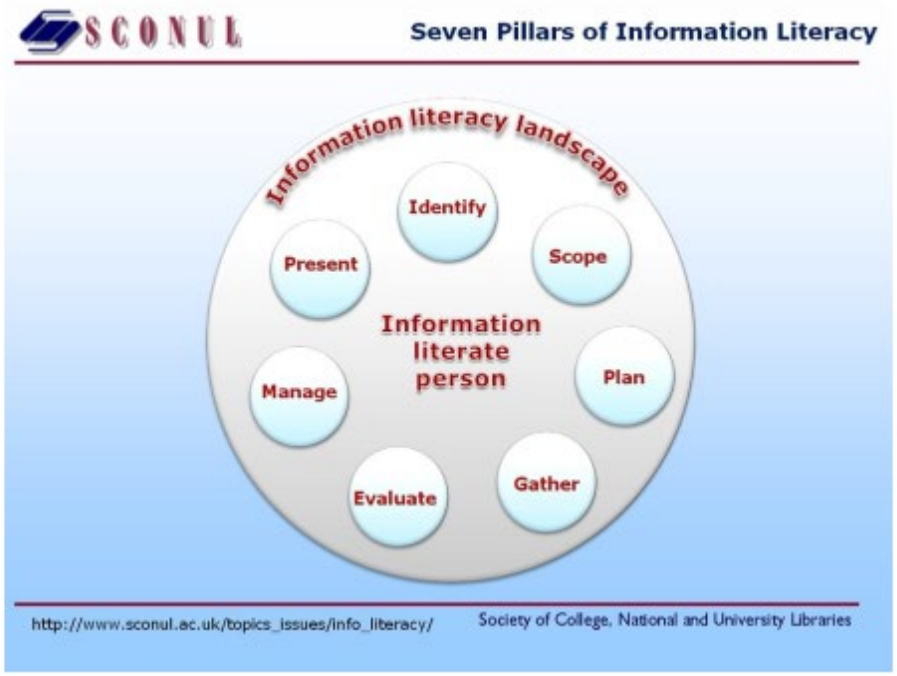


Figure 2.2: SCONUL's Seven Pillars of Information Literacy (Bent & Stubbings 2011).

The first of the seven pillars is recognising the need for information. The information literate person should know that new information and data are continuously being created and that there is always much to learn. Information literacy entails developing a learning habit. An information literate person recognises the lack of knowledge in a subject area and the subsequent need for information. That need will motivate the information literate person to begin looking for information. Such a person should be able to communicate current knowledge on a topic, be responsible for an information search, and manage time efficiently to complete a search (Bent & Stubbings 2011:5).

The second pillar is identifying current knowledge and ways to address knowledge gaps. Having recognised the need for information, a person must now find information to address that need. This involves assessing current knowledge and gaps. The information literate person

should be able to identify the available types of information and their features in terms of format (digital or print). This pillar also involves understanding the publication process, the issues connected with accessibility, and the services available to help with access. This knowledge will help the information literate person select the appropriate information types and search tools to access the information (Bent & Stubbings 2011:6).

The third pillar is the construction of techniques to locate information and data. The information literate person must understand the various searching strategies available for discovering information, the distinctions between search tools, the need to revise keywords and vary search techniques according to the resources available, and the use of controlled vocabularies in searching. This knowledge will help the information literate person state the search question clearly and use appropriate keywords, concepts, the most suitable search tools and strategies, and controlled vocabularies to meet their information need Bent & Stubbings 2011:7).

The fourth pillar is locating and accessing information and data. The information literate person must understand the following:

i. How information and data are organised.
ii. How digital technologies are providing shared tools to create and share information.
iii. The issues related to connecting new data.
iv. The different elements of a citation and how this defines an information resource.
v. The distinction between free and paid for resources.

This knowledge will enable the information literate person to use information retrieval tools and resources effectively, retrieve full-text information, use appropriate strategies to collect new data. and determine when the information need has been met Bent & Stubbings 2011:8).

The fifth pillar is the assessment of information and data. The information literate person must understand the following:

i. The information and data landscape.
ii. Issues of quality, accuracy, relevance, bias, reputation, and credibility relating to information and data sources.

iii. How information is evaluated and published
iv. The relevance of citation in their learning/research context.

This understanding will enable the information literate person to distinguish between diverse information resources and the information they provide, select appropriate material on their search topic, evaluate the quality, accuracy, relevance, bias, reputation, and credibility of the information resources found, and critically assess and appraise their own results and those of others (Bent & Stubbings 2011:9).

The sixth pillar is the organisation of information ethically and professionally. The information literate person must be truthful in all aspects of information management and distribution and adopt suitable data handling methods. The information literate person must also understand the relevance of ethically storing and sharing information and data. The understanding will enable the information literate person to use bibliographical software to manage information, cite printed and electronic sources using appropriate referencing styles, show knowledge of the rights of others, including ethics, data protection, copyright, plagiarism, and any other intellectual property issues, and meet standards of conduct for academic integrity (Bent & Stubbings 2011:10).

The seventh pillar is the presentation of the information and the new knowledge created. The presentation can be in several ways such as verbal reporting, writing, publication of the results in appropriate publishing outlets as well as the creation of personal profiles in appropriate social networking sites, discussion lists, blogs, etc. to disseminate the new knowledge created (Bent & Stubbings 2011:11).

2.6 The Australian and New Zealand Information Literacy Framework

This framework was developed from the Association of College and Research Libraries' (ACRL) information literacy competency standards for higher education (Bundy 2004:3). According to Bundy (2004:3), "the framework provides the principles, standards and practice that can support information literacy education in all education sectors". The framework integrates standards and learning outcomes that are made up of the characteristics, attributes, processes, knowledge, skills, attitudes, beliefs, and aspirations linked to an information literate person (Bundy 2004:7). The framework, which is divided into six standard, makes it possible

to embed information literacy in the design and teaching of educational programs across the curriculum as well as providing institutions with direction for policy development within disciplines and professions (Bundy 2004:7).

The first standard of the framework requires the information literate person to recognise the need for information and to determine the nature and extent of the information needed (Bundy 2004:11). At this point, the information literate person attempts to understand the topic to be investigated by identifying its key concepts and terms, as well as conferring with others to understand it better. The information literate person also considers the scope, purpose and importance of other information sources and the re-examination of the initial information needed to settle on the actual topic to be investigated (Bundy 2004:13).

The second standard states that the information literate person discovers the needed information effectively and efficiently by using proper methods, including the construction of effective search strategies to acquire information (Bundy 2004:14). The information literate person identifies appropriate methods by investigating their benefits, scope, content, and organisation as well as consulting with librarians and other information professionals to assist in selecting the right tools (Bundy 2004:15). This standard also requires the information literate person to construct an effective search strategy by using keywords, synonyms, related terms, and controlled vocabularies (Bundy 2004:15). The information literate person should be up to date with current information sources, technologies, and access tools by subscribing to listservs and discussion groups and constantly sifting through print and electronic resources (Bundy 2004:15).

The third standard requires the information literate person to critically evaluate the information and the information-seeking process (Bundy 2004:16). The information literate examines the importance of the information obtained through the quality of the results, identifies gaps in the search results, and then revises the search strategy where necessary to obtain new results based on the reflection of the information-seeking process (Bundy 2004:17).

The fourth standard requires the information literate person to manage the information gathered (Bundy 2004:18). The information literate person is required to record the information and its sources by noting all relevant citation information for future reference (Bundy 2004:19). The

information literate person also creates a system to organise and manage the information collected (Bundy 2004:19).

The fifth standard requires an information literate person to use prior and new information to create new understandings (Bundy 2004:20). The information literate person determines whether the information satisfies the research need, makes conclusions based upon the information gathered, and then selects the information that relates to the topic (Bundy 2004:21). The information literate person should communicate the new knowledge effectively through appropriate communication media to the targeted audience by using a style that supports the purposes of the intended audience (Bundy 2004:21).

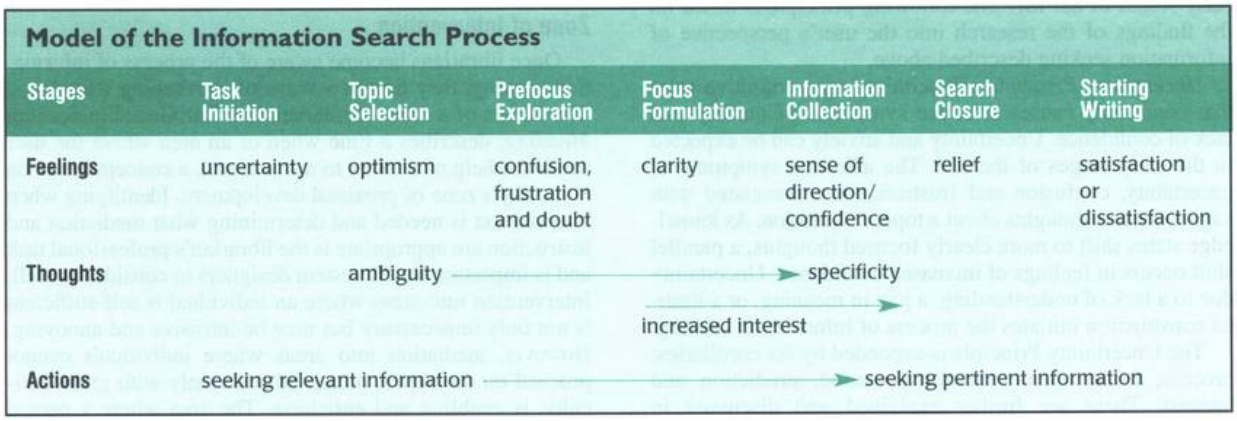
The sixth standard requires an information literate person to use information with understanding and to recognise the cultural, ethical, economic, legal, and social issues associated with the use of information (Bundy 2004:22). The information literate person should be able to identify issues related to privacy and security in the print and electronic environments and censorship and freedom of speech and to respect local and diverse viewpoints of using information (Bundy 2004:23). The information literate person should also understand plagiarism and correctly cite the work and ideas of others and show an understanding of intellectual property, copyright, and fair use of copyrighted material (Bundy 2004:23).

2.7 Kuhlthau's Information Search Process (ISP) model

The study at hand utilised Kuhlthau's Information Search Process (ISP) model, which was initiated in the 1980s, updated in the 1990s and adapted by Kuhlthau, Heinström and Todd (2008), as its theoretical framework. This model serves as a framework for understanding the information search experience of people in a diverse library and information setting (Kuhlthau, Heinström & Todd 2008). A key aspect of the ISP, according to Kuhlthau (2005:1), "is the notion that uncertainty, both affective and cognitive, increases and decreases in the process of information seeking".

Kuhlthau's empirical studies show that the information search process occurs in six stages: initiation, selection, exploration, formulation, collection, and presentation (Kuhlthau, Heinström & Todd, 2008). According to (Kuhlthau 1999:13, 2016:1), each stage involves

common patterns of feeling, thinking, and acting. Kuhlthau's Information Search Process (ISP) model is illustrated in Figure 2.3 below.



In the first stage - initiation - an individual becomes aware of a lack of knowledge, information, or understanding to solve a complex problem or accomplish an involved project. This stage is associated with feelings of uncertainty and apprehension.

The next stage is the selection phase, which entails identifying and selecting a general area or topic to be investigated. Feelings of uncertainty often lead to confidence after the selection has been made, and the search can start. Users' thoughts hover on weighing prospective topics against the guidelines of personal interest, assignment requirements, information available, and time allotted (Kuhlthau 2004:46).

The third stage is the exploration phase. It is the most difficult stage for most users and the one most information service providers and information system designers interpret incorrectly. Confusion, uncertainty and doubt increase during this time. Exploration entails investigating information on a general topic to understand it. Users' thoughts hover on becoming sufficiently informed about a topic to form a focused viewpoint that will aid the search and lead to achieving their aim.

The fourth stage is the formulation of focus. It is the critical moment of the process when feelings of doubt reduce and optimism increases. Thoughts become more clear, and a focused

point of view is formed. During this time, a change in feelings is commonly noted, with indications of increased confidence and a sense of clarity.

Collection is the fifth stage in the information-seeking process, when the interaction between the user and the information system works most effectively and efficiently. The task entails collecting information related to the focused topic, and users' thoughts centre on defining, extending and supporting the focus.

The last stage of the model is the presentation phase. The task is to complete the search and resolve the problem. There is a common feeling of relief and satisfaction if the search was successful and disappointment if it was not. Thoughts centre on ending the search with a personalised synthesis of the topic (Kuhlthau 2004:50). These different stages in the information search process aligns with the definition of information literacy which requires individuals to recognise when information is needed and have the ability to locate, evaluate, and use effectively the needed information.

The ISP model is very useful for this study. While the models discussed above are relevant and anyone of them can be used in this study, the ISP model was used in this study because it has been mentioned by Brand-Gruwel *et al.* (2009) and Cisek (2014:12) to be a prominent model in qualitative studies. The model was grouped into three categories: initiation and identification, exploration and formulation. and collection and presentation. Figure 2.4 below illustrates how the model was adapted in this study.

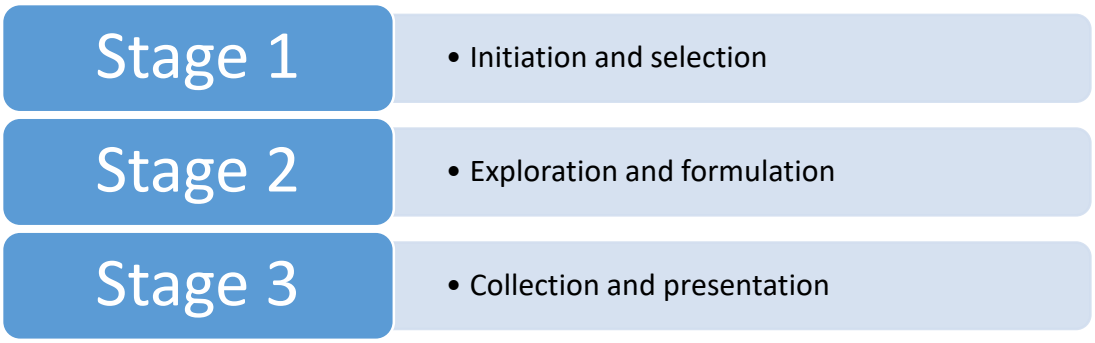


Figure 2.4: Components of the adapted ISP model

The initiation and selection stage is the point when students show the need for information to solve a problem and start to identify a topic to be investigated. For the purposes of this study, during the initiation and identification stage, the researcher investigated how students sought information to solve a problem and how they selected the topic to be studied. The students' strategies to seek and find information were emphasised.

During the exploration and formulation stage, students infuse their personal understanding into a general topic to focus and form a viewpoint on. In this stage, the investigation focused on how students accessed information for their studies.

The collection and presentation stage is when the students gather information about the focused topic and finally complete the research by finding solutions to the problem. In this study, the researcher investigated how the students analysed, integrated, synthesised, and used information to satisfy their academic needs. The relationship between the constructs of the theory and research questions is illustrated in Table 2.2 below.

Table 2.2: The relationship between the constructs of the theory and research questions

Constructs	**Research Question**
	What are the different understandings of "information literacy" by undergraduate students of KNUST?
Initiation and selection stage	When do undergraduate students think they need information?
Exploration and formulation stage	What are the strategies, including using appropriate commands such as Boolean operators, truncation, and advanced search instructions for undergraduate students of KNUST to retrieve information?
Collection stage	What are undergraduate students of KNUST's understanding of the terms "information appraisal" or "evaluation"?
Collection and presentation stage	What are undergraduate students' understanding of ethical and legal use of information?
All the six stages: Initiation, selection, exploration, formulation, collection and presentation	What problems do undergraduate students face in finding and using library and Internet information effectively and efficiently?

2.8 Relevance of Kuhlthau's Information Search Process model to the study

Kuhlthau's Information Search Process (ISP) model is a well-known framework in information science. It is particularly useful for understanding how individuals search for and use information. It also has important implications for addressing undergraduate students' challenges in searching for and using information effectively and efficiently. The model serves to understand the emotional, cognitive, and behavioural aspects of the information seeking process. The ISP model is appropriate to the study and to the qualitative research approach used in the study in the following ways:

To begin with, the ISP model starts with the initiation phase, where students feel uncertain and anxious about beginning their search. Recognising these feelings is important to help librarians and faculty provide the support needed to manage these emotions. Second, students may encounter conflicting information as they explore, leading to confusion. The model demonstrates the normalcy of feelings, helping students navigate this difficult phase with the right support. Third, the ISP model provides a clear path from selecting a topic to formulating a research focus. This helps students move from a broad area of interest to a specific research question, minimising the risk of being overwhelmed by the information available. Fourth, the model encourages students to engage deeply with the information they encounter. This fosters critical thinking and the ability to synthesise different sources into a clear understanding. The model allows students to revisit and refine their searches, promoting a more in-depth approach to information seeking. Fifth, the ISP model supports the development of research skills, such as defining information needs, developing search strategies, evaluating sources, and using information ethically. These skills are essential for conducting effective and efficient research. Sixth, the ISP model guides students in coherently organising and presenting their research findings.

2.9 Summary

This chapter started with an explanation of a theoretical framework and its uses and importance. This was followed by a discussion of some of the theories and models associated with information literacy by Doyle (1994), Bruce (1997), Bent & Stubbings (2011), and Bundy (2004) . All the models address common skills that an information literate person must possess,

such as the recognition of the need for information, knowledge of formats and sources of information and how to access them, development of search strategies, evaluation of the information sources and the utilisation of these information resources in an ethical manner. The chapter discussed the model adopted for this study - the Information Search Process by Carol C. Kuhlthau (see Figure 6.1 in Chapter Six for the application of the model in the study). The chapter concluded with a discussion of the relevance of the ISP model to the study.

Chapter Three presents a review of the existing literature related to the problem under study.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter explores studies that have already been conducted on the topic under investigation. It positions the study by presenting relevant research about the conceptions of information literacy, identification of information needs, location of information, appraisal of information, ethical and legal use of information, and challenges associated with finding and using information by undergraduate students in line with the objectives of this study.

A literature review provides a comprehensive overview of literature related to a theme/theory/method and synthesises prior studies to strengthen the foundation of knowledge (Paul & Criado 2020:1). Literature reviews are essential for every research (Boell & Cecez-Kecmanovic 2015:161). The review creates a firm foundation for advancing knowledge. Boell and Cecez-Kecmanovic (2015:161) add that the literature review provides an overview, synthesis, and a critical assessment of previous research, challenging or problematising existing knowledge and identifying or constructing novel research problems and good research questions. Eckstein's (2017:2) point of view is that a "literature review places the study in a larger context by presenting, evaluating, and contextualising research related to the topic of inquiry".

3.2 Information literacy (IL)

There are many definitions of information literacy. Some dwell on the information-literate person's abilities, behaviour, learning process, and environment. The Association of College and Research Libraries (2015:3) defines information literacy as a "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". Similarly, Addison and Meyers (2013) define information literacy as "a set of skills, abilities, or behaviours exhibited by individuals in their information seeking within digital environments". Meanwhile, Tirado (2012) considers the learning process and environment in the definition of information literacy. The author defines

information literacy as the "teaching-learning process designed for an individual or group of people, under the professional leadership and guidance of an educational or library institution, using different teaching strategies and learning environments".

Different conceptions of information literacy have been reported in several studies. Some of these studies focused on faculty, librarians, postgraduate students, and high school students. Others focused on undergraduate students. Studies by Bury (2011), Nielsen and Borlund (2011), Michalak and Rysavy (2016), and Ojaranta (2019) included faculty, librarians, postgraduate students, and high school students as their study participants. Undergraduate students were the focus of studies conducted by Charalambous (2018), Diehm and Lupton (2014), Dokphrom (2013); Fázik and Steinerová (2020), Godbey and Dema (2017) Johnston, Partridge and Hughes (2014). It must be noted that the undergraduate students in these studies conceived or perceived information literacy differently than the participants in the studies mentioned earlier.

In Charalambous' (2018:26) study titled "University of Cyprus library students' perceptions of information literacy" the participants understood information literacy to mean the search and use of information, access to information, obtaining information through technology, the ability to use technology/computers, handling of information properly, and the use of databases. A study by Diehm and Lupton (2014) on university students' experiences of learning information literacy in an Australian university reported that the students experienced learning information literacy in the following six ways: learning to find information, learning a process to use information, learning to use information to create a product, learning to use information to build a personal knowledge base, learning to use information to advance disciplinary knowledge, and learning to use the information to grow as a person and to contribute to others (Diehm & Lupton 2014).

Similarly, participants in Dokphrom's (2013:117) study, which sought to identify the information literacy of undergraduate students in the Faculty of Arts, at Silpakorn University in Thailand, conceived of information literacy as acquiring information, researching information, determining information needs, and locating, searching, evaluating, analysing, applying and using information. In a study conducted by Fázik and Steinerová (2020:1) in

Slovakia about newly admitted undergraduate students and their information literacy experience, the students conceived information literacy in three categories: digital technologies, knowledge, and truth. These conceptions point to the diversity of information literacy in relation to other types of literacies, mainly digital, reading, and media literacy, as well as to intersections with other scientific disciplines such as psychology, cognitive science, or philosophy (Fázik & Steinerová 2020).

In Godbey and Dema's (2017) investigation of the information literacy skills and perceptions of information literacy among a sample of undergraduate teacher education students at the University of Nevada, Las Vegas, the students understood information literacy skills to require flexibility, creativity, and collaboration. They discussed this both in the context of their coursework, in which they often participate in group projects, and in the context of the teaching profession, where they recognise the importance of learning from peers (Godbey & Dema 2017:8). Johnston, Partridge, and Hughes (2014:558-560) explored the information literacy experiences of English as a foreign language (EFL) in the United Arab Emirates (UAE), and found that information literacy is experienced as a process, as identifying relevant and reliable information, as applying techniques to use information across languages and as acquiring knowledge on topics and issues. They also indicated language impacted EFL students' information literacy experiences (Johnston, Partridge & Hughes 2014).

The concept of information literacy is multifaceted, encompassing several definitions and perceptions that vary across different contexts and groups. The diversity in definitions shows that information literacy is not a one-size-fits-all concept but a dynamic and evolving set of abilities and processes. These include discovering, evaluating, and ethically using information, often influenced by digital environments, learning contexts, and cultural factors. The reviewed studies underscore the importance of understanding these varying conceptions, particularly among different groups such as faculty, librarians, and students at various academic levels. This diversity in understanding reflects the broad applicability of information literacy across disciplines and its integral role in educational and professional settings.

3.3 Identification of information needs

Identification of information needs is an essential, day-to-day need of students, and it is one of the competencies required of an information-literate person (Igbinovia, Okuonghae & Adebayo 2020:4; Hussain, Li & Alsanad 2022:4). Being aware of the information needed directs the learning path of students. Studies conducted by Charalambous (2018), Phillips *et al.* (2019), Kocevar-Weidinger *et al.* (2019), Dolničar and Podgornik (2023), and Makinde, Hamzat and Koiki-Owoyele (2023) have reported on the identification of information needs of undergraduate studies.

In their investigation of methods for teaching information literacy to engineering undergraduate students, Phillips *et al.* (2019:45) reported that undergraduate students identify their information needs when attending to assignments and project works. Much of the students' information needs in the study were expressed through access to information resources, such as people, client information, standards, existing product information, and market information (Phillips *et al.* 2018).

Charalambous' (2018) study in Cyprus about undergraduate library students' perceptions of information literacy revealed that the students first identify their information needs in the search for information. The students determine their information needs through a thorough consideration of the subject, which then informs the likely information necessary to solve the problem (Charalambous 2018:41). In a similar study conducted by Kocevar-Weidinger *et al.* (2019:175) at four US institutions of higher education, the students were able to identify their information needs, which were sparked by curiosity and problem-solving (Kocevar-Weidinger *et al.* 2019:175). Tan and Theng (2006:203) also report that participants in their study in Singapore could clearly identify their information needs.

Again, Dolničar and Podgornik's (2023:9) study in Slovenia on the factors influencing the information literacy of university students found that 69% of respondents identified their information needs before they looked for the information to address that need. Finally, Makinde, Hamzat, and Koiki-Owoyele (2023:8) reported in a study on the assessment of information literacy, attitudes toward research, and research competence of library and

information science undergraduates in Nigerian universities that 71.7% of respondents could easily identify the need for information.

Identifying information needs is essential for students, particularly those at the undergraduate level, as it significantly influences their learning processes and outcomes. The reviewed studies consistently demonstrate that, students recognise their information needs as a first step in addressing academic tasks such as assignments, projects, and problem-solving activities. This awareness, often triggered by specific academic requirements or curiosity, guides their search for relevant information. Identifying information needs is essential for effective information literacy, enabling students to navigate and utilise information resources more efficiently and effectively. This competency supports their academic success and prepares them for professional and lifelong learning contexts.

3.4 Locating information

One of the skills required of an information-literate person is to locate information using appropriate techniques. Locating and accessing these information sources requires good searching skills. These skills involve identifying keywords or terms, key phrases, and synonyms or related terms in a topic and using Boolean logic (AND, OR, and NOT), truncation, and wildcards to formulate a search query (Landøy, Popa & Repanovici 2020:44).

Several studies have been conducted in the USA, South Africa, Ghana, Nigeria, Greece, Cyprus, Russia, Canada, Australia, Pakistan, Serbia, Slovenia, Slovakia, Vietnam, and Uzbekistan on how undergraduate students search and locate information and the sources they use to access information. In a study conducted at CPUT, Zulaiga and Omar (2018:7) found that students increasingly used the library and approached librarians for information and assistance. In their study that assessed the information literacy skills of education students in a multi-campus institution in Ghana, Asiedu, Plockey, and Kordie (2020:16-17) found that students used Google as their first port of call for information. The study further indicated that students employed Boolean operators in their search strategy to access information. In a similar study on the assessment of information literacy, attitude towards research, and research competence of library and information science undergraduates in Nigerian universities,

Makinde, Hamzat, and Koiki-Owoyele (2023:8) reported that 87.3% of the students did not have the requisite skills needed to locate and access information for research. The study recommended training on acquiring information literacy skills at the earlier levels of the Library and Information Science degree to help with research motivation and comprehension.

Gross and Latham (2011:171-172) investigated the experiences with and perceptions of information literacy among first-year college students in the USA and reported that many students used the Internet, friends, and family members to search for and access information. They mentioned that the students most commonly used Google as a search engine and understood how to use keywords and Boolean logic to search and access information (Gross & Latham 2011:171-173). Godbey and Dema (2017:7) conducted a study in the USA to assess the information literacy skills of a sample of undergraduate teacher education students. They found that the students could not access information and recommended the need for librarians and faculty to help students develop information literacy skills (Godbey & Dema 2017:14).

Similarly, Taylor and Dalal (2017:96) investigated gender and information literacy in a university in the USA and found that the students relied on the Internet (web) for their information needs with the male students (94%) using the web more often than female students (88%). In another study in the USA, Kocevar-Weidinger *et al.* (2019:179) investigated how first-year students conduct everyday life research and how, if possible, their everyday research skills can inform information literacy instruction in higher education and found that the students relied on Google and their friends for their information needs. In their study comparing the information needs and experiences of undergraduate students and practicing engineers in the USA, Philips *et al.* (2019:42) found that students heavily utilised Google, peers, the library, videos, and online forums as a source of information. Robison, Fawley, and Marshall (2020:4-6) conducted a study on what junior and senior undergraduate transfer students in the USA need from their libraries and reported that the students relied on using the same research tools as at their previous institutions, such as JSTOR, Academic Search Premier, advice from their course instructors, and librarians. Liang, Kim, and Kitheka (2022:5) reported in their study that assessed the self-perceptions of students in the USA's research abilities that most (68.3%) of the respondents used Google Scholar half of the time or more to retrieve information. In contrast, few used academic databases or inter-library loan services.

Nikolopoulou and Gialamas (2011:21) investigated undergraduate students' information search practices in Greece. They found that students used Google more frequently for university assignments and personal purposes than the library's subscribed databases. Most (73%) of the students were not using the subscribed databases (Nikolopoulou & Gialamas 2011:27). Foteini, Kyprianos, Koulouris, and Marketou (2022:26-29) investigated the information behaviour of undergraduate health students at the University of West Attica in Greece and found that most of the students (63% in ALIS and 68% in Phys) used search engines to meet their information needs. Additionally, the students reported using keywords to search for information. Charalambous (2018:32) found in a study in Cyprus that most students use the web to satisfy their information needs. The students were unfamiliar with Boolean operators, did not know how to use them, and could not use "advanced" or "extended" search options (Charalambous 2018:42).

Bury (2011:50) studied faculty attitudes, perceptions, and experiences of information literacy at York University in Canada and revealed that most students rely on Google for their information needs. A similar study in Canada by Detlor *et al.* (2011:579) investigating the factors affecting student learning outcomes of information literacy instruction (ILI), revealed that students have poor search skills when using authoritative online library resources. The study recommended improving the student's information literacy skills (Detlor *et al.* 2011:583).

In their study that explored university students' experiences of learning information literacy in Australia, Diehm and Lupton (2014:7) reported that the students relied on other people such as their peers, lecturers, friends, library staff and experts, networks outside of the university, books, journal articles and websites, the Internet, Google, library databases, and the library catalogue as their sources of information. Hughes, Hall and Pozzi (2017:309) found in their study that surveyed first-year undergraduate international students' library and information use at an Australian university that the student participants used a wide range of resources and search tools for their assignments, with books and journal articles being the most commonly used. The resource type widely preferred by the students was electronic materials. The students also used free Internet tools such as Google (77%) and Google Scholar (55%) considerably more than QUT Library's discovery layer tool (31.5%) (Hughes, Hall & Pozzi 2017:309).

Bartol, Dolničar, Podgornik, Rodic and Zoranović (2018:377) assessed the information literacy of first and second-year students enrolled at the School of Agriculture (Faculty of Agriculture), Novi Sad, in Serbia, and found an improvement in their expertise in advanced search techniques using Boolean search operators and search query formulation. In another study conducted by Fázik and Steinerová (2020:7) in Slovakia about newly admitted undergraduate students and their information literacy experience, the students were reported to rely on the Internet, especially Google, for their information needs.

Huynh and Tran's (2020:86) study, which investigated librarianship students' e-specialised information-seeking habits in Vietnam, indicated that the students predominantly use Google to search for the information they need. The study further indicated that the students were aware of Boolean logic and keywords and could use them to search for their information needs. On the contrary, a study assessing undergraduate and postgraduate students' information literacy skills in Pakistan by Safdar and Idrees (2021:12) found that very few (16%) students could use Boolean logic to search for information.

Vasilyeva and Shilov (2022:104) found in their study conducted in Russia aimed at developing students' skills to identify reliable scientific sources, that all students (100%) access information from the Internet. The study further revealed that students were unaware of electronic platforms providing access to scientific publications and data, such as Dimensions, Microsoft Academic, Scopus, Web of Science, etc. Additionally, not many were familiar with Google Scholar and the Russian Science Citation Index (RSCI). Dolničar and Podgornik's (2023:9-10) study in Slovenia on the factors influencing the information literacy of university students found that the students have poor searching skills. They argued that a lack of information searching skills could hinder students' research work and affect citizens' ability to verify information when confronted with dubious claims either in social media or other information sources that may seem legitimate at first glance. Similarly, Mavlanova and Khalikova's (2023:7) study in Uzbekistan on students' problems in searching for reliable information on the Internet found that more than half of the students searched for information on the Internet. The students also relied on their experience, friends, or authoritative people when accessing information.

The ability to locate information effectively is an essential skill for information-literate individuals, yet many undergraduate students globally face challenges in developing these competencies. The reviewed studies reveal a heavy reliance on the Internet, particularly search engines like Google, as students' primary source of information. While some students show knowledge of advanced search techniques, such as Boolean logic and keyword use, many struggle with these skills, leading to difficulties in accessing credible and relevant information. This gap in information literacy highlights the need for targeted training and instruction, particularly in the early stages of higher education, to equip students with the necessary skills to navigate diverse information sources effectively. Better searching capabilities are crucial for academic success and for promoting critical thinking and responsible information use in broader societal contexts.

3.5 Appraisal of information

One of the abilities of an information-literate person is to be able to appraise and evaluate information critically. Information literate persons are therefore expected to assess the quality, accuracy, relevance, bias, reputation, and credibility of the information resources found (Bent & Stubbings 2011:9). The information literate person is also expected to be aware of the peer review process of scholarly publishing and the appropriate extraction of information matching the information need.

Several studies on the information literacy skills of undergraduate students have reported mixed results about the students' capabilities to assess the information they have before they use it. Among the studies on information evaluation are the ones carried out by Hsieh and Holden (2010) Detlor *et al.* (2011), Gross and Latham (2011), Diehm and Lupton (2014), Petermanec and Šebjan (2017), Simonsen, Sare, and Bankston (2017), Godbey and Dema (2017), Bakermans and Plotke (2018), Bartol *et al.* (2018), Kocevar-Weidinger *et al*. (2019), and Fázik and Steinerová (2020).

In the USA, Gross and Latham (2011:177) investigated first-year college students' experiences with and perceptions of information literacy. They revealed that the students' readily discuss the need to evaluate sources, compare sources, and consider whether the sources are appropriate for the question they are responding to. Simonsen, Sare and Bankston (2017:208)

assessed the information literacy needs of undergraduate forensic science students in the USA and revealed that the students could evaluate statements that needed to be cited, and differentiate between scholarly and popular articles. Similarly, Godbey and Dema (2017:7) revealed that the information literacy skill students performed best was the evaluation of sources. In Canada, Detlor *et al.* (2011:579) reported that the students performed relatively well at evaluating sources.

Bartol *et al.* (2018:380) found that 50.4% of students could successfully evaluate information. Fázik and Steinerová's (2020:8) study revealed that newly admitted undergraduate students could evaluate information successfully and competently through information verification, credibility assessment, and skepticism to establish the truth. Diehm and Lupton 2014 reported that students saw evaluation skills as critical in differentiating the large quantities of electronic information they retrieve daily. Similarly, both Charalambous (2018:32) and Kocevar-Weidinger *et al.* (2019:179) found that through the trust they have in their library to provide them with reliable and valid information, reliance on some signs and clues such as citations, references, and the publisher, their professors or lecturers, and the use of multiple sources to determine the most accurate and useful answer, students were able to effectively and efficiently evaluate these information resources for their trustworthiness in these studies.

Other studies conducted by Petermanec and Šebjan (2017:70-73), and Bakermans and Plotke (2018:103), however, reported poor evaluation skills of students. The students in these studies were unable to assess the relevance of sources and were not skilled in evaluating information and information sources. Hsieh and Holden's (2010:465) investigation on the effectiveness of a university's single-session information literacy instruction in the USA found that students did not possess the required skills to evaluate information sources they encountered. Therefore, the authors proposed the need for more training in evaluating sources to improve students' information evaluation skills. In another study in the USA, Bakermans and Plotke (2018:103) assessed the changes in student perceptions of their competency in information literacy after continuous efforts in course curriculum. The study found that students' perceived ability to assess source relevance remained low because most students only referred to examining whether the source provided the correct information and nothing further. In Slovenia,

Petermanec and Šebjan 2017:72) evaluated components of information literacy in undergraduate students and reported a lower point in the field of evaluation.

The ability to appraise information is a fundamental aspect of information literacy, yet this skill's effectiveness varies widely among undergraduate students. While some studies indicate that students can assess information quality, relevance, and credibility, mainly when guided by reliable sources like libraries or professors, other research highlights significant gaps in these abilities. The inconsistency in students' evaluation skills underscores the need for more robust and comprehensive training in this area. Enhancing students' capacity to critically evaluate information is essential not only for their academic success but also for their ability to responsibly navigate the increasingly complex and information-rich world. Addressing these gaps through targeted education and ongoing support could significantly improve students' overall information literacy and their ability to make informed decisions.

3.6 Ethical and legal use of information

Among others, information literate persons are supposed to be able to cite printed and electronic sources using appropriate referencing styles, show knowledge of issues relating to the rights of others, including ethics, data protection, copyright, plagiarism, and any other intellectual property issues, and meet the standards of conduct for academic integrity (Bent & Stubbings 2011:10).

Several studies have reported on students' ability or inability to ethically and legally use information, including those by Hsieh and Holden (2010), Detlor *et al.* (2011), Chisango (2012), Godbey and Dema (2017), Bakermans and Plotke (2018), Bartol *et al.* (2018), Zulaiga and Omar (2018), Asiedu, Plockey and Kordie (2020), and Graves, LeMire and Anders (2021).

In study in South Africa, Chisango (2012:64) found that students understood the concept behind referencing and plagiarism. Similarly, Zulaiga and Omar (2018:7) reported that students consciously tried to cite accurately. In Canada, Detlor *et al.* (2011:579) reported that the students at all three schools under study did well at documenting sources. They felt this may be because the students are frequently required to cite and use proper bibliographic formats in

their written school assignments. Similarly, Bakermans and Plotke's (2018:103) study in the USA revealed an increase (74%) in the perception of the knowledge and application of proper citation formatting and use. The students indicated that they can adequately cite sources. In Ghana, Asiedu, Plockey and Kordie's (2020:22) study revealed that students had a fair knowledge of plagiarism. In all these studies mentioned above, students showed adequate knowledge and understanding of information's legal and ethical use. Students could cite or reference other authors' results, format and do in-text citations, ascertain what information should be part of a correct reference, and understood plagiarism and how to avoid it.

However, Hsieh and Holden (2010:465), Bartol *et al.* (2018:380), and Graves, LeMire and Anders (2021:8) reported that the students had difficulty determining what constituted plagiarism, could not cite an information resource, did not know referencing techniques, could not document sources or format citations. Hsieh and Holden's (2010:465) study in the USA revealed poor performance in the area of citation. Graves, LeMire and Anders' (2021:8) study showed that the students had poor citation formatting skills. Finally, Bartol *et al.* (2018:380) found that students had misconceptions about copyright and the reproduction of recent works of others.

3.6.1 Information ethics

Information ethics is a field addressing the ethical challenges arising from the increasing role of information and technology in society. It encompasses issues of privacy, intellectual property, accessibility, and censorship. It influences how people use and produce information and affects information services, information technology, and professional practices (Marreiros, Ulman, Quaresma, Xiong & Harris 2024:8).

Several studies have been conducted about information ethics among undergraduate students. Cilliers (2017:1) investigated information ethics of young adults at a higher education institution in the Eastern Cape Province of South Africa and found that plagiarism is a problem among first-year students. The students in the study understood what software piracy was but did not think it was wrong to copy software from the Internet. The study recommended that information ethics be included in the undergraduate curriculum to prepare students to deal with

these ethical problems. In a literature review, Al-Nuaimi, Al-Aufi and Bouazza (2017:392) in Oman studied the effects of sociocultural factors on the information ethics of undergraduate students and reported an alarming expansion of unethical information practices among undergraduates. In Nigeria Ebiefung (2023:11) investigated the knowledge of information ethics (plagiarism and privacy) and digital information-seeking behaviour of first-year undergraduates in Topfaith University and found that first-year undergraduate students' knowledge of information ethics is moderate. Another study in Nigeria by Olaojo and Oyeboade (2020:93-94), which examined undergraduate students awareness and compliance with information ethics in University of Ibadan revealed a moderate level of compliance with information ethics. According to the study, most respondents always try to avoid plagiarism while using intellectual property. The study recommended the enlightenment of undergraduate students on the ethical use of intellectual property. In a study of information ethics among undergraduate students in seven different countries, Marreiros *et al.* (2024:8) identified four clusters, uncovering groups of people with very high (legalists), high (moralists), fair (pragmatists), and low (anarchists) perceptions of the information ethics issues among the students.

While many studies indicate that undergraduate students possess some level of understanding of ethical and legal information use, particularly in areas such as citation, plagiarism, and intellectual property, there remains a gap in the consistent use of these skills. Many students demonstrate proficiency in correctly citing sources and recognising the importance of academic integrity, as seen in studies from diverse regions. However, other researches highlight persistent challenges, including difficulties in understanding plagiarism, mastering citation formats, and accurately applying referencing techniques. This inconsistency suggests that while progress has been made in educating students on these crucial aspects of information literacy, there is still a need for more targeted instruction and support to ensure that all students can confidently and ethically navigate the complexities of information use in academic and professional contexts.

There are other important related issues this review should have catered for such as digital literacy, which encompasses a broad range of skills and competencies required to effectively

navigate and utilise digital technologies (Moyo *et al.* 2015:120), and later developments, such as data literacy, which is the ability of non-specialists to use and understand data (Frank, Walker, Julie & Tygel 2012). Others are skills and competency development in undergraduate, which can be achieved through the acquisition of social skills (Gul, Batool, Khan & Jabeen 2023:308) and life skills (Nair & Fahimirad 2019:71), but the researcher decided to concentrate on the discussed issues above to align with the objectives set for this study.

3.7 Challenges associated with finding and using information

Students face several challenges when searching, locating, accessing, and using information. Studies by Hsieh and Holden (2010), Achonna (2011), Simonsen, Sare and Bankston (2017), Phillips *et al.* (2018), Zulaiga and Omar (2018), and Robison, Fawley and Marshall (2020) all highlighted some of these challenges.

Phillips *et al.* (2019:44) reported that the major challenges students faced included locating, evaluating, and accessing information or data. Robison, Fawley and Marshall (2020:4-5) found students faced challenges that included a lack of Wi-Fi at home, time management, the temptation to satisfice in information seeking, and a relative lack of librarian contact. In Hsieh and Holden's (2010:465) study, difficulty differentiating between library catalogue and journal databases was mentioned as a challenge faced by the students. Simonsen, Sare and Bankston's (2017:208) study found locating information sources and identifying the right order for sections of a scholarly scientific article as challenges faced by students. In Hulseberg and Versluis's (2017:20) study, students mentioned starting a research project, finding enough relevant sources, selecting the most appropriate sources, integrating sources into their research, finding the full text of known items, managing their time, and organising and citing sources as main challenges.

In their study exploring the readiness of distance education students at the College of Distance Education, University of Cape Coast in Ghana to use digital learning materials, Arthur-Nyarko, Agyei and Armah (2020:9) reported the high cost of internet bundles, device battery problems, small screen size, and lack of access to the internet as challenges faced by the participants. Meanwhile in Nigeria, Achonna's (2011:31) study revealed that students faced power outages and inadequate computers when searching and accessing information. Omeluzor, Akibu and

Akinwoye (2016:2) investigated students' perception, use, and challenges of electronic information resources at the Federal University of Petroleum Resources Effurun, in Nigeria. They found lack of awareness, lack of training, unreliable Internet connectivity, insufficient e-resources in various study areas, unavailability of e-resources on a 24/7 basis, and difficulty in identifying relevant information to meet users needs as challenges faced by the students. Similarly, Ugwu and Orsu (2017:1) found a lack of browsing skills, low internet bandwidth, insufficient ICT infrastructure, lack of internet access at home, absence of online assignments, lack of motivation to use online information and lack of personal laptops as challenges faced by students when searching and accessing information.

In South Africa, Zulaiga and Omar (2018:7-8) found unstable networks and no internet connectivity as the main challenges faced by students, while Moyo and Okemwa's (2022:11) study on students' perceptions of information literacy at two South African universities revealed that the students had bandwidth and Internet connectivity challenges when accessing information.

Hughes, Hall and Pozzi (2017:313) reported that students in Australia struggled with using the library catalogue, finding books on the shelves, using online databases, identifying relevant resources, having limited resources, and information overload. Yevelson-Shorsher and Bronstein's (2018:541) study conducted in Israel identified difficulty in looking for information for a research study, inability to use the library's resources, apparent gap between the level of their information literacy skills and the expectations of the faculty, teaching techniques that interfere with obtaining information literacy skills, and impatience and reluctance to invest time and effort to search for information as challenges faced by the participants.

In a study on the barriers to online learning during the time of Covid-19 in the Philippines, Baticulon, Sy, Alberto, Maron, Mabulay, Rizada, Tiu, Clarion and Reyes (2021:619-620) identified difficulty in adjusting learning styles, availability of fast and reliable internet connections, infrastructure, and sociopolitical issues as challenges faced by the students. Prasetyawan, Heriyanto and Shuhidan (2021:5) investigated lecturers' perceptions of students' information literacy at Diponegoro University, Indonesia, and revealed that the students were faced with a language barrier and, as a result, could not read academic literature in English. In

a study to identify the challenges students in Pakistan faced in accessing information from academic libraries during Covid-19, Batool, Malik, Safdar and Ali (2022:1) found limited access to the internet and digital devices such as smart-phones, limited information skills, lack of access to printed material, printers, scanners, recorders, and websites with limited guidelines as the primary challenges faced by students when searching and accessing information.

Students across various regions face many challenges when searching for, locating, accessing, and using information. These challenges are diverse, ranging from technical difficulties such as unstable internet connections, power outages, and inadequate ICT infrastructure to skills-related issues like difficulty differentiating between resources, managing time, and integrating sources into research. Additionally, socio-economic factors, such as the high cost of internet bundles, lack of personal devices, and limited access to digital resources, further complicate students' information-seeking processes. These obstacles highlight the need for targeted interventions, including improved infrastructure, enhanced training on information literacy skills, and increased access to digital resources to support students in their academic pursuits.

3.8 Summary

Information literacy encompasses the ability to identify an information need, search and access the needed information, evaluate the accessed information, and effectively and efficiently utilise the information to address a particular problem. Information literacy can, therefore, be determined or measured in one's ability to determine an information need, search and access information, and evaluate and use information effectively and efficiently. The components of this literature review, which looked at studies conducted on undergraduate students' information literacy competencies, addressed these themes that constitute information literacy.

The next chapter presents the research methodology adopted for this study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

A research methodology is the philosophical underpinnings of research intended to generate new knowledge and methods as tools and techniques to collect and analyze data (McGregor 2019:29). It is also a way of seeking data or information about a situation or people's lives, experiences, or activities (Wadsworth 2011:58). A research methodology lends credibility to research and helps to produce scientifically sound results. It also gives a detailed plan that assists researchers in staying on track, making the process convenient, efficient, and manageable. A research methodology informs the data collection and analysis processes and, ultimately, the types of contribution to knowledge that findings claim to make (Delaney 2014:81). This chapter presents the research methodology summarised in Chapter One. It begins by looking at research paradigms and approaches in general and then specifically at the paradigm and approach adopted for this study. This is followed by the research design, study population, sampling technique and sample size, data collection methods, reliability and validity, data analysis, documentary sources, and ethical considerations.

4.2 Research paradigm

A research paradigm is a set of beliefs and assumptions that underpins all research. These beliefs and assumptions are often also described as worldviews (Creswell & Creswell 2018:5) or paradigms (Neuman 2014:96). Originally, a paradigm was understood as an accepted model or pattern (Chen 2010:994), but in 1970, it was given new meaning by historian and philosopher, Thomas Kuhn. Kuhn envisaged a paradigm as a representation of the set of practices that make up the centre of the scientific discipline (Chen 2010:994; Cunningham 2018). Kuhn (1970) refers to the network of conceptual, theoretical, and methodological commitments shared by scientists in a given field as a paradigm (Cunningham 2018). Creamer (2018:44) defines a paradigm as "a set of philosophical assumptions that are inherently coherent about the nature of reality and the researcher's role in constructing it and is agreed upon by a community of scholars". Consequently, a research paradigm helps the researcher decide on the research methodology to use in a particular study and the type of questions to be

asked. The use of a paradigm in a study can serve as a link to a wide array of literature and invite a broader audience to one's work (Creamer 2018:45). The choice of paradigm also assists in justifying why either qualitative, quantitative, or mixed-methods is chosen for a particular research project (Creswell 2009:5).

Several research paradigms can be employed in social science research. Among them are positivism, postpositivism, interpretivism, contructivism, advocacy/participatory, and pragmatism (Creswell 2009:7; Wahyuni 2012:70; Willis 2012:8). In both positivism and post-positivism, an attempt is made to understand social science through the lens of natural science (Creswell 2009:7; Wahyuni 2012:71; Neuman 2014:97). Proponents of both believe in the relationship between cause and outcome as well as the existence of a universal generalisation that can be applied across contexts (Wahyuni 2012:71). Even though positivist and post-positivist researchers largely adopt the quantitative research approach (Creswell 2009:6), some post-positivist researchers also apply the qualitative approach in their studies (Wahyuni 2012:70).

Advocacy or a participatory worldview is another philosophical assumption developed in the 1980s by researchers who felt that the post-positivist assumptions imposed structural laws and theories that did not fit marginalised individuals in society (Creswell 2009:9). Advocacy and the participatory paradigm operate with the notion that politics and a political agenda should be embedded in every research inquiry (Creswell 2009:9). Followers of this paradigm contends that every research project should have an action agenda for reform and this reform is expected to change the lives of the participants, the institutions where they work, and the researcher's life as well (Creswell 2009:9). Advocacy research gives participants a voice, thus raising their consciousness to make their lives better (Creswell 2009:9). The research approach in the advocacy and the participatory paradigm is qualitative, but it can also be a foundation for quantitative research (Creswell 2009:9). The philosophical worldview of advocacy focuses on the needs of groups and individuals within society that may be marginalised (Creswell 2009:9).

Pragmatism arises from actions, situations, and consequences rather than antecedent conditions (Creswell 2009:10). Creamer (2018:6) claims that pragmatism "acknowledges diversity and complexity and sets aside debates about philosophy in favor of what works in a particular

setting or for a particular set of research questions". According to Wahyuni (2012:71), instead of questioning ontology and epistemology as the first step, pragmatists start with the research question to determine their research framework. Pragmatism dwells on the research problem and applies all available approaches to understand the problem (Creswell 2009:10). Pragmatist are thus advocates of mixed-methods research (Creswell 2009:10; Wahyuni 2012:71; Creamer 2018:6).

Interpretivism or constructivism is the "systematic analysis of socially meaningful actions through the direct detailed observation of people in natural settings to arrive at understandings and interpretations of how people create and maintain their social worlds" (Neuman 2014:104). Interpretivists or constructivists do not share the same idea as the positivists, who believe that the same research methods can be used to study human behaviour (Willis 2012:6). Constructivists or interpretivists usually adopt the qualitative research approach (Creswell 2009:8; Wahyuni 2012:70; Neuman 2014:103). They believe that individuals seek an understanding of the world in which they live and work and that such individuals have a subjective understanding of their experiences, which are directed toward particular objects (Creswell 2009:8; Willis 2012:6; Wahyuni 2012:70). As Creswell (2009:8) further explains, the meanings they derive from these experiences, are varied and multiple, which lead the researcher to look for the complexity of views rather than narrowing meanings into a few categories. The philosophical foundations of interpretivism, according to (Willis 2012:7), "can be found in Immanuel Kant's *Critique of Pure Reason* (1781), in which he argued that humans interpret their sensations; they do not directly experience the "out there" world as it is".

A social constructivist worldview, which emphasises the qualitative method, was adopted for this study. The researcher adopted the social constructivist worldview because it relies as much as possible on the participants' views of the situation being studied, the use of open-ended questions, and the use or transfer of the described experiences of the phenomenon by the readers to their settings (Creswell 2009:8; Slevitch 2011:78). This paradigm enabled the researcher to get first-hand information about undergraduate students of KNUST's understanding and perceptions of information literacy through interviews conducted in their setting. This paradigm enabled the participants to freely express their views and opinions about information literacy. Using the paradigm allowed the researcher to gather the needed data for

the study. Therefore, adopting this worldview, which employs open-ended questions and interviews in the participants' natural settings, enabled the researcher to explore the participants' understanding, experiences, opinions, and attitudes about information literacy in-depth. This paradigm, therefore, influenced the choice of the research approach for this study.

4.3 Research approach

A research approach is the "plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation" (Creswell 2014:3). Three different approaches, namely quantitative, qualitative, and mixed-methods (Creswell & Creswell 2018:2) can be adopted when conducting research. The choice of approach is informed by the philosophical assumptions the researcher brings to the study, procedures of inquiry, and specific research methods of data collection, analysis, and interpretation (Creswell 2014:3).

Quantitative research entails testing objective theories by examining the relationship between variables (Creswell 2009:4). Quantitative research makes assumptions about testing theories deductively, incorporating bias protection, controlling for alternative explanations, and generalising and replicating the findings (Creswell 2009:4).

The qualitative research approach, on the other hand, deals with phenomena by analysing experiences, behaviours and relations without the use of statistics and mathematics and the processing of numerical data (Basias & Pollalis 2018:94). Qualitative research is a way to study the social interactions of humans in naturally occurring situations (Lichtman 2014:10). Creswell (2009:4) states that qualitative research enables the researcher to investigate and comprehend the meanings that individuals or groups ascribe to a social or human problem.

Mixed-methods research is a method of investigation that blends both qualitative and quantitative approaches (Creswell 2009:4). Using both approaches concurrently ensures that the overall strength of a study is more significant than in either qualitative or quantitative research on their own. The use of mixed methods helps to overcome the limitations of quantitative and qualitative methodologies, allowing the researcher to get rich information that could not be obtained using each method alone (Almeida 2018:137).

This study used a qualitative research approach because it provides answers to questions by examining various social settings and the people who live in them (Berg & Lune 2011:8). This decision was influenced by the critical role that a researcher plays in qualitative research in the process of collecting data and making sense of or interpreting the phenomena that are observed (Lichtman 2014:10). Finally, the qualitative approach helps to assess people's attitudes, opinions, and behaviours subjectively. This method was used to collect data on a variety of issues and opinions on information literacy from the study's population.

This study was guided by Lichtman's (2014) view of common elements of qualitative research. Among Lichtman (2014) elements of qualitative research include:

i. It aims to understand and interpret the meaning of human interaction and social phenomena.
ii. It considers questions that involve the what and why of human behaviour.
iii. The researcher creates reality. As such, there is no single interpretation of reality but multiple interpretations.
iv. It involves a search for themes or a narrative story. Data is usually presented as words or pictures.
v. It encourages the presentation of findings in alternative styles (Licthman 2014).

In line with these elements identified by Lichtman (2014), the researcher asked the study participants questions on issues related to information literacy that they encountered daily in their natural environment. The questions focused on how the participants perceived information literacy in general rather than specific aspects. The researcher garnered rich, useful data using this approach. The researcher did not manipulate the data elicited from the study participants, which ensured openness in the process. The researcher captured the exact statements of the experiences and perspectives of the study participants on information literacy. The respondents freely disclosed their experiences, thoughts, and feelings without any difficulty. Since researchers often create reality in qualitative studies, the researcher created multiple interpretations of how undergraduate students seek and use information.

The researcher analysed the data collected using this approach and arranged it under themes. The researcher used thematic analysis, one of the alternative styles for analysing qualitative

data, to present the undergraduate students' views regarding how they search and use information. The personal experiences of the researcher, who witnessed how undergraduate students search and use information daily, played an important role in understanding the study participants' perception of information literacy. The researcher presented the results in line with the study's objectives, adding detailed quotations to illustrate the themes identified.

4.4 Research design

A research design is a type of inquiry that provide specific direction for procedures in a research study (Creswell & Creswell 2018:11). The researcher adopted the case study method for this study. Case study is a strategy that contributes to understanding individuals, groups, and organisations, social, political, movements, events, or geographic units and related phenomena in various circumstances (Neuman, 2014:42; Yin, 2009:1). Yin (2009:18) defines a case study as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomena and context are not clearly evident". Neuman (2014:42) defines it as "an in-depth examination of an extensive amount of information about very few units or cases for one period or across multiple periods of time".

The case study design was adopted for this study to get the answers to questions about how the participants perceive and conceive information literacy in KNUST. The topic's relevance and the study's setting, also influenced the choice of the case study design for this study. The case study design was used in the case selection, the number of study participants, and the data collection. Using interviews, one of the instruments that can be applied in case studies for data collection, enabled the researcher to collect valuable and comprehensive information about how undergraduate students in KNUST seek and use information daily.

One of the drawbacks of case study research is the lack of rigour and the extent to which the researcher's or participants' personal biases could influence the study's outcomes. This typically happens in case studies due to the continuous interaction between the researcher and the participants (Yin 2009:11). This drawback was addressed by minimising the researcher's and participants' biases. The researcher consciously encouraged participants to be mindful of

their biases when responding to the questions. The researcher also refrained from introducing his own biases as far as possible in questioning the participants.

The second drawback of the case study design is the lack of a scientific basis for the generalisation of study results to other people with similar problems (Yin 2009:11). The researcher addressed this drawback through the selection of a sample that was representative of undergraduate students at KNUST. The final drawback of a case study is that such studies can take long and result in considerable, unreadable documents (Yin 2009:11). The researcher addressed this drawback by working strictly with the interview schedule developed for the study.

There are four study designs to choose from based on the particular sets of conditions for a study: the single case study, either holistic or embedded, and the multiple case study, either holistic or embedded (Yin 2009:39). The holistic single case study examines only the global nature of an organisation or a programme; thus, it focuses on only one unit of analysis. On the other hand, the embedded single case study examines more than one unit of analysis. Holistic and embedded multiple case studies arise when the same studies contain several cases or several units of analysis (Yin 2009:46).

This study adopted the holistic single case study design, as it only studied one case. Yin (2009:40) provides the following five justifications for conducting single case study research:

i. The case is important in testing a hypothesis or theory;
ii. The case is a unique;
iii. The case is representative;
iv. The case is revelatory;
v. The case is longitudinal, and the research is exploratory (Yin 2009:40).

In this study, the case was representative and depicted the circumstances and conditions of an everyday situation. Adopting the single case study design allowed the researcher to investigate the information literacy practices of undergraduate students at KNUST in-depth. The researcher could provide a detailed description and understanding of how the students seek, access, and use information by adopting the single case study.

4.5 Study population

A population is a group of persons (or institutions, events, or other subjects of study) a researcher wants to describe or about which they want to generalise (Taylor 2012:1030). According to Taylor (2012:1030), "a group may be defined as a population due either to an inherent characteristic of the group itself (such as residence in a particular city) or to a particular characteristic of interest to the researcher (such as having a particular health condition)".

The population for this study consists of undergraduate students enrolled at the six colleges of the Kwame Nkrumah University of Science and Technology (KNUST). These students share common characteristics in their daily search for and use of information for their assignments, thesis, and dissertations. Table 4.1 illustrates the breakdown of the students from the university's various colleges.

Table 4.1: Population of the study

College	**Total number of undergraduate students**
College of Art and Built Environment (CABE)	8 974
College of Agriculture and Natural Resources (CANR)	5 259
College of Engineering (COE)	7 325
College of Health Sciences (COHS)	16 854
College of Humanities and Social Sciences (COHSS)	12 452
College of Science (COS)	8 441
Institute of Distance Learning (IDL)	6 824
Total	**66 129**

Source: Kwame Nkrumah University of Science and Technology 2020

As seen from Table 4.1, the total number of undergraduate students that constitute this study's population is 66,129.

4.6 Sampling

Sampling is necessary since the study of an entire population is sometimes not possible and also sometimes impracticable in some research due to the issue of cost, time, and other factors. Sampling is "the selection of a subset of a population for inclusion in a study" (Daniel 2014:2).

This study used non-probability sampling, which is the sampling technique primarily employed in qualitative studies (Daniel 2014:12). With this sampling technique, the researcher cannot state the probability of a specific element of the population being included in the sample (Connaway & Powell 2010:117). Therefore, not all population members can be selected to participate in a study. This technique has been successfully used in previous case studies in the Library and Information Science field (Maina 2012:15; Akakandelwa & Jain 2013:569; Mtega, Dulle, Malekani & Chailla 2015:47). This sampling method is often applied in qualitative studies that search for insight and depth in understanding a particular phenomenon.

There are various types of non-probability sampling: quota sampling, purposive sampling, convenience sampling, and snowball sampling. The researcher employed convenience sampling and quota sampling in the study. Convenience sampling enables the selection of participant from the target population based on their availability and convenience of the researcher (Andrade 2021:86). Quota sampling on the other hand enables the identification of general groups into which cases or people are placed and the selection of cases to reach a fixed number in each group (Neuman 2014:249). Additionally, quota sampling is convenient, saves time and money, and accurately represents the population. Participants in this study were therefore selected based on the researcher's convenience. In this study, quotas of ten undergraduate students were allotted to each college in the university to constitute the sample size.

Sample size refers to the number of units from which data was gathered. There are four approaches to determining sample sizes for qualitative studies: rule of thumb, conceptual models, numerical guidelines derived from empirical investigation, and statistical formulae (Sim, Saunders, Waterfield & Kingstone 2018:621). Three factors—the nature of the topic, the quality of data, and the study design—played a role in determining the sample size for this study. Authors such as Adler and Adler (2012), Creswell (2013), Marshall, Cardon, Poddar, and Fontenot (2013), Ritchie, Lewis, Elam, Tennant, and Rahim (2014), and Boddy (2016), have suggested sample sizes for qualitative studies based on the rule of the thumb approach. These authors recommended sample sizes ranging from 20 to 60 participants. However, given the population size and the researcher's determination to collect enough rich data for this study, the number of participants exceeds these recommendations. As a result, ten representatives

made up of five male and five female students from each of the university's colleges were chosen as the sample for this study. This brought the sample size to 70. Other factors that influenced the sample size for this study were the contact time spent on each research participant (Marshall et al. 2013) and the homogeneity of the population under consideration (Trotter 2012; Daniel 2014:10).

Table 4.2 illustrates the composition of the sample. The size of the sample selected for this study was representative of the population and enabled the generalisation of the study's outcomes to the entire population of undergraduate students at KNUST.

Table 4.2: Sample size of the study

College	**Sample size**
College of Art and Built Environment (CABE)	10
College of Agriculture and Natural Resources (CANR)	10
College of Engineering (COE)	10
College of Health Sciences (COHS)	10
College of Humanities and Social Sciences (COHSS)	10
College of Science (COS)	10
Institute of Distance Learning (IDL)	10
Total	**70**

4.7 Data collection methods

Data collection is the process of collecting information on variables of interest in a systematic manner to answer stated research questions, test hypotheses, and evaluate outcomes (The Office of Research Integrity n.d.). A suitable data collection method will improve research findings' accuracy, validity, and dependability. There are several methods to collect primary data for case studies. The data can come from documents, archival records, interviews, direct

observation, participant observation, and physical artifacts (Yin 2009:83). Factors such as the ease of administering the instrument, the ease of receiving responses, and the time and cost involved, influence the choice of a data collection instrument. The researcher adopted the interview and observation as the data collection instruments for this study.

4.7.1 Interview

Brinkmann and Kvale (2018:8) state that an interview "is a professional interaction, which goes beyond the spontaneous exchange of views as in everyday conversation". The process involves careful questioning and listening by the interviewer to elicit useful information from the interviewee. Interviews can be structured (standardised), unstructured (non-standardised), or partially structured (Turner 2010:754; Jamshed 2014:87).

Yin (2009:89) notes that interviews are vital for case study research. Therefore, this study's primary data collection instrument was semi-structured interviews in which all the individuals in the chosen sample were asked the same open-ended questions (Basias & Pollalis 2018:97). The interviews were conducted one-on-one and face-to-face. Using interviews facilitated the collection of valuable and detailed information about the information literacy practices of undergraduate students at KNUST.

The interview schedule was pretested on five undergraduate students in a private university (University College of Management Studies) in Kumasi. Pretesting refers to evaluating the measurement properties of survey questions and how they relate to the quality of data generated by the questions (Caporaso 2020). Pretesting ensures that the collected data is valid and reliable. Pretesting allowed the researcher to ascertain the appropriateness of the questions and the length of time an interview session would last. Through pretesting, the researcher could fine-tune the interview questions for the main study.

In January and February 2023, the researcher interviewed the participants using a semi-structured interview schedule to elicit data for the study. The researcher conducted the interviews himself at KNUST's various colleges. The researcher and the interviewees observed national and UNISA Covid-19 protocols by wearing face masks and observing adequate social distancing for the duration of the interviews. The participants were made to read the participant

information sheet and sign the consent form before the interviews. (See Appendices E and F for details).

Using semi-structured interviews enabled the researcher to control the format of the questions. Semi-structured interviews also allowed the researcher to compare the participants' answers. The researcher prepared a predetermined list of questions to which the participants had to respond. The researcher recorded all the interviews with a digital voice recorder with the participants' permission. Each interview lasted approximately two hours. The interview aligned with the study's objectives and covered areas such as the conception of information literacy, identification of information needs, location of information, appraisal of information, ethical and legal use of information, and problems associated with finding and using information effectively and efficiently.

The researcher received immediate responses to the questions posed. The interviews allowed the participants to express their viewpoints and experiences fully, and they could contribute as much detailed information as they desired. When necessary, the researcher asked follow-up questions to probe some responses (Turner 2010:756). Through the interviews, the researcher explored the research participants' understanding and experiences of information literacy (Edwards & Holland 2013:90-91). (See Appendix A for the interview schedule).

4.7.2 Observation

Observation, one of the oldest data collection methods, is a broad category of data gathering in which a researcher chooses a point of balance between observation and participation (Connaway & Powell 2010:180; 216). According to Connaway and Powell (2010:216-217), researchers are expected to do the following when carrying out an observation exercise:

i. Use the extant research literature to provide background, insight, and questions.
ii. Gain access to a community with integrity.
iii. Choose a sample that most effectively addresses the research questions.
iv. Deliberately identify and follow a chosen researcher role.
v. Document data collection with care, detail, and reflection.

vi. Thoughtfully meet all ethical obligations, particularly those that are unexpected.
vii. Analyse the resulting data accurately, honestly, and thoroughly.

Researchers play four different roles when using the observation technique: complete participant, participant-as-observer, observer-as-participant, and complete observer (Yin 2009:93; Connaway & Powell 2010:217). A researcher can carry out all of these roles obtrusively or unobtrusively. Obtrusive observation requires the researcher to build enough rapport with the participant(s) to overcome the natural reactions that anyone might have to being observed. In contrast, unobtrusive observation requires the researcher to fade quietly and naturally into the surroundings (Connaway & Powell 2010:218). Observational evidence is often useful in providing additional information about the topic being studied (Yin 2009:93). Additionally, observation offers the opportunity to determine how well the observed and self-reported data match as well as counter the ill effects of time order, history, and maturation (Connaway & Powell 2010:217).

In this study, the researcher used both obtrusive and unobtrusive techniques to observe undergraduate students' information-seeking behaviour at the circulation desks, reference desks, electronic information centres, computer terminals, and shelves at the various libraries in the university. The researcher solicited the help of library assistants in the various college libraries to assist in the observation exercise. The researcher gave them a checklist to record the students' activities. On-the-spot notes and recordings were made during the data collection exercise. This was done to ensure the recordings' accuracy and not to forget what was observed. The researcher took the following measures suggested by Connaway and Powell (2010:181-182) to ensure the accuracy of the things observed:

i. The researcher used two or more people to observe the same behaviour, with the same technique, and then compared the results.
ii. The researcher tried to avoid biases that could easily creep in during the observation.
iii. The researcher avoided becoming involved in the activity being observed.
iv. The researcher was careful and did not take the participants' behaviour for granted.
v. The researcher obtained reactions from the participants regarding the accuracy of the observations.

The researcher's observation and field notes supplemented the data collected through interviews. (See Appendix B for the observation guide).

4.8 Reliability and validity

Reliability and validity are central concerns in all research (Neuman 2014:211) and are particularly important in the case study method due to the dependence on data produced from limited or particular samples. Consequently, reliability and validity are crucial in this study due to the limited number of selected participants.

Reliability means dependability or consistency (Neuman 2014:212). It refers to how consistently a measuring instrument produces results. To achieve reliability, the researcher developed a case study protocol that contained the instrument as well as the processes and general rules to be followed in data collection, as mentioned by (Yin 2009:67). The instrument was pretested on undergraduate students from the University College of Management Studies (UCOMS), a private tertiary institution in Kumasi. The pretesting of the instrument enabled the researcher to clarify some confusing statements to make them more straightforward to the study's participants.

Validity, on the other hand, implies truthfulness. It refers to how well an idea "fits" with reality (Neuman 2014:212). Validity shows the need to limit factors that might affect the outcome of a study (Marczyk. DeMatteo & Festinger 2005:158). As Denzin and Lincoln (2005:5) claim: "Without validity, there is no truth, and without truth, there is no claim of validity". There are three types of validity—internal, external, and construct validity. This study adequately addressed factors that could cast doubts on the research's credibility. The researcher managed incidents during the study, such as data fabrication or falsification, intrinsic changes within the participants, and selection biases that could affect the validity of the research.

Internal validity establishes a cause-and-effect relationship where certain conditions lead to other conditions (Yin 2009:34). In this study, internal validity was achieved through triangulation, which involved using different data sources, including interviews and observation, to collect the views and opinions of the participants about their knowledge,

understanding, conception, and perception of information literacy (Creswell & Creswell 2018:314).

External validity refers to how findings can be generalised beyond the study itself. The selected sample, namely undergraduate students exhibiting characteristics similar to the study population, and the case study itself, made it possible for external validity to be achieved in this study. This allowed the study's findings to be generalised to all KNUST undergraduate students.

Construct validity refers to the quality of conceptualising the relevant concepts in a study. Construct validity was achieved in this study by providing participants with an operational definition of information literacy skills. In addition, the researcher showed the participants draft copies of the interviews and the interpretations to garner feedback from them to improve the final report. The researcher also formed a focus group of participants to review and validate the study's findings (Creswell & Miller 2000:127).

4.9 Data analysis

After collection, data must be processed and analysed in line with the study's objectives. The process involves examining, editing, coding, classifying, testing, and tabulating collected data (Yin 2009:109). Knowledge about data analysis can assist a researcher in interpreting data to give profound insights into the problem being studied. The researcher analysed the data collected through the interviews qualitatively.

Qualitative data analysis is an important step in the research process and entails the organisation and interpretation of linguistic material to make statements about implicit and explicit dimensions and structures of meaning-making in the material and what is represented in it (Flick 2014:4). Flick (2014:2) maintains that "whatever the data are, it is their analysis that, decisively, forms the outcomes of the research".

Qualitative data can be analysed via narrative, discourse, conversation, framework, phenomenological, visual, content, and thematic analysis. Yin (2009:116-133) also identifies pattern matching, connecting data to propositions, explanation building, logic models, time-

series analysis, and cross-case synthesis as ways to analyse qualitative data. The researcher used thematic analysis to analyse the data collected from participants.

A thematic approach is a method of analysing and placing qualitative data under common themes (Byrne 2017:1). These themes can be ideas, topics, or patterns of meaning that the study participants often repeat. Thematic analysis allows great flexibility in data interpretation. It enables the researcher to handle extensive data sets more easily by arranging them into broad themes. The usual stages of thematic analysis are:

i. preliminary scanning of the materials
ii. developing a set of thematic categories, informed both by pre-existing understanding
iii. coding elements in the materials as representatives of the themes developed, and
iv. using a software package (Byrne (2017:1).

In this study, data was analysed based on the study's objectives. The objectives were:

i. To ascertain the different conceptions of information literacy among undergraduate students at KNUST.
ii. To ascertain how undergraduate students at KNUST identify their information needs.
iii. To investigate how undergraduate students at KNUST locate information.
iv. To assess how undergraduate students at KNUST appraise the accessed information.
v. To establish whether undergraduate students at KNUST ethically and legally use information.

The researcher reviewed, coded, and organised all the interview transcripts under themes. The researcher also reviewed and organised the notes made during the interviews and observation under common themes. Finally, the researcher thoroughly read through all the themes to ensure there was no ambiguity in the themes created.

Data analysis started with sorting and arranging the data obtained from the interviews and the notes taken during the interviews in an Excel spreadsheet. Each question had its own separate Excel worksheet. The researcher populated the worksheet with words and phrases used by the participants. This process was followed by the coding of the interview transcripts. Coding involved separating the text data into groups and labelling the groups with terms.

The data was then integrated by employing the thematic analysis technique. The researcher ensured there were no errors in the information entered into the Excel spreadsheets by identifying, removing, and correcting any responses with problems. Cleaning ensured the validity of the data and, subsequently, the results of this study.

4.10 Ethical considerations

According to Wellington (2015), ethics "refers to the moral principle and guiding conduct, which is held by a group or even a profession". Given (2008a:274) describes ethics as "the part of human philosophy concerned with appropriate conduct and virtuous living". Ethics is primarily concerned, therefore, with how people behave and act. Similarly, Nair (2014:31) defines ethics as a certain well founded standards of 'right' and 'wrong', expressed in terms of rights, obligations and benefits to the society.

Research ethics is a set of guidelines that assist researchers in conducting research so that it is done justly without harming anybody (Hickey 2018:8). Therefore, ethical behaviour in research is critical, especially when the research involves human subjects. Every research project should follow these ethical guidelines to ensure the research's integrity.

To ensure the integrity of this study, the ethical guidelines and standards such as respect for persons, beneficence, justice, inclusiveness, informed consent of participants, no coercion, autonomy, veracity, privacy and confidentiality, and the awareness of risks and benefits involved in research (UNISA 2016:11; Hickey 2018:12-13) were adhered to by the researcher.

The researcher did not collect personal information about the study participants. The researcher avoided questions that could easily affect the participants psychologically, such as sex or gender-related questions and deception or false feedback, which might be embarrassing. The participants were told of their right to withdraw from the study at any time and not to answer questions that appeared to be sensitive to them. The study participants were assured that their privacy would be protected and that the information collected from them would be used purely and solely for this research.

The participants were also not forced to take part in the research. The purpose of the study was fully explained to the study participants. They were encouraged to seek clarifications about questions they were not entirely clear about and not to feel intimidated. The study participants also signed a consent form of participation. In this form, the researcher assured the confidentiality of their responses.

The researcher also complied with the research ethics policy of UNISA. The policy served as a guide to this study. The following were considered:

i. Participating students were given a written authority outlining the purpose of the study.
ii. The dignity, privacy, and confidentiality of participants were respected and protected.
iii. Before involving them in the study, an informed consent form was developed for participants to sign.
iv. Participants were not directly or indirectly coerced and unduly induced to participate in the research.
v. The form specified that the right to participate was voluntary and to withdraw from the research at any time.
vi. The research participants were not exploited. The personal information provided by the participants was not used for any unlawful and secondary purposes incompatible with the original purpose consented to by the participants.
vii. The criteria for the selection of research participants were fair and scientific. Participants were not burdened with repeated demands on their time and knowledge by the researcher to participate in the study.
viii. The research was conducted in an honest, fair, and transparent manner.
ix. The purpose and procedure of the research were clarified during the interviews (UNISA 2016:12-13).

4.11 Summary

This chapter presented the methodology adopted for the study, starting with the research paradigm and the examination of the theoretical viewpoint of the research approach and design. The chapter discussed the study's population, sampling technique, sample size, and the reasons

for choosing them. The researcher explained the rationale for choosing a qualitative research approach. The chapter also covered the methods for data collection (interview and observation), reliability and validity and how to achieve them and analysis (thematic analysis. Finally, issues relating to ethical considerations in research were also discussed. The next chapter reports on the findings of the study.

CHAPTER FIVE

PRESENTATION OF FINDINGS

5.1 Introduction

The previous chapter discussed the research methodology adopted for this study. This chapter presents the study's findings on the information literacy competencies and proficiencies of undergraduate students at Kwame Nkrumah University of Science and Technology (KNUST), derived from interviews conducted with the participants. The presentation of the findings is guided by themes derived from the study's objectives. These are the students' conception of information literacy, identification of information needs, location of information, appraisal of information, ethical and legal use of information, and the problems associated with finding and using information. To ensure that participants' identities in this study were protected and not revealed, the researcher assigned a number ranging from 1 to 70 to each student interviewed. As envisaged in this study, seventy students were interviewed to elicit information for this study. The response rate, therefore, was hundred percent.

5.2 Conception of information literacy (IL)

This section details the participants' answers to a question seeking their different views on or understanding of information literacy. Participants were asked to explain their understanding of information literacy. The researcher identified several themes after reading and coding the interview transcripts The emerging themes included literacy (the ability to read, write, and understand a particular subject), access and use of information, understanding knowledge and problem-solving, knowledge of ICTs, information creation, and information communication. The results are presented in general groups of descriptions of conceptions that reflect the participants' understanding of information literacy. These groups do not reflect any particular student's understanding but have been put together based on the researcher's interpretation of the participants' responses. Thus, each theme only represents a part of the various meanings that express the overall conception of the information-literate student within the group.

5.2.1 Conception of literacy

The first theme that emerged from the transcripts of the interviews was literacy. This theme was derived from the responses of six participants. The UNESCO Institute for Statistics (2023) defines literacy as "the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts". The participants understood literacy as having the ability to read and write, particularly in English, and being able to use English to accomplish their educational goals. To represent literacy, the participants used words and phrases such as *read, write, understand, make meaning, being educated,* and *level of knowledge*. From the participants' perspective, a person is considered literate if they can read, write, and understand things they are confronted with. Knowledge of English by the participants will make it possible for them to assess any information to determine its potential benefits for present and future needs. Overall, participants understood literacy simply as the ability to read and write, as the following excerpts illustrate:

> *Information Literacy is one's ability to understand and make meanings from words, letters, and symbols that are being communicated* (Participant 41).
>
> *Being educated on some specific information or having knowledge on a topic or a piece of information* (Participant 35).
>
> *Knowing how to read and write and access to information* (Participant 32).
>
> *Information Literacy is the ability that one has to read and write as well to understand what is being read and being able to evaluate it to come up with conclusions or to make a decision* (Participant 26).
>
> *It is the level of knowledge you have* (Participant 25).

Based on the excerpts above, to be called information literate from the participants' perspective means that someone exhibits the ability to read, write, and understand English, which is the language of instruction in schools in Ghana.

5.2.2 Conception of access and use of information (assessment, organisation, and dissemination of information)

The second theme that emerged was access and use of information. Information access is defined as "the freedom or ability to identify, obtain and make use of a database or information effectively for one's own development" (Svärd 2021). The theme also includes evaluation, organisation, and dissemination of information. This theme was derived from the responses of 36 participants. Words that were used by most of the participants to depict access and use of information included *discovery, gain, obtain, find, get, gather, identify, understand, search, locate, use, evaluate,* and *transmit.* In expressing these words to depict access and use of information, many participants also continuously used the terms *ability* or *skill*. It means that being information literate requires some level of personal effort. Some participants perceived or understood information literacy as an attempt to access information, as illustrated in the responses below:

> *Information literacy is the knowledge of where and how to find relevant data on any subject matter* (Participant 34).
>
> *Information literacy is a set of integrated abilities encompassing the reflective discovery of information* (Participant 8).
>
> *Information literacy is one's ability to search for and identify information pertaining to one's subject of interest* (Participant 23).
>
> *I understand information literacy as getting conversant with how to get the right information to what one is looking for* (Participant 6).
>
> *Information literacy is the ability to find and get information* (Participant 5).
>
> *Information literacy is knowing how to find the right information* (Participant 9).
>
> *Information literacy is getting information with ease* (Participant 46).

Other participants went beyond understanding information literacy simply as access to information. They understood information literacy as understanding, searching, evaluating, and using information.

Participant 4 made the following observation:

> *Information literacy is "a way in which individuals gain or obtain information, evaluate and understand it*.

Some participants stressed *how* an information-literate person should use information by making use of the words *effective* and *efficient*, as indicated in the excerpts below:

> *It is the ability of an individual to recognise when there is a need for information and have the ability to locate, evaluate and efficiently use the needed information* (Participant 47).

> *Information literacy is the ability of an individual to recognise when information is needed and have the ability to locate, evaluate and effectively use the needed information* (Participant 50).

Some participants also argued that an information-literate person should also be able to use and transmit information in *different formats* as they will be confronted with or come across information in various forms as students. Their ability to navigate these different formats is crucial. The following excerpts relate to using information in different forms or formats.

> *Information literacy is the ability to find, evaluate and communicate information in various formats* (Participant 13).

> *Information literacy is the ability to access processed data, interpret and analyse for personal or academic purposes. It involves the skills and understanding a person has regarding the usage of available information on websites, books in the library and other literature or publications* (Participant 40).

Information literacy is the ability to find, evaluate, organise, use and communicate information in all its various formats, especially in decision making (Participant 44).

Ability to find, evaluate, organise, use and communicate information in various forms (Participant 49).

Information literacy is the ability to locate, assess, organise, use and transmit information in all of its different forms (Participant 61).

Information literacy is the ability as a user to find, evaluate, organise and use information in all various format (Participant 68).

Information literacy is the ability or capacity of an individual to locate, assess, organise, use and transmit or disseminate information of all forms (Participant 70).

Other responses emphasised that information literacy includes elements such as access to information, organisation of information, evaluation of information, use of information, and communication of information. Here are some of those responses:

Information literacy empowers people in all walks of life to seek, evaluate, use and create information effectively to achieve their personal, social, occupational and educational goals (Participant 14).

Information literacy is the ability of an individual to use, find, evaluate, organise and communicate information attained in various ways (Participant 51).

It has to do with the ability to find and organise data by an individual for decisions or evaluation purpose (Participant 52).

My understanding of information literacy is how data and educative body of work is found by an individual, the ability to use and organise the information as well as its evaluation (Participant 64).

It is the ability to identify, locate and evaluate information (Participant 69).

The participants understood information literacy to encompass the ability to access (search and find), organise, evaluate, use, and disseminate information. From this understanding of information literacy, an information literate student must exhibit certain qualities or capabilities such as searching, finding, accessing, organising, critically appraising, efficiently and effectively using, and disseminating information.

5.2.3 Understanding knowledge and problem-solving

Another theme that illustrated the participants' understanding of information literacy was the ability to understand knowledge and how to solve problems. Knowledge is defined as "information, understanding, or skill that you get from experience or education" (Encyclopædia Britannica 2023). Jonassen and Hung (2012:2680) define problem-solving as "the process of constructing and applying mental representations of problems to finding solutions to those problems that are encountered in nearly every context". This theme was derived from the responses of twelve participants. Participants did not merely understand information literacy or was not simply seen or understood by the participants who formed this theme as the acquisition of knowledge alone but as how that acquired knowledge can also be used to solve problems and aid in decision-making. The participants used words and phrases such as ability, understanding, and skill that imply some level of personal involvement in expressing this conception. Some participants understood information literacy as the ability to understand knowledge, as highlighted in the excerpts below:

> *Information literacy is the ability to comprehend knowledge and apply it to difficult issues in the interest of the greater good* (Participant 1).

> *It is the level of one's understanding or knowledge about a certain thing* (Participant 62).

Other participants understood information beyond the level of access, use, and evaluation of information and said it included aspects of decision-making, problem-solving, and knowledge acquisition. Within these responses, some participants emphasised *decision-making*, *problem-solving*, and *knowledge acquisition*. Here are some responses emphasising decision-making or problem-solving:

I understand information literacy as a skill of accessing information systems and databases and using them effectively for the purpose of problem-solving (Participant 10).

Information literacy is the ability to understand a given data and to utilise that understanding to solve challenges (Participant 12).

It has to do with the ability to find and organise data by an individual for decisions or evaluations purpose (Participant 52).

Well, I think information literacy is being able to use and find information surrounding you in any form which can help you do anything like solving a problem (Participant 53).

Information literacy is the ability to find, evaluate, organise, use, and communicate information in all its various formats which promote problem-solving approaches and thinking skills (Participant 54).

The ability to find, organise and evaluate data for decision making and knowledge acquisition (Participant 59).

Those who understood information literacy as a combination of problem-solving and decision-making or knowledge acquisition, responded as follows:

It is the ability to find, organise and use information in various forms for decision making, knowledge acquisition and solving problems (Participant 15).

Information literacy is the ability to access, manipulate, evaluate, organise and able to use and communicate information in many forms for decision making and problem-solving (Participant 38).

It is the ability of an individual to use information in a practical manner. For example, being able to use information or knowledge in problem-solving or decision making (Participant 39).

> *I understand it to be one's ability to find, organise and evaluate data for use in decision making or problem-solving as well as the acquisition of knowledge* (Participant 69).

This theme, therefore, suggests that everyone who can use information to solve problems, make decisions, and acquire knowledge is considered information-literate by these participants.

5.2.4 Knowledge of ICTs

The fourth understanding of information literacy is the ability to have some knowledge of information and communication technologies (ICTs). Knowledge of ICT is "the ability to work with technology" (Amushigamo, Hidengwa & Herman 2018:331). This theme was identified based on the responses of two participants. According to these participants, an information literate person is either tool, digitally, or computer literate. Computer literacy usually refers to the abilities required to use computers to investigate, create, and communicate effectively for learning and for working (Fraillon, Ainley, Schulz, Duckworth & Friedman 2019:15). Computer literacy is regarded as a requirement for all students in the 21st century (Fraillon *et al.* 2019:15) From the participants' perspective, an information literate person is therefore expected to be able to use the various ICT tools at their disposal without any difficulty. The excerpts below highlight this understanding of information literacy:

> *Information literacy is the use of the computer or device for information* (Participant 27).

> *The term refers to what is happening currently, especially in the tech world, and how one should treat it* (Participant 63).

5.2.5 Knowledge about information creation

The fifth conception of information literacy entails knowledge about the creation of. Information creation "is the application of information for the creation of new information" (Gorichanaz 2019:100; Harviainen & Melkko 2022:2). This theme was identified based on the responses of two participants. To these participants, for a person to be considered information

literate requires them to possess skills in how information is created or produced and how the use of that information will lead to the creation of more or new knowledge. The excerpts below illustrate this conception of information literacy.

> *Information literacy is a 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* (Participant 42).

> *Information literacy is the understanding of how information is valued as well as how it is being produced* (Participant 55).

5.2.6 Information communication

The sixth conception of information literacy indicated by participants is information communication. This presupposes an ability on the part of an information-literate person to share or pass on knowledge to another person. The Merriam-Webster online dictionary (n.d.) defines communication as the "exchange of information between individuals through a common system of signs, symbols, or behaviour". Communication is crucial in preparing students to not only be lifelong learners, but also members of a larger community with a voice and a sense of responsibility to others (Ananiadou & Claro 2009:10). This theme was derived from the responses of seven participants. Thus, these participants argued that knowing how to access, appraise, and use the information was not enough. An information-literate person must also know how to communicate the information after use. In expressing this view, the participants mentioned words and phrases such as *distributing, passing on,* and *disseminating*. The participants also used words such as *skills, properly, effectively,* and *well* to show how the information-literate person should communicate. The participants highlighted the level of personal involvement in communication with words such as *ability* and *being able*. The excerpts below illustrate the participants' understanding of information literacy as information communication:

> *Information literacy in my own terms is the knowledge and skills to communicate, reference and properly disseminate information amongst various parties* (Participant 11).

From direct understanding of both keywords (information and literacy), I'll say information literacy is a way of distributing or passing on knowledge to someone with the necessary level of understanding involved (Participant 21).

Information literacy simply means being able to communicate information in all various forms (Participant 22).

Information literacy means to be able to communicate well (Participant 28).

Information literacy is the ability to find, organise and communicate information effectively in all situations (Participant 36).

Information literacy is the ability to communicate information using different media or formats (Participant 57).

Information literacy can be understood as the way one can analyse and use data to communicate to yield understanding (Participant 58).

From the perspective of these participants, the information-literate person must not just be a user of information but also a good communicator.

5.3 Identification of information needs

The study's second objective was to establish how the participants identified their information needs since recognising an information need is one of the required competencies of an information literate student (Bent & Stubbings 2011:5; Igbinovia, Okuonghae & Adebayo 2020:4). Generally, the participants will always need information because they are students. Some participants used words and phrases such as *always, all the time, at all points,* and *every day* to emphasise the urgent need for information. The participants required information for their academic work and leisure, to clear doubts, and sometimes to satisfy their curiosity. Several themes, namely the need for information for academic work, decision-making, problem-solving, broadening of knowledge base, leisure, curiosity, and clearing of doubts, emerged from the interviews.

5.3.1 The need for information for academic work

The first theme that emerged was the need for information for academic work. The identification of this theme was based on the responses of 21 participants. As mentioned, it can be assumed that the participants will always need information because they are students. They would need information to successfully complete their assignments, research projects, and examinations. These needs are typically met at a particular time in the semester and within the academic year. Participants mentioned that they needed information for their *assignments, projects, laboratory work, research, internships,* and *examinations*. The following excerpts illustrate how the participants identify their information needs:

> *I know I need information when I don't know the thing off the head and need to figure it out, or as a student, when I have been given an assignment to work on* (Participant 9).

> *I always need information even when I am not looking for it. But one tries to find or search for information when one requires it to progress. For example, I spend more time at the library now because I need more information to complete my final year project* (Participant 39).
> *I identify my information needs based on the task given. Different tasks require different information. Reports on lab work demand practical information, while most of our daily assignments demand information from different sources. Information is needed in all daily works* (Participant 40).

> *I need information when I am to undertake research, an assignment, or an undergraduate project* (Participant 47).

> *Information is needed for activities like research work, project work, assignment and most of all during preparation for examination* (Participant 53).

> *I feel the need for information when we are given assignments or project works and when we go for internship* (Participant 56).

I need information when I recognise that the information I have is not enough to help me with my work or assignment (Participant 66)

5.3.2 Information for decision-making or problem-solving

The second theme that emerged on information needs was the need for information to assist in decision-making and problem-solving. This theme was based on the responses of thirteen participants. Decision-making and problem-solving are part of our everyday lives. Especially as students, the participants need information to help them with the challenges they might encounter in their academic journey. The participants, therefore, intimated that the availability of information made it possible for them to make the right decision and assist in resolving the problems they encountered each day. Their information needs were, therefore, stimulated by the desire to make decisions and solve problems. The excerpts below illustrate this information need:

I need information when there is a problem to be solved (Participant 7).

I need information during decision-making times, problem-solving, and broad knowledge acquisition (Participant 15).

One needs information for making decisions and when you need to communicate for a change. Problem-solving requires valid information for further prevention and settlement (Participant 36).

I usually need information when a particular problem needs to be solved (Participant 42).

I need information in situations requiring me to think outside the box and come up with solutions to a problem. Sometimes I feel like I need to add up to my vocabulary to be sophisticated with wisdom (Participant 51).

Information is needed at all points in various situations, such as making decisions and evaluating a set of data for a particular purpose" (Participant 52).

Information is needed when the needs arise. For instance, when the need arises to make a decision (Participant 61).

5.3.3 Broadening of knowledge base

The third theme established in identifying the participants' information needs is the need for information to broaden one's knowledge base. This theme was derived from the responses of fourteen participants. The participants' desire for information is not limited to academic activities, decision-making, and problem-solving but also knowledge acquisition in other spheres. They intimated that their quest for information was to *widen* or *broaden* their horizons about other issues of importance around them. They expressed their pursuit of information with phrases such as *to know more* or *to understand* something, as the following excerpts illustrate:

I need information to widen my horizon on issues (Participant 1).

Information is the basis on which individual moves, but information needs are crucial to me when I want to understand or know more about a certain situation (Participant 4).

I need information when I want to broaden my knowledge in an area or a topic (Participant 26).

I need information for my personal needs. For example, I need information to broaden my understanding and knowledge (Participant 35).

I need information whenever I hear about something I have not heard before or whenever I need to know more about an idea or a question asked (Participant 38).

I need information during the time that I need to know more about an idea or about something (it could be a situation or an incident that has occurred) (Participant 55).

I need information when I discover an issue that interests me and wants to know more about it. Also, I need information when I hear about something new (Participant 60).

5.3.4 Lack of information

The fourth theme on the need for information was inadequate information. This theme was derived from the responses of thirteen participants. These participants needed information when they had little or no knowledge about a topic or had difficulty understanding a situation. The participants used words and phrases such as *clueless, do not know something,* or *do not understand* to represent the state of inadequacy. The excerpts below explain this motivation for seeking information:

> *I need information when I encounter a topic or a word form that I do not understand* (Participant 26).
>
> *I realise the need for information when I find myself in an uncomfortable situation due to lack of knowledge and when I am clueless about a particular topic* (Participant 27).
>
> *I feel the need for information when I find myself in an unfavorable situation due to inadequate knowledge* (Participant 30).
>
> *I need to recognise the need for information when I want to accomplish something but am limited by lack of information* (Participant 32).
>
> *Mostly I tend to acquire information when what I have in mind about a particular thing or situation is insufficient to plan with* (Participant 41).
>
> *I feel the need for information when I find it difficult to understand an issue* (Participant 58).
>
> *I really need information when I'm beginning a new process of starting something new* (Participant 59).
> *I need information when I realise I do not know something about a particular topic* (Participant 65).
>
> *You realise that you need information when you lack the knowledge to complete a task, whether consciously or unconsciously* (Participant 70).

5.3.5 Curiosity, doubt, and updating

The fifth theme emerging from the interviews on identifying information needs was curiosity, doubts, and a need to be updated about things. This theme was based on the responses of three participants. The participants' information need was encouraged by the desire to entertain themselves, probe, clear certain reservations about issues, and update themselves on events happening around them. Participants used phrases such as *satisfy my curiosity*, *to be informed of happenings,* and *when I have doubts* to articulate this theme. The excerpts below illustrate their responses in support of this theme:

> *I need information to satisfy my curiosity* (Participant 8).

> *I need information when I want to be informed of happenings in my social networks* (Participant 11).

> *I look for information when I have doubts about something* (Participant 41).

5.3.6 The need for information at all times

The final theme on identifying information needs was the need for information at all times. This theme was derived from the responses of six participants. The participants indicated that, as far as they were concerned, information needs should not be triggered simply by a task or an event. This means that an information-literate person should be seeking information constantly. Phrases such as *knowledge is power, information invigorates me,* and *learning is like breathing,* were used by the participants to reinforce how they saw information and why it should be sought constantly. The excerpts below highlight these responses:

> *I need information everyday. Knowledge is power and can be acquired when the right information is retrieved for a specific subject* (Participant 6).

> *I think I need information everyday since information invigorates me to take action. I do not wait for challenging situations to come before I look for information* (Participant 12).

I need information every second because learning is like breathing. You cannot do away with it. We need information in every second or point of our life (Participant 14).

I need it all the time (Participant 18).

We need information each and every day (Participant 22).

I need information always to be updated on what is happening around me (Participant 67).

5.4 Location of information

The study's third objective was to ascertain how the participants located information. The information-literate person must understand the various search strategies available for discovering information, the distinctions between search tools, the need to revise keywords and vary search techniques based on the resources available, and the use of controlled vocabularies in searching (Bent & Stubbings 2011:7). Students' academic success hinges very much on their ability to know where to find the required resources they need for their studies. Therefore, how they locate information in the library or on the Internet is crucial. According to Dolničar and Podgornik (2023:10), a "lack of information searching skills can hinder students' research work, on the one hand, as well as affects citizens' ability to verify information when confronted with dubious claims either in social media or in other information sources that may seem legitimate". The participants' responses to the question and observations by the researcher revealed three primary sources of information. These sources are the Internet, library and librarians, and other individuals.

5.4.1 The Internet as a source of information

The primary source of information for the participants is the Internet, and 64 participants mentioned it in their responses. The participants saw the Internet as convenient, up-to-date, time-saving, and more accessible than the library, allowing one to work within one's space. Resources the participants retrieved online included electronic books, journals, and videos. The following excerpts illustrate the significance of the Internet as a source of information:

Online is where I locate the information I need because of the wide range of information that can reach you from a click away (Participant 4).

I mostly access the information I need online. This is because one does not have to be in the library to access or get information. One has to be in his or her own space when accessing information at any time (Participant 20).

I search for scholarly articles or journals online (Participant 24).

I search for information mostly online. All library resources, more often than not, can be found online. Online information is more accessible (Participant 34).

I start by reading reference work and non-fiction books of the information I need. I then do a deep research on the topic online. The information obtained are recorded and further researches are done to update it (Participant 42).

I normally prefer surfing the internet for information since it saves time and makes my work easier (Participant 51).

I mostly use online medium and everything electronic. I rarely use the library because most of the books are out of date (Participant 56).

I mostly locate my information resources from online, through online libraries, books and also educational sites (Participant 68).

Search engines such as Google, Google Scholar, YouTube, Medscape, and online databases to which the library prescribed were also mentioned by the participants as information sources. The excerpts below highlight the participants' use of these search engines for the needed information resources:

I search on the Internet. For example, I use Google to search for the exact information I need (Participant 25).

I use YouTube which provides almost all the knowledge I require in my course. I also use Google which helps a lot in my general searches (Participant 37).

I visit relevant websites and relevant television stations as well as YouTube channels which may have the information I need (Participant 59).

I use the library online databases (Participant 61).

I use Google to search for information resource I need (Participant 67).

I use Google Scholar to search for the information I need (Participant 70).

Participants employed keywords, phrases, and Boolean operators (AND, NOT, and OR) in formulating their online search queries. Other strategies to locate the information they needed included using book titles, the table of contents of books, and recommendations from their lecturers. The excerpts below highlight the participants' use of these search terms, phrases, and Boolean Logic to aid their search query formulation:

I combine keywords and Boolean operators such as AND and OR in my searches online (Participant 1).

I identify the keywords which are important to the information needed. I then surf through the right website to get the information (Participant 7).

I search through a search engine with a keyword concerning what I need (Participant 17).

I search for the information I need by entering the keyword in the search engine (Participant 18).
I mostly use keywords and phrases. Although I learned about Boolean operators, truncation and wildcards, I barely use them in my searching (Participant 26).

Firstly, I look up for the keywords on the Internet to give me a broader understanding of the topic. After, knowing what I really need, I search for project pdfs and textbooks in order to gather the actual information I need (Participant 39).

I use keywords and phrases for a general search online. In situations where most of the keywords and phrases appears in large number of articles, the Boolean operators as well as the filtering parameters such as dates, scope etc. are used (Participant 40).

I basically type in the appropriate keyword, phrase or Boolean operator in the search engine to display similar articles so I can get the needed information (Participant 51).

I mostly search with keywords online to help me to easily locate the information I want. I also go through several sites to compare different items before settling on the best one (Participant 52).

I use keywords to search and also apply the Boolean operators; AND, OR, NOT sometimes. Although using the operators is not easy for me (Participant 68).

5.4.2 The library and librarians as sources of information

The second most prevalent source of information is the library and librarians. Eighteen participants mentioned their dependence on these sources. These participants consider the library and librarians as integral information sources. Therefore, even though the Internet seems to be the primary source of information for most participants, the library was also still used by these participants. Phrases such as *I use the library, I go to the library, I read books in the library, the library is my last resort, I go to the librarian, I ask for librarian's help,* and *I contact librarians,* were used to amplify this theme. Most participants went to the library or spoke to a librarian to request printed textbooks. The excerpts below illustrate how the participants accessed their information resources using the library and librarians:

I use the library when seeking for information (Participant 3).

I mostly prefer to use textbook, so I go to the library but when one is not around, I resort to the Internet but my preference is the library because, to me not all of the information on the Internet is valid or true (Participant 26).

I go to the librarian when I need information (Participant 29).

I obtain information from various sources. For instance, I read books in the library (Participant 36).

If I find difficulty in getting the information I need the library is my last resort (Participant 37).

I ask for librarian's help when I need information (Participant 38).

I read books in the library to widen my understanding of my research (Participant 53).

I contact librarians for assistance when looking for a particular book (Participant 70).

Materials in any library are accessed via the use of the catalogue, which contains the names of the authors, titles, subject headings (keywords), and call numbers or class numbers of available books. Some participants mentioned using the library catalogue, call numbers, and book titles as tools to locate books in the library, as the excerpts below illustrate:

I use the call numbers to search on the shelves for books in the library (Participant 1).

I use the labels, keywords to scan through the books for best selection (Participant 40).

5.4.3 Other individuals as a source of information

The third source of information mentioned by four participants was other individuals. These participants did not consider the Internet and the library as the only sources of information. For them, individuals with some *experience* or *knowledge* of the area they were seeking information on were important information sources. This is called referral services, where people with specialised knowledge are contacted for guidance. The excerpts below highlight these individuals' contribution as information sources:

I look for information from experienced people who had also been at my current situation (Participant 14).

My search for information is done face to face with the best person who can give me that information (Participant 17).

I ask people for their knowledge or idea about a particular situation (Participant 30).

I obtain information from persons (Participant 36).

5.5 Information appraisal

The study's fourth objective sought to establish the participants' understanding of information appraisal and how they evaluate or appraise the information resources they encounter daily. Information appraisal or evaluation is the careful consideration of the information you find (Landøy, Popa & Repanovici 2020:77). It involves deciding where to look for information, sifting through it, and deciding what to use (Center for Public Issues Education 2014). An information-literate person must understand the information and data landscape, issues of quality, accuracy, relevance, bias, reputation, and credibility related to information and data sources, how information is evaluated and published, and the relevance of citation in their learning/research context (Bent & Stubbings 2011:9). The participants' responses illuminated four related themes: assessment of information, evaluation of information, examination of information, and verification of information source.

5.5.1 Assessment of information

The first understanding of information appraisal is related to information assessment as identified by 29 participants. These participants indicated that all information one encounters must undergo some level of critical assessment to ascertain its quality, informational value, usefulness, relevance, truthfulness, credibility, validity, accuracy, and authenticity. Subsequently, many participants mentioned the word *checking*. The excerpts below highlight participants' understanding of information appraisal as information assessment:

Information appraisal is assessing the records to determine whether they possess evidential value or informational value (Participant 1).

Information appraisal is an assessment of information to see whether it is useful or not (Participant 4).

Information appraisal describes the act of assessing information (Participant 15).

Information appraisal is the assessment of information to be sure of the quality of the information (Participant, 17).

Information appraisal is the organisation of information by its relevance (Participant 23).

Information appraisal is the checking for and choosing of the right kind of information that matches your research (Participant 24).

Information appraisal refers to the process of assessing information acquired in order to determine its credibility (Participant 30).

Information appraisal is the checking of the validity and accuracy of information. It can be done by assessing the books, articles or journals used by a researcher to confirm the truth in the information (Participant 33).

Information appraisal is the assessment of the information by thinking critically about it being valid. You also check whether there are other sources that confirms the information (Participant 38).

Information appraisal to my understanding is the check or analysis done on an available information to know the credibility and authenticity of the information. Key parameters checked are the source, name of the author, dates and the organisation of the information (Participant 40).

5.5.2 Evaluation of information

The second understanding of information appraisal is information evaluation. This theme was deduced from fifteen participants' responses. Evaluation involves identifying, reviewing, analysing, differentiating, understanding, scrutinising, separating, and distinguishing the

encountered information. The discovered information must be *reliable, valid, accurate, right, authentic, valuable*, and *worthy*. Words like *identifying, analysing, reviewing, differentiating, scrutinising, separating* and *distinguishing* illustrate the concept of evaluation. The following excerpts highlight the participants' understanding of information evaluation:

> *Information evaluation is understanding how to identify the right information needed for a specific topic, subject, etc* (Participant 6).

> *Information appraisal or evaluation is to analyse data based on various principles to foster decision making* (Participant 12).

> *Information appraisal is the act of reviewing and understanding the accessed information* (Participant 20).

> *Information evaluation is your take on accessed information, thus whether the information is reliable, valid, accurate or not* (Participant 22).

> *Information evaluation is the ability to be able to understand what you have read to solve a problem or to be able to relate it to something meaningful* (Participant 26).

> *Information appraisal is trying to differentiate the importance or value of information retrieved* (Participant 43).

> *Information appraisal involves the act of understanding and valuating the nature of a particular information as to the purpose you need it for* (Participant 50).

> *Information evaluation as I understand is how information is scrutinised to ensure that it has the relevant items needed. It is used to pin-point the accuracy of information* (Participant 52).

> *I think information appraisals is separating information with value from information with no value* (Participant 53).

Information appraisal is the process of distinguishing records of information of good value from those of no value to eliminate the bad or irrelevant information from the relevant ones (Participant 70).

5.5.3 Examination and verification of an information source

The third understanding of information appraisal is information examination and source verification. This theme was based on the responses of ten participants. Examination involves critically investigating and verifying the information and its source to ascertain its reliability, validity, accuracy, and credibility. The participants used words such as *examining, verifying, thinking critically,* and *assessing* to describe what must be done in the examination process. The following excerpts highlight the participants' understanding of information appraisal as information examination and source verification:

Information appraisal has to do with examining whether the information you are using is original or appropriate for its use (Participant 3).

Information appraisal is acknowledging information and its source and verifying of the information gained based on the synopsis or outline you've been given before drawing conclusions (Participant 11).

I understand information appraisal to be the careful examination of data that has been gathered in order to establish its validity (Participant 60).

Appraisal or evaluation of information encourages you to think critically about the reliability, validity, accuracy, authority, timeliness, and point of view or bias of information sources (Participant 61).

Information appraisal is determining how authentic the information or data is in regards to its credibility (Participant 64).

Information evaluation is assessing the source of the information. For example, who the author is and who published the information (Participant 68).

Information appraisal or evaluation is an assessment to know that the source of my information is credible (Participant 69).

5.5.4 Appraisal of information resources

There are certain standards to appraise or evaluate information resources. These indicators include authority, currency, accuracy, objectivity, purpose, and appropriateness of the information (Center for Public Issues Education 2014; Landøy, Popa & Repanovici 2020:80). The participants were, therefore, asked to demonstrate how they evaluate information resources they encountered daily based on their responses to the main question regarding their understanding of information appraisal. Even though not all the responses were useful because some participants did not evaluate the information resources they used, there were some valuable responses. These responses were grouped under accuracy, authority, objectivity, currency, purpose, and appropriateness.

5.5.4.1 Accuracy of information

The first theme derived from the participants' responses regarding evaluating information resources is the accuracy of information. This theme was derived from 23 participants' responses. Accuracy implies the correctness of the information resources (Landøy, Popa & Repanovici 2020:80). Participants attempted to *verify, check, assess, compare, scrutinise, review*, and *read through* the information resources to ensure that the information resources they retrieved were credible, reliable, and accurate. The following excerpts demonstrate how the participants evaluate information using accuracy as an indicator:

I verify the source, assess the information gained, check if it is within the outline I have been given, draw conclusions, and do a final draft (Participant 11).

I do this by proofreading the information based on the appropriate requirements and carefully scrutinising it in the context it is being desired for (Participant 17).

I read through and check from other sources to confirm the information (Participant 20).

I do this by reviewing and comparing with other information from other sites (Participant 24).

I try to understand it and check if it makes sense with the examples given (Participant 26).

I do this by checking the source of the information and other sources in order to corroborate the information (Participant 33).

I compare it with other information from different sources (Participant 41).

I do this by comparing the same information between two or more sources (Participant 46).

I do so by comparing the information gathered to other sources and then take the information of the ones related or similar (Participant 47).

I do so by asking questions like; Are there other sources that I can use to verify the information? (Participant 55).

I appraise the information I access by going through over and over to be sure if they provide value relating to a question (Participant 57).

I make sure other sources verify the information given (Participant 58).

I read through the information and try to find other similar data and compare to see which one has more understanding (Participant 60).

I do this by verifying from other sources, be it from the individual persons or from the internet (Participant 63).

I do this by verifying from other sources. I do so by also getting evidence to support whatever information that I collect (Participant 64).

5.5.4.2 Authority of information

The second theme derived from the participants' responses regarding evaluating information resources is the authority of information. This theme was based on the responses of seven participants. The source behind the compilation or publication of information resources is very important (Center for Public Issues Education 2014; Landøy, Popa & Repanovici, 2020:80). The participants indicated that they *checked, looked out for, read through,* and *tried to know* where the information was coming from. In other words, they tried to ascertain the source or the person responsible for the information. The following excerpts demonstrate how the participants evaluated information using authority as an indicator:

> *I check the source of the information* (Participant 13).
>
> *I do this by reading through the information to see if the content is what I need. If its online, the source of the information (website) comes into play* (Participant 35).
>
> *I look out for the one responsible for the content* (Participant 42).
>
> *A background check is conducted regarding how the information has been organised, the key points stated, name of author, dates and other works done* (Participant 44).
>
> *I do this by asking questions like; Where does the information come from?* (Participant 55).
>
> *I try to know where the information is coming from* (Participant 58).
>
> *I do this by knowing the source of the information* (Participant 59).

5.5.4.3 Objectivity of information

The third theme regarding how participants evaluate information resources is the objectivity of information. This theme was derived from the responses of five participants. The idea of objectivity invokes neutrality on the part of authors and publishers in the creation and publication of the information resources and is crucial in this sense (Center for Public Issues Education 2014; Landøy, Popa & Repanovici 2020:80). In responding to this question,

participants used words like *unbiased, not biased, neutral language*, and *peer-reviewed* to demonstrate how they can identify objectivity in the information resources they access. The following excerpts show how the participants evaluated information using objectivity as an indicator:

> *I check to see if it was well scrutinised or peer-reviewed* (Participant 2).

> *I check to see whether it has been reviewed and whether the language used was neutral* (Participant 15).

> *I check for any bias nature from the content* (Participant 42).

> *I do so by asking questions like; Does the language seem unbiased and free of emotion? Or as the information been reviewed?* (Participant 55).

> *I ensure the information is not bias in any form* (Participant 56).

5.5.4.4 Currency of information

The fourth theme derived from the participants' responses regarding evaluating information resources is the currency of information. This theme was derived from the responses of two participants. Currency relates to the publication date of an information resource or the "newness of the resource" (Center for Public Issues Education 2014; Landøy, Popa & Repanovici 2020:80). Therefore, it looks at how recent a publication is, since a dated resource may not be useful. The participants indicated that they could evaluate an information resource based on the date of publication of the information resource. The more recent the information resource is by publication date, the more relevant it is. The following excerpts demonstrate how the participants evaluated information using currency as an indicator:

> *I sort or filter my search results by date* (Participant 23).

> *I look at how current the information is* (Participant 42).

5.5.4.5 Purpose of information

The fifth theme regarding how participants evaluated information resources is the purpose of information. This theme was based on the responses of three participants. Purpose relates to the intention behind creating and publishing information resources (St. Johnsbury Academy 2023). The participants mentioned that they tried to check and know the purpose of every information source they encountered. This ensures they do not use any information but purposeful information. The following excerpts demonstrate how the participants evaluated information using purpose as an indicator:

> *I check to see if the information fulfills the purpose for which it was intended for* (Participant 56).
>
> *I do this by trying to know the purpose of the information* (Participant 59).
>
> *I take into consideration the significance of that information; what the information intend to achieve and its relevance now and tomorrow's impact of such information to the targeted population* (Participant 61).

5.5.4.6 Appropriateness of information

The sixth theme regarding evaluating information resources is the appropriateness of information. This theme was derived from the responses of five participants. Appropriateness implies that any information resource should be valid with well-supported accounts. Information-literate persons should look for citations in documents and check how facts and statistics were collected (St. Johnsbury Academy 2023). The participants mentioned they could determine the appropriateness of the information resources retrieved through *references, citations*, and *footnotes*. The following excerpts demonstrate how the participants evaluated information using appropriateness as an indicator:

> *I check with the references to verify the information* (Participant 2).
>
> *I often use citation and reference for this kind of information* (Participant 3).

I look at the number of data points in the material (Participant 32).

I check the organisation of the book and the website (Participant 42).

I do this by checking for citations, footnotes, or bibliography (Participant 46).

5.6 Ethical and legal use of information

The study's fifth objective sought to establish whether the participants used information ethically and legally. The ability to ethically and legally use information is an essential competency and skill of an information-literate person (Bent & Stubbings 2011:10). The proper use of information, citation or source attribution or acknowledgement, fair use, and prevention of plagiarism are all characteristics of people who use information ethically and legally (Bent & Stubbings 2011:10). Three themes, namely the proper use of information, citation of sources, and plagiarism, were identified based on the participants' understanding in response to the question.

5.6.1 Appropriate use of information

The correct or appropriate use of information is the first theme derived from the participants' responses regarding their understanding of the legal and ethical use of information. This theme was based on the responses of 40 participants. The appropriate use of information involves respecting the rights of authors and publishers. Users should use information correctly to avoid infringing on the intellectual property rights of authors and publishers (Bent & Stubbings 2011:10). Fair use of information is key to the appropriate use of information. Fair use is a legal doctrine that allows portions of copyrighted materials to be used without permission of the copyright owner, provided the use is fair and reasonable, does not substantially impair the value of the materials, and does not curtail the profits reasonably expected by the owner (Merriam-Webster n.d.). Users are expected to seek permission from copyright holders where there is the need to do so before photocopying copyrighted material. Users cannot duplicate any copyrighted material and make it available for sale. According to the participants, appropriate information use includes *not infringing on the rights of original owners and other people, giving written permission to the authors to use particular information, avoiding pirated*

information, not misusing information, and *acquiring information the right way*. Others include *not using the information to hurt or blackmail people, using information for academic purposes, heeding the law that governs the use of information, society should not be affected negatively by the use of information,* and *using information for a good reason*. Furthermore, participants mentioned *quoting* and *paraphrasing* or *summarising* as actions to ensure the appropriate use of information. The following excerpts demonstrate the participants' understanding of the legal and ethical use of information:

> *Legal and use of information means using information without infringing on the original owner's rights* (Participant 4).
>
> *This means to use the information with written permission to the author(s) and the author granting you permission to access or use the information. It can also mean briefly quoting excerpts from a research paper* (Participant 10).
>
> *This means using the right channel to process information, such as avoiding pirated books or printing books without the appropriate authority from the author* (Participant 12).
>
> *In simple terms it refers to the right or appropriate use of information and even the right ways used to acquire and use information* (Participant 15).
>
> *It is the use of information for the appropriate work and not to misuse it* (Participant 17).
>
> *It is the act of using information ethically and properly in order not for the information to hurt or affect anyone* (Participant 20).
>
> *It refers to the right and proper use of information without the intention of harming or blackmailing* (Participant 30).
>
> *It simply means the proper use of information while sticking to ethics* (Participant 33).
>
> *It means understanding the moral and lawful law governing the use of information and applying or heeding to them* (Participant 35).

Legal use of information is when the information obtained is valid and the purpose for which it is to be used for does not affect society (Participant 36).

This is the most appropriate and rightful way of accessing information and using them (Participant 42).

It means using information rightly without causing harm to another or against the law (Participant 46).

It means using information ethically and properly for the intended purpose for which the information is needed (Participant 47).

Ethical and legal use of information involves the use of information for a good reason by following all the rules needed (Participant 51).

Ethical and legal use of information, per my understanding has to do with the appropriate use of information which does not infringe on people's rights that has been widely accepted by society. It includes using the appropriate means to obtain and share information (Participant 52).

Ethical use of information implies having good moral behaviours in the use of any information. Legal use also implies using information in regard of the rules of the country. That is not using information in ways that flout laws (Participant 60).

It means using information such that it causes zero harm to the environment or persons (Participant 63).

Ethical and legal use of information refers to using information in a more academic way by reading and making one's own understanding known in the academic research work rather than plundering and copying which leads to plagiarism (Participant 64).

Ethical and legal use of information means the right way of using information (Participant 66).

It means the right ways of obtaining information and the right use of the information (Participant 67).

5.6.2 Citation of sources

The second theme regarding participants' understanding of information's legal and ethical use was the citation of sources. This theme is derived from the responses of seventeen participants. Citing or acknowledging authors when using their works also sets information-literate people apart from non-information-literate people (Bent & Stubbings 2011:10). A citation is referencing an information source used in research or acknowledging a source of information (Turnitin LLC 2017; Edgell 2021:3). Citations include in-text citations and end-of-paper citations, or full citations (Edgell 2021:3) An in-text citation is embedded in the body of the text to connect specific content passages to corresponding full citations, whereas full citations are usually included as references listed at the end of papers (Edgell 2021:3). The participants' responses indicated that they somewhat understood what "citation" means. They used words and phrases such as *acknowledging, making known the source of information, telling the reader the source of information, referencing information,* and *giving credit to authors or sources* to illustrate their understanding of citation, as the following excerpts illustrate:

Citation is the act of acknowledging a piece of literature or research (Participant 2).

Citation is a short description of information which includes the name of the author, date, and title of the publication (Participant 3).

Citation is making it known where the information you published or presented is from or the source of the information (Participant 4).

Citation is the act of acknowledging the work of an author (Participant 5).

Citation is a way of telling the reader that certain information being used come from a different source (Participant 15).

Citation means referencing information and data taken from other people's work (Participant 19).

Citation is the act of quoting or referencing a person or book in scholarly work (Participant 20).

Citation is more like a reference to a book or research paper. It involves mentioning the source of a work in an official report (Participant 52).

Citation means giving credit to authors when their work is used in another work (Participant 62).

Citation in my understanding is to reference or acknowledgement given to scholars when their knowledge is used to address or critique a point (Participant 64).

Citation means giving credit to sources used in research work (Participant 68).

Citation is giving credit to the sources of the information used in an academic work (Participant 69).

The participants indicated that they cited their sources and knew what was involved in the process of citing sources. Some participants mentioned using Mendeley and Google Scholar citation buttons as tools to create or generate their references. Some participants mentioned the American Psychological Association (APA) and Harvard citation styles as styles they often used. The following excerpts explain their use of citation:

If the information is retrieved from online; I will state the title, the name of the author, date and link to the website (Participant 3).

I cite by writing the name of the person or the author, date of publication and where I had that information (Participant 5).

I cite by providing in-text citation and also end of write up citation. The citation style I use is APA style (Participant 8).

I cite by using in-text citation and referencing the information using the APA sixth edition (Participant 9).

I cite by using in-text and referencing the information at the end of assignment under references using the APA style (Participant 10).

I state the author's name, followed by the year of publication, the title of the reference material, the edition, the publisher and the page on which the information was taken from (Participant 26).

I use Mendeley so if I took a particular statement from a source, at the end of that statement Mendeley generates the reference for me (Participant 30).

I get my papers from Google Scholar, so I just click on the cite button and I just get citation for that paper (Participant 37).

I provide the person's name, research title, journal, date and issue number (Participant 45).

I cite the sources by referencing those papers and books with respect to the author's names and titles of paper and particular page in which the information is retrieved, as well as adding their year of publication (Participant 49).

I cite through the use of reference applications. I particularly use Mendeley (Participant 63).

5.6.3 Plagiarism

The final theme regarding the participants' understanding of the legal and ethical use of information was plagiarism. According to Uzun and Kilis (2020:2), students plagiarise intentionally, which is often deliberate or premeditated, and unintentionally due to a lack of knowledge about proper referencing. The participants indicated that they cited to avoid plagiarising works that were not theirs. Their responses, therefore, prompted a question on their understanding of the word plagiarism. Plagiarism—a severe problem in academic institutions (Uzun & Kils 2020:1)—is the act of claiming someone else's work as your own, including putting your name on someone else's paper or project (Turnitin LLC 2017b). The participants

understood plagiarism as using someone's work without *acknowledging, citing, giving credit,* or *seeking permission*. The following excerpts indicate their understanding of plagiarism:

> *Plagiarism means using someone's knowledge or information without acknowledging them as the original owners of that informatio*n (Participant 3).
>
> *It is copying someone's work and presenting it as your own without the person's consent* (Participant 4).
>
> *Plagiarism is the act of using another person's information without acknowledgment (Participant 5).*
>
> *Plagiarism is taking or lifting someone's work from an online source without acknowledging or citing the author, publisher, writer among others (Participant 6).*
>
> *It is when someone takes credit for other people's work without acknowledging them or seeking permission for using their works* (Participant 7).
>
> *Plagiarism is the use of someone's work without acknowledging them. In such cases you make the reader believe it is your own work* (Participant 8).
>
> *It means copying someone's work without due acknowledgement* (Participant 32).
>
> *It refers to presenting someone's else work without proper acknowledgement or no acknowledgement at all* (Participant 33).
>
> *Plagiarism is presenting someone else work as your own without a full acknowledgement or consent or reference* (Participant 36).
>
> *Plagiarism is copying someone's information and using it without giving that person any credit in the form of referencing the person* (Participant 41).
>
> *Plagiarism is the practice of taking someone's work or ideas and passing them off as one's own* (Participant 42).

Plagiarism is the act of producing another person's work as your own, without their consent and without simply acknowledging them (Participant 50).

It is an academic theft in which the information of others is communicated by a second person as if it is their own words. It also means using someone's work without duly acknowledging the individual (Participant 57).

Plagiarism is to copy and plunder other academic scholar's academic writing, I personally label it as academic theft (Participant 64).

Plagiarism is the act of using someone's work or ideas and portraying them as yours (Participant 67).

Beyond understanding what constitutes plagiarism, the participants also knew how to avoid it. They applied *plagiarism checkers, citing, paraphrasing, summarising, quoting, seeking approval from copyright owners,* and *not copying verbatim* to avoid plagiarising. The following excerpts highlight these issues:

I avoid plagiarism by using a plagiarism checker before you submit. I also paraphrase or quote from your sources (Participant 1).

I avoid plagiarism by quoting, paraphrasing, and asking permission from the owner (Participant 22).

To prevent plagiarism, one must learn to acknowledge any information obtained from other sources (Participant 36).

There are a lot of paraphrasing tools available to assist in using the exact words of an author, but I usually do my best to get the concept of the article or the part of interest, analyse and pen down the main point in my own words. In times of difficulties, I use the paraphrasing tool and cite the article afterward (Participant 40).

I avoid plagiarism by referencing people (authors and owners) for every information taken from their work (Participant 42).

I avoid plagiarism by understanding and deriving my own words from someone's own and also cite as well (Participant 44).

"*I avoid plagiarism by acknowledging the person or seeking their consent* (Participant 50).

I avoid plagiarism by crediting the owner of the information and making reference to the source of information (Participant 53).

I avoid plagiarism by citing the source of information used (Participant 66).

The participants' understanding of ethical and legal use of information includes included acknowledging or citing the source, seeking permission, quoting, paraphrasing, or summarising the information they use in their write-ups. The excerpts below demonstrate the participants' understanding of the legal and ethical use of information:

It means the use of information while citing the information or quoting brief excerpts and not the whole book (Participant 1).

It means acknowledging the source of your information. For example, citing and giving credit to the original owners of the information (Participant 3).

This is when an individual gets information through the right source, uses it appropriately and cite the source (Participant 5).

It means using information in a technically orderly manner. Thus, following specific order for example, how to cite the APA style (Participant 6).

It means using information without any negative motive. Ethical in the sense of citing or giving attribution to people and websites for the information they provide (Participant 7).

This means using information for personal needs and also citing the source (Participant 9).

This means using information ethically and properly and giving credit to where credit is due (Participant 13).

Ethical use of information is the use of works of others by ensuring that the work is cited in order to avoid plagiarism (Participant 22).

The use of information, following the copyright law and avoiding plagiarism (Participant 38).

Ethical and legal use of information is the disclosure or acknowledging the sources used in literature or assignments. To avoid abusing the copyright and status of the author or source, every literature or article used for any task completion must be cited (Participant 40).

Using the information in the right way by referencing authors, paraphrasing and not plagiarising (Participant 43).

This is the citing, quoting and paraphrasing of information ethically in order to avoid plagiarising other people's works (Participant 50).

Legal use of information is using information the right way and giving credit when we use other people's work (Participant 53).

Ethical use of information seeks to imply using information right without implicating yourself. In other words, in the course of using information, you get to acknowledge the sources or individuals who are the originators of such information (Participant 57).

It means to legally or ethically use the work of others by quoting and citing the work of others (Participant 59).

5.7 Challenges in finding and using information

The study's sixth objective related to participants' problems or challenges in finding and using information. Information users face a host of challenges when searching for and using

information, ranging from the unavailability of information (Batool *et al.* 2022), unreliable Internet (Zulaiga & Omar 2018; Baticulon *et al.* 2021), lack of skills to search for the information needed (Catalano 2017; Frerejean *et al.* 2018), and poor knowledge of how to ethically and legally use information (Phillips *et al.* 2018). Nine themes were identified from the views expressed by the participants in response to the question and from the observation. These are low levels of computer knowledge and information searching skills, poor and unstable Internet connections, unavailability of information, and payment and login requests for information resources. The other themes are information overload and untrustworthy information, unwillingness to share information, unresolved problems, unfavourable library opening hours, and unsolicited advertisements.

5.7.1 Low level of computer knowledge and information-searching skills

The first theme regarding the challenges they participants faced in finding and using information was the lack of computer knowledge and information-searching skills. This theme was derived from the responses of ten participants. Knowledge of computers and good internet searching skills, including using information retrieval tools, knowing where to find the information, and knowing the appropriate databases or journals, are prerequisites to finding information. The participants mentioned that they lacked the know-how to find the needed information. Therefore, they spent a lot of time searching for information. Participants used phrases like *lack of adequate knowledge, too much time spent searching, difficulty in retrieving, lack of proper keywords, lack of retrieval skills,* and *searching multiple times* to illustrate this challenge. The following excerpts highlight this challenge:

> *Lack of adequate know-how or knowledge to find information* (Participant 11).

> *Where to find the right information for the work being done mostly gives me a hard time* (Participant 17).

> *Too much time is spent searching for exact information and a long time to find* (Participant 28).

> *Difficulty in retrieving electronic resources* (Participant 42).

Lack of proper keywords needed to find the information (Participant 30).

Lack of retrieval skills to be able to get the information (Participant 51).

Searching multiple times with different phrases and keywords just to get the right data (Participant 56).

Difficulty knowing the right database or journal to search within (Participant 62).

5.7.2 Poor and unstable Internet connectivity

The second theme regarding the challenges participants faced in finding and using information was poor and unstable Internet connections. This theme was derived from the responses of 23 participants. Reliable Internet connections are crucial to accessing information online. A poor and unstable Internet connection hampers information users' efforts to access the information they need to solve a problem. The participants used the following words to illustrate this problem: *poor, unstable, bad, lack of,* and *slow Internet*. The following excerpts highlight this challenge:

The challenge I face is poor Internet connectivity (Participant 3).

Unstable network access is the challenge I normally face (Participant 13).

The challenge I face is lack of Internet connection (Participant 22).

I face slow Internet connection (Participant 30).

I face poor Internet connections in the library and on campus (Participant 37).

Poor access to Internet when I need information at a particular time (Participant 50).

Internet access is sometimes very unstable (Participant 52).

5.7.3 Unavailability of information

The third theme regarding the challenges participants faced in finding and using information was the unavailability of information. This theme was derived from the responses of nineteen participants. The information available in textbooks in the library or online may sometimes not meet the exact needs of users, which sometimes creates some level of anxiety and frustration. The participants indicated that they did not always get what they searched for online or from textbooks in the library. This might result from there being little to no research on a particular topic or a user's lack of adequate information-searching skills. Words and phrases such *as under-researched, does not appear like I want it, information wanted is not found, lack of good content, limited resources,* and *the information needed is not available* were used to illustrate this challenge, as highlighted in the following excerpt:

> *Unavailability of information, especially when it is under-researched* (Participant 2).
>
> *Some of the information doesn't appear like I want it to be*" (Participant 3).
>
> *Sometimes the specific information wanted is not found no matter the Boolean operator used* (Participant 6).
>
> *There is a lack of good content on the internet* (Participant 7).
>
> *There are limited resources for particular topics* (Participant 10).
>
> *Inability to source information from sources you find important* (Participant 11).
>
> *Sometimes finding the exact information you want may not be available depending on the source used* (Participant 25).
>
> *The actual information you need sometimes is not available* (Participant 29).
>
> *Sometimes, it is difficult to get the information that you need* (Participant 31).
>
> *Some information are not easily accessible. You have to go through long processes just to get pieces of it* (Participant 32).

Sometimes there is difficulty in finding the book that contains what you want in the library (Participant 37).

Difficulty in finding the right source of information needed (Participant 42).

Inability to access or non-availability of certain details of the source in question for referencing (Participant 57).

5.7.4 Information overload and untrustworthy information

The fourth theme regarding the challenges participants faced in finding and using information was information overload and untrustworthy information. This theme was derived from the responses of twelve participants. Information overload, which may include credible and low-quality information, is the bane of many information seekers, including this study's participants. The Internet is awash with information created by people from all walks of life. A search for an item yields a large number of results, which causes some information seekers to experience anxiety or confusion. The participants' responses also point to this problem. They used terms such as *so much, large or wide pool, too much, trusted, irrelevant,* and *not very credible information* to highlight this problem. The following excerpts illustrate this challenge.

There is confusion due to so much information on the Internet (Participant 22).

Locating the original sources of the information is difficult due to so much information (Participant 23).

Difficulty selecting the best information from a large or wide pool of information on the Internet (Participant 40).

Mostly people do not give the right information so most information in the Internet is not trusted (Participant 46).

I feel confused because of too much information on the Internet (Participant 51).

There is a lot of irrelevant information online, which makes it tiring to get what I actually want (Participant 52).

One of the challenges is evaluating the information to know if it has value or not (Participant 53).

Sometimes the information I find is not very credible, and I realise that mostly after some time of use (Participant 65).

The challenge I face is information overload (Participant 66).

5.7.5 Payment and login request for information resources

The fifth theme regarding the challenges participants faced in finding and using information was payment for and login requests for information resources. This theme was derived from the responses of fifteen participants. Not all online information is open to the public or free to download and use. Access to some of these information resources is purely through payment or sometimes through a request to register and log in. These requests are bothersome to some information seekers whose only interest is to access the information and use it to address the problem at hand. The requests to either pay, which they consider expensive, or to log in to access the information resources they need for their activities deterred participants. The following excerpts highlight this challenge:

The challenge I have is when I have to pay for articles before I can view and use them. The fees are usually beyond my means (Participant 2).

Some information or papers need to be paid for online before they could be accessed (Participant 15).

In most of the sites, you have to pay before you can access the information (Participant 27).

Some websites demand payment before the information can be accessed (Participant 40).

Some information on the Internet requires that you pay some amount of money before it can be accessed. It is also very difficult when certain sites demand my email account before the needed information can be accessed (Participant 41).

The only problem is that most of the needed articles are meant to be purchased (Participant 61).

Most helpful and up to date information are mostly for sale, and due to economic constraints it is inaccessible (Participant 64).

Most sites which have the proper information are hard to access. They are mostly expensive (Participant, 67).

5.7.6 Unwillingness to share information

The sixth theme regarding the challenges participants faced in finding and using information was an unwillingness to share information. This theme was derived from the responses of three participants. Unwillingness on the part of some people to share information or knowledge with others is an issue for some information seekers. The participants indicated that sometimes, people were unwilling to share information, as highlighted in the following excerpts.

Sometimes participants are not willing to release their ideas (Participant 36).

Unwillingness of people to give information (Participant 59).

People are sometimes unwilling to give information (Participant 60).

5.7.7 Unresolved problem

The seventh theme identified from the participants' responses regarding the challenges participants faced in finding and using information was the non-resolution of problems. This theme was derived from the responses of five participants. Every information seeker aims to procure the information required to solve a particular problem. They expect direct or ready-made answers to the questions they have. Unfortunately, not all information seekers, including

some of the participants in this study, can get the solution they want with the information they have at hand. Thus, the information they acquire may not directly answer or solve the question or the problem they need to be solved. The participants in this study indicated they often did not get the required answers to their questions. The participants used phrases such as *does not directly solve the question, does not answer all my questions, no answers at all to my question,* and *do not have a direct answer to my question* to highlight the problem. The following excerpts illustrate this challenge:

> *The challenge I have is when the information I get does not directly solve the question* (Participant 19).
>
> *The information I get does not answer all my questions* (Participant 34).
>
> *Sometimes there are no answers at all to my question* (Participant 44).
>
> *Sometimes websites do not have a direct answer to my question* (Participant 49).

5.7.8 Unfavourable library opening hours

The eighth theme regarding the challenges participants faced in finding and using information was unfavourable library opening hours. This theme was derived from the responses of three participants. Many libraries do not operate throughout the day, and specific opening and closing hours do not always benefit some library users. The participants used phrases such as *limited library opening hours* and *libraries are not open all the time* to illustrate this challenge as highlighted in following excerpts:

> *Limited library opening hours* (Participant 42).
>
> *Libraries aren't open all the time* (Participant 52).
>
> *Inability to go to the library because of the opening hours* (Participant 55).

5.7.9 Unsolicited advertisements

The ninth theme regarding the challenges participants faced in finding and using information was unsolicited advertisements. This theme was derived from the responses of two participants. Unsolicited advertisements are a major concern for most information seekers. These advertisements pop up anytime searches are made on search engines and online information dissemination platforms. Such pop-ups are annoying because they can divert attention away from why the search engine or website was visited in the first place. The participants considered these pop-ups as time wasters and attention distractors, as illustrated in these excerpts:

> *There are too many advertisements* (Participant 24).

> *Lots of advertisements popping up and wasting one's time* (Participant 26).

5.8 Summary

This chapter presented the study's findings based on the study objectives. The results indicate that the participants perceived information literacy as literacy, access and use of information, understanding knowledge and problem solving, knowledge of ICT, knowledge of information creation, and information communication. The participants were able to identify their information needs through their desire for information for academic work, the need for information for decision-making and problem-solving, the need to broaden their knowledge base, a lack of information, curiosity, clearing up doubts, keeping updated, and the need to have information at all times. The Internet, library and librarians, and other individuals were the participants' main information sources. The participants understood information appraisal as information assessment, evaluation, examination, and verification of information sources. Information was appraised based on the following indicators: accuracy, authority, objectivity, currency, purpose, and appropriateness to appraise information. The participants understood ethical and legal use of information as the right to use information and the citation of sources, which ultimately helps prevent plagiarism. Challenges included a lack or a low level of computer knowledge and information searching skills, poor and unstable Internet connection, unavailability of information, payment and login requests for information resources, information overload, untrustworthy information, unwillingness to share information, non-

resolution of problems, unfavourable library opening hours, and unsolicited advertisements. The next chapter presents a discussion of the results.

CHAPTER SIX

DISCUSSION OF FINDINGS

6.1 Introduction

The previous chapter presented the findings of the study, which investigated the information literacy competencies and proficiencies of undergraduate students at Kwame Nkrumah University of Science and Technology (KNUST). The findings were presented in themes derived from the study's objectives. This chapter discusses the findings presented in Chapter Five in-depth. This discussion is based on the six objectives of the study:

i. To ascertain the different conceptions of information literacy among undergraduate students at KNUST.
ii. To ascertain how undergraduate students at KNUST identify their information needs.
iii. To investigate how undergraduate students at KNUST locate information.
iv. To assess how undergraduate students at KNUST appraise the accessed information.
v. To establish whether undergraduate students at KNUST ethically and legally use information.
vi. To investigate the problems undergraduate students at KNUST face in finding and using information effectively and efficiently

This chapter aims to interpret the meaning of the findings through the lens of the literature reviewed, the theoretical framework, and the methodology outlined for this study in an effort to answer the research questions.

The study identified personal and institutional challenges that affect undergraduate students' access to and efficient use of information. To help resolve these challenges, the researcher developed an information literacy competency (ILC) model for KNUST to assist undergraduate students in searching, accessing, and using information efficiently and effectively.

6.2 Conception of information literacy

According to the ACRL Board of Directors (2015:8), “Information literacy is 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. Different people conceive or understand information literacy differently. These different conceptions of information literacy have been reported in several studies focusing on faculty, librarians, postgraduate and undergraduate students, and high school learners, including those by Bury (2011), Gross and Latham (2011), Nielsen and Borlund (2011), Dokphrom (2013), Diehm and Lupton (2014), Johnston, Partridge and Hughes (2014), Michalak and Rysavy (2016), Godbey and Dema (2017), Charalambous (2018), Ojaranta (2019), and Fázik and Steinerová (2020).

The findings, as presented in Chapter Five, section 5.2, showed that undergraduate students at KNUST understand information literacy as literacy (the ability to read, write, and understand a particular subject), access and use of information (which encompasses the ability to search and find, organise, evaluate, use, and disseminate information), understanding of knowledge and problem-solving (including decision making), knowledge and use of ICT tools, and knowledge of how information is created and communicated. Even though these different understandings of information literacy by the participants do not, by definition, fully represent what information literacy is in totality, their different conceptions do show, to some extent, a semblance of what information literacy is and who an information literate person should be.

Some of these findings are consistent with earlier studies discussed in Chapter Three, section 3.2 by Dokphrom (2013:117), Diehm and Lupton (2014), Johnston, Partridge and Hughes (2014:558-560), and Charalambous (2018:26) that pointed out the diversity of conceptions of information literacy among undergraduate students. The participants in these studies understood information literacy as knowing where to find information, using the information to develop one's ideas (Diehm & Lupton 2014), interpreting and summarising information from a range of sources, proper use of the library, acquiring information, researching information, determining information needs, locating, searching, evaluating, analysing, applying and using information (Dokphrom 2013), identifying relevant and reliable information, applying techniques to use information across languages, acquiring knowledge on topics and issues (Johnston *et al.* 2014), searching for and using of information, access to information, obtaining information through technology, the ability to use

technology/computers, properly handling information, and using databases (Charalambous 2018).

6.3 Identification of information needs

The identification of an information need is one of the competencies required of an information-literate person (Hussain, Li & Alsanad 2022:4). An information need is an innate desire that prompts an individual to a search for information (Tella, Bode-Obanla & Age 2020:95). It is influenced by factors such as the variety of available information sources, the potential uses for the information, the user's background, motivation, professional orientation, and individual characteristics, and socio-political, economic, legal, and regulatory environments (Wilson 2000:52). The ability to correctly determine a need is characterised by the "ability to recognise when information is needed, as well as the type, extent, and nature of the information needed" (Hussain, Li &Alsanad 2022:4). This aligns with the initiation and selection stage of the ISP model adopted for this study where the information user is expected to first of all, indicate the need for information.

The findings presented in Chapter Five, section 5.3 showed that undergraduate students at KNUST identify their information needs when they need information for their academic work, like assignments, research projects, and examinations, when they are making decisions or solving problems, and when they want to acquire more knowledge in other spheres to broaden their knowledge base. They also identify their information needs when they lack information about a topic or have difficulty understanding a situation, when they want to entertain themselves, satisfy their curiosity, clear some doubts they may have about something, and update themselves on events happening around them.

Some of the findings in this study are consistent with earlier studies discussed in Chapter Three, section 3.3 by Charalambous (2018:30-41), Phillips *et al.* (2019:45), Kocevar-Weidinger *et al.* (2019:175), Dolničar and Podgornik (2023:9), and Makinde, Hamzat and Koiki-Owoyele (2023:8), which identified assignments, project works (Phillips *et al.* 2019), curiosity, and problem-solving (Charalambous 2018; Kocevar-Weidinger *et al.* 2019) as the reasons that occasioned the search for information by the undergraduate students. It must be noted that the reasons cited by the participants in this current study are far more than those mentioned in the

literature above. Again, the information needs of the students in this study are not just for immediate academic purposes like assignments, examinations, and projects but for other equally important purposes, like updating themselves on events happening around them, understanding a situation, and entertainment.

6.4 Location of information

The ability to search for and find information is an essential competency and skill all information-literate persons should have (Bent & Stubbings 2011:5). Hulseberg and Versluis (2017:14) argue that the nature of information, especially scholarly information, and how it is accessed is complex, contested, changeable (to some extent), and sometimes confusing. The ability to search and find information aligns with the exploration and formulation stage of the ISP model adopted for this study, where the information user is expected to look for information that satisfies the identified information need.

As presented in Chapter Five, section 5.4, the findings reveal that undergraduate students at KNUST search, find, and access information from the Internet (using search engines such as Google, Google Scholar, YouTube, Medscape, and the online databases subscribed to by the library). This finding confirms those of earlier studies discussed in Chapter Three section 3.4 by Bury (2011:50), Gross and Latham (2011:171-172), Nikolopoulou and Gialamas (2011), Diehm and Lupton (2014), Hughes, Hall and Pozzi (2017:309), Taylor and Dalal (2017:90), Charalambous (2018:32), Rosman *et al.* (2018:97), Yevelson-Shorsher and Bronstein (2018:536), and Kocevar-Weidinger *et al.* (2019:179), where the Internet, and by extension Google and Google Scholar, were mentioned as sources that the participants utilise in their search for information. The students' overreliance on free Internet sites for information may affect the quality of information they access and use. This may lead to students using untrustworthy, unvalidated, and unacademic information resources for their assignments, projects, and examinations.

Other studies that also highlight students' reliance on free Internet search engines (Google) include those by Asiedu, Plockey and Kordie (2020), Dahlen *et al.* (2020:2), Fázik and Steinerová (2020), Huynh and Tuyet Tran (2020:85), Robison, Fawley and Marshall (2020:4-

6), Foteini *et al.* (2022:30), Liang, Kim and Kitheka (2022:5), and Vasilyeva and Shilov (2022:104).

Other information sources the participants in this study mentioned were the library, librarians, and other individuals. The use of the library, librarians, and other individuals as means to access information conforms with previous studies discussed in Chapter Three section 3.4 by Gross and Latham (2011:171-172), Diehm and Lupton (2014), Saunders *et al*. (2015:88), Zulaiga and Omar (2018:7), Kocevar-Weidinger *et al.* (2019:179), Phillips *et al.* (2019:42), and Robison, Fawley and Marshall (2020:4-6). In these studies, the participants mentioned friends, family members (Gross & Latham 2011; Kocevar-Weidinger *et al.* 2019) library, library staff, experts (Diehm & Lupton 2014; Phillips *et al*. 2019; Zulaiga & Omar 2018) library databases and catalogues, and instructors (Robison *et al.* 2020) as their sources of information. The use of these sources by the undergraduate students in the current study indicates an awareness on their part of the library's unique role and the role librarians and experts play in acquiring and providing high-quality information resources for the library's users. This also indicates that the students trust the capabilities of the library, librarians, and experts to provide them with credible information. Contrary to this revelation, Foteini *et al.* (2022:30) reported that undergraduate students who participated in their study did not consider librarians as a source for their information needs.

The study further revealed that the participants used keywords, phrases, and Boolean operators (AND, NOT, and OR) to formulate their online search queries to access information. They also used book titles, the tables of contents of books, and recommendations as ways to access necessary information. This revelation suggests that, to some extent, the undergraduate students in this study are information literate, even though their usage of these search tools to search and access the needed information may be minimal. This also means that the participants in this study would not struggle too much with searching and accessing the information required for their academic work. This revelation confirms earlier studies discussed in Chapter Three section 3.4 by Chrysanthi (2014:23), Huynh and Tuyet Tran (2020:85), and Foteini *et al.* (2022:29), which indicated that the participants in their studies were aware of Boolean logic and the use of keywords and phrases to search for information.

However, the studies by Detlor *et al.* (2011:579), Godbey and Dema (2017:7), Charalambous (2018:42), Graves, LeMire and Anders (2021:6), Safdar and Idrees (2021:12), and Makinde, Hamzat and Koiki-Owoyele (2023:8) discussed in Chapter Three section 3.4 contradict this finding. In these studies, the students admitted to being unfamiliar with Boolean operators and how to use them (Charalambous 2018; Safdar & Idrees 2021), not skilled in using search strategies or search tools (Graves *et al.* 2021; Makinde *et al.* 2023), poor searching skills (Detlor *et al.* 2011; Dolničar & Podgornik 2023) and unable to use "advanced" or "extended" search options for accessing information (Godbey & Dema 2017). The results of these previous studies suggest that the undergraduate students who were studied were not information literate. Unlike, the undergraduate students in the studies mentioned above, the undergraduate students in the current study are fully aware of these search tools. Furthermore, they were not merely aware of these search tools, but also made efforts to use them effectively to search for the information they required.

Finally, the study found that students primarily accessed or downloaded e-books in PDF format online, while they accessed printed books rather than e-journals or printed journals from the library. This finding agrees with previous studies discussed in Chapter Three section 3.4 by Hughes, Hall and Pozzi (2017:309), Charalambous (2018:29), Foteini *et al.* (2022:30), and Liang, Kim, and Kitheka (2022:5), where the students mentioned showed a preference for books over journals. This finding has profound implications for the amount of money spent annually by the university to renew the licences of various e-resources, mostly journals from reputable databases and publishers such as Emerald, Sage, EBSCO, Science-Direct, Scopus, and Taylor and Francis. The infrequent use of these e-journals implies a financial loss to the university. The library can channel this money into other vital projects. It also means that the students are not using the most up-to-date information or research in their fields of study for their immediate academic needs.

6.5 Appraisal of information

Critical evaluation of information resources is an essential competency and skill all information-literate persons should have. The ability to appraise information aligns with the collection stage of the ISP model adopted for this study. The information user in this stage is

expected to be able to assess the information they encounter before they use it to address their needs. This ability is often highlighted as necessary for upholding a democratic society and for people's health and safety (Haider & Sundin 2022a:1176). With the abundance of information, especially on the Internet, often called information overload (Bouleimen, Luceri, Cardoso, Bottur, Hermida, Addimando, Beretta, Galloni & Giordano 2023:1; Phillips, Bordelon & Kapral 2023:106), information explosion (Popa & Repanovici 2022:13), or information pollution (Mavlanova & Khalikova 2023:3), as well as the current challenge with artificial intelligence (AI)-generated texts (Köbis & Mossink 2021:1) and predatory open access publishing (Frandsen, Lamptey, Borteye & Teye (2022:156), the competency and skill to evaluate online information resources is critical.

The findings of this study, as presented in Chapter Five, section 5.5, show that the participants understood information appraisal as information assessment, information evaluation, information examination, and verification of information sources. These different understandings of information appraisal show that the participants were reasonably aware of the need to critique and differentiate between the large quantities of information resources they come across daily. It can also be inferred that they have been assessing the information they use to some extent. This finding agrees with those of Simonsen, Sare and Bankston (2017:208), Bartol *et al.* (2018:380), Fázik and Steinerová (2020), Liang, Kim and Kitheka (2022:6), and Dolničar and Podgornik (2023:9) discussed in Chapter Three, section 3.5, where the undergraduate students involved in the studies, were mentioned to be able to evaluate information successfully and competently through processing, reasoning, critical thinking, logical deductions, verification, credibility assessment, and skepticism

.

However, other studies conducted by Dorvlo and Dadzie (2016:2), Petermanec and Šebjan (2017:70), Bakermans and Plotke (2018:103), Hussain, Li and Alsanad (2022:10), and Makinde, Hamzat and Koiki-Owoyele (2023:8), reported poor evaluation skills of students. The students in these studies were not skilled in evaluating information and information sources, which could be attributed to the absence of teaching information literacy skills in the universities where the studies were conducted. From this discussion, one can infer that the undergraduate students in the current study can better evaluate information resources than those in previous studies. This also means that the undergraduate students in this study are somewhat

information literate. Additionally, the undergraduate students in this study are more likely to use credible, trustworthy, and up-to-date information to meet their academic needs.

The results further indicate that the participants used accuracy, authority, objectivity, currency, purpose, and appropriateness as indicators to appraise the information resources they came across. This revelation further amplifies, to some extent, the capabilities of the participants to effectively and efficiently assess the information resources they use for academic purposes. Some of these findings corroborate earlier studies by Angell and Tewell (2017:105), Folk (2021:1047), Foteini *et al.* (2022:30), and Russo and Jankowski (2023:13). In these studies, the undergraduate students involved applied widely-held criteria to evaluate the information resources they encountered. The participants in these studies thus looked at whether the information appeared on a government website, featuring website's domain like .org, .gov, .edu (Angell & Tewell 2017), fact-checked sources, ascertained whether a scholarly or medical institution was associated with the article, and whether the authors were credentialed or qualified professionals (Russo & Jankowski 2023). Other criteria include whether the document contains statistics and facts (validity and objectivity), its publication date (currency), and whether it is a scholarly journal article from a library database. The participants in this current study are far more knowledgeable in evaluating information resources than those in the previous studies mentioned. The participants in this study also considered the purpose and the appropriateness of the information encountered in assessing information. They, therefore, went beyond using authority, objectivity, validity, and currency when assessing information, as the students in the previous studies mentioned above did.

6.6 Ethical and legal use of information

Responsible and ethical use of information is a significant concern in the academic community today (Hussain, Li & Alsanad 2022:13; Dolničar & Podgornik 2023:9). Responsible use of information aligns with the presentation stage of the ISP model adopted for this study. In this stage, the information user is expected to know to integrate, synthesise, and use the information to satisfy their needs. Information literate persons should know how to cite printed and electronic sources using appropriate referencing styles, show knowledge of issues relating to the rights of others, including ethics, data protection, copyright, plagiarism, and any other

intellectual property issues, and meet the standards of conduct for academic integrity (Bent & Stubbings 2011:10; Hussain, Li & Alsanad 2022:13).

As presented in Chapter Five, section 5.6, the findings show that the participants understood how to use information ethically and legally. They mentioned the need to respect original owners' rights, seek permission where necessary, avoid using pirated information, avoid using or misusing information to hurt or blackmail people, properly cite information sources, and avoid plagiarism. These findings suggest that the study participants are, to some extent, information literate. This finding conforms with earlier studies discussed in Chapter Three, section 3.6 by Detlor *et al.* (2011:579), Chisango (2012:64), Bakermans and Plotke (2018:103), Bartol *et al.* (2018:380), Zulaiga and Omar (2018:7), Asiedu, Plockey and Kordie (2020), and Liang, Kim and Kitheka (2022:5). The undergraduate students in these studies also showed knowledge and understanding of legal and ethical information use. The participants could cite or reference other authors' results (Bakermans & Plotke 2018; Bartol *et al.* 2018; Zulaiga & Omar 2018), format and do in-text citations, include the correct information in a reference (Liang *et al.* 2022), understand plagiarism and avoid committing it (Asiedu *et al.* 2020; Chisango 2012), document sources, and use quality sources (Detlor *et al.* 2011).

At the same time, Hsieh and Holden (2010:465), Godbey and Dema (2017:7), Bartol *et al.* (2018:380), Graves, LeMire and Anders (2021:8), and Dolničar and Podgornik (2023:9) reported that the undergraduate students in their studies had difficulty determining what constituted plagiarism, could not cite an information resource, did not know referencing techniques, could not document sources or format citations. The revelations in these studies suggest that the undergraduate students who participated are not information literate, unlike the participants in the current study, who were aware of these legal and ethical issues and knew how to avoid infringing on them.

It should be noted, that the undergraduate students in the study at hand were aware of other unethical practices connected with access and use of information that were not reported in the literature mentioned above. The participants were also concerned about other unethical practices associated with accessing and using information. Some of these unethical practices included blackmailing and information piracy. Blackmailing and information piracy are

concerning issues for information users and creators. Blackmailing causes affected people to question their own sense of reality, leading to anxiety and depression. For information creators like authors and publishers, information piracy negatively affects their revenue and could lead to job losses. The knowledge of these unethical practices suggests that the participants in the study at hand are, to some extent, more information literate than the participants in the studies reported above. The knowledge of these unethical practices will also likely impact how the students access and use information positively.

6.7 Problems faced in finding and using information

Information-literate people are supposed to know how to search for, find, and use information (Bent & Stubbings 2011:5). Information users, however, face many challenges when searching and using information. The problems information users face in finding and using information, align with all the six stages of the ISP model adopted for this study. The information user faces challenges when trying to identify their information needs when searching for the needed information, when appraising the information, and when using the information.

As the study's findings in Chapter Five, section 5.7 suggest, the participants faced several challenges in their quest for information. These challenges included a lack of computer knowledge and information searching skills, poor and unstable Internet connections, unavailability of information, and payment and login requests for information resources. Other challenges were information overload and untrustworthy information, unwillingness to share information, unresolved problems, unfavourable library opening hours, and unsolicited advertisements. These challenges that occur either at a personal or institutional level, might negatively affect how information is searched for, accessed, and used by the participants. Firstly, the challenges might affect students' ability to search for required information properly. In cases where their searches are successful, poor Internet connections, a lack of information, payment requests, and information overload will make it virtually impossible for them to access the necessary information. These challenges will also negatively affect the utilisation of the electronic resources subscribed to by the library.

Some of these findings confirm previous studies discussed in Chapter Three, section 3.7 by Hsieh and Holden (2010:465), Achonna (2011:31), Hughes *et al.* (2017:310-313), Hulseberg and Versluis (2017:20), Simonsen, Sare and Bankston (2017:208), Phillips *et al.* (2019:44), Yevelson-Shorsher and Bronstein (2018:541), Zulaiga and Omar (2018:7-8), Robison, Fawley and Marshall (2020), Baticulon *et al.* (2021:619), Guo and Huang (2021), Prasetyawan, Heriyanto and Shuhidan (2021:5), Batool *et al.* (2022:1), and Moyo and Okemwa (2022:5-12). In these studies, students mentioned challenges such as issues with copyright, locating, evaluating, and accessing information or data (Phillips *et al.* 2019), ethical use of information, identifying credible information from junk ones, running a search query online (Catalano 2017), specifying the search keywords, evaluating search results (Frerejean *et al.* 2018), misinformation (Guo & Huang 2021), and a relative lack of librarian contact (Robison *et al.* 2020). Additional challenges that these studies identified included power outages, inadequate computers (Achonna 2011), lack of computer skills (Ugwu & Orsu 2017), unstable networks, no internet connectivity (Arthur-Nyarko *et al.* 2020; Baticulon *et al.* 2021; Batool *et al.* 2022; Moyo & Okemwa 2022; Omeluzor *et al.* 2016; Zulaiga & Omar 2018), difficulty in differentiating between library catalogues and journal databases (Hsieh & Holden 2010), difficulty in using online databases, locating information sources and identifying the right order for sections of a scholarly scientific article (Simonsen *et al.* 2017), insufficient planning time and inadequate resources (Guo & Huang 2021), information overload (Hughes *et al.* 2017), data and compatible gadgets limitations (Moyo & Okemwa 2022), difficulty in integrating sources into their research and organising and citing sources (Hulseberg & Versluis 2017). These challenges, which can be experienced at a personal and institutional level, affect access and efficient use of information. The students can only search for, access and use information efficiently and effectively when these challenges are resolved by the various stakeholders in the university. The University Information Technology Service (UITS) would have to resolve poor and unstable Internet connections and lack of computer knowledge. Challenges such as lack of information searching skills, unfavourable library opening hours, unavailability of information, and payment and login requests for information resources, information overload and untrustworthy information must be resolved by the library. Challenges that need to be resolved by the students include unwillingness to share information, unresolved problems, and unsolicited advertisements.

6.8 Information Literacy Competency Model for undergraduate students

Based on the findings of the study, the researcher developed an Information Literacy Competency Model for undergraduate students, which also incorporates aspects of the Kuhlthau Information Search Process (Kuhlthau, Heinström & Todd 2008), the theoretical framework for this study. This model was developed to help mitigate the challenges undergraduate students at KNUST encounter when accessing and using information. Among the challenges identified are a lack of computer knowledge and information searching skills, poor and unstable Internet connections, the unavailability of information, information overload and untrustworthy information, an unwillingness to share information, and unfavourable library opening hours. The model illustrates the role stakeholders, namely the library, university management, University Information Technology Services (UITS) and faculty, are expected to play in resolving the students' challenges. Competence is seen in the ability to identify information needs, the ability to strategise and search for appropriate information, the skills to evaluate the accessed information, and the confidence and skill to use the information efficiently and ethically. Figure 6.1 illustrates the Information Literacy Competency Model for undergraduate students.

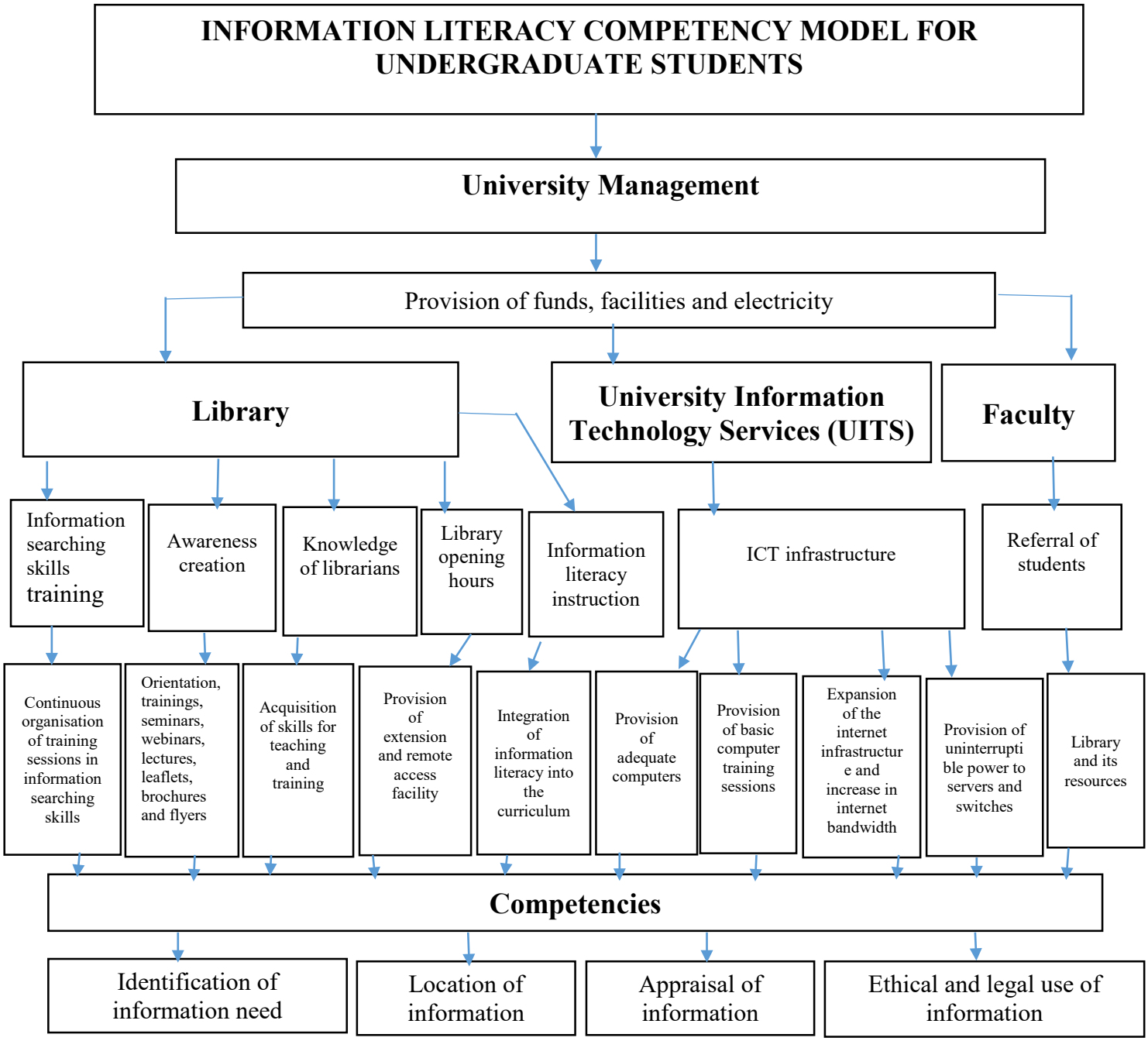


Figure 6.1: Information Literacy Competency Model for undergraduate students

Each stakeholder, as depicted in the model, should perform a specific function to help mitigate the students' challenges. The library could create awareness about its resources during orientation, training, seminars, webinars, and lectures. Leaflets, brochures, and flyers about the

library's resources and how to access them would complement this effort. Training librarians to teach information literacy with a focus on the identification of information needs, location of information, appraisal of information, and ethical and legal use of information, extending the opening hours of the library, and providing remote access to the library's resources would significantly boost the use of the resources; thereby solving the challenges related to access to, knowledge, and use of information. University management should create an enabling environment by providing adequate funding, infrastructure, and regular power supply to the library, UITS, and faculty to enable them to provide the required services. The UITS should provide adequate computers, basic computer training sessions, Internet infrastructure expansion, and Internet bandwidth to help resolve the associated challenges. Finally, the teaching faculty should work collaboratively with the library to help resolve the lack of information by referring the students to the library's resources through assignments and group project work.

This model is useful in the following ways:

i. It shows the specific role each stakeholder, namely the library, university management, UITS, and faculty, plays in helping resolve the challenges the students face when searching for, accessing, and using information
ii. It provides solutions to the challenges students face in seeking and using information.
iii. It builds the necessary competencies, such as identifying information needs, locating information, appraising information, and ethical and legal use of information.

6.9 Summary

This chapter discussed the study's findings based on the study's objectives. The first objective dealt with students' understanding of information literacy. The discussion highlighted the students' various conceptions of information literacy. The second objective dealt with how students identified their information needs. The discussion centred on what motivates the students to look for information. Findings related to the third objective centred on how the students search for, find, and access information. The students identified the Internet, the library and librarians, and other individuals as their primary sources of information.

The fourth objective centred on the students' understanding of information appraisal and how they appraise information. The fifth objective dealt with the ethical and legal use of information. The students' understanding of ethical and legal use of the information included the proper use of information, citation of sources, and how to avoid plagiarism. The sixth objective addressed students' various challenges in finding and using information.

The final section of the chapter, illustrated with a model, described the role each stakeholder in the university would have to play to help resolve the challenges the students face in searching for, accessing, evaluating, and utilising information. The model serves as the researcher's contribution to knowledge in delivering information literacy training to undergraduate students in Ghana.

CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

7.1 Introduction

The previous chapter discussed the study's findings and identified the challenges undergraduate students at Kwame Nkrumah University of Science and Technology (KNUST) face in accessing and using information. The chapter discussed the study's findings based on themes derived from the study's objectives. The discussion was centred on information literacy, the umbrella term embracing other themes such as identifying information needs, locating information, appraisal of information, ethical and legal use of information, and challenges associated with finding and using information ethically and efficiently. The contribution to knowledge in this study was the development of a model to help resolve the challenges students face when accessing and using information.

This chapter summarises the study and draws conclusions based on the findings. The chapter ends with recommendations to help improve students' information literacy skills.

7.2 Summary

Information literacy is "the adoption of appropriate information behaviour to obtain, through whatever channel or medium, information well fitted to information needs, together with a critical awareness of the importance of wise and ethical use of information in society" (Boon, Johnston & Webber 2007:205). It is a necessary skill in every aspect of a person's life. It enables students to know when and why they need information, where to locate it, and how to assess, use, and communicate it ethically and legally.

However, studies have shown that undergraduate students have difficulties searching for, accessing, evaluating, and efficiently and effectively using the available information resources to support their academic endeavours. Instead, they rely on untrustworthy sources found on the Internet. This observation necessitated this study to investigate information literacy skills among undergraduate students at KNUST to identify the skills, competencies, and proficiencies they need for their academic activities.

The study identified the following six objectives to investigate this problem:

i. To ascertain the different conceptions (understanding) of information literacy among undergraduate students at KNUST.
ii. To ascertain how undergraduate students at KNUST identify their information needs.
iii. To investigate how undergraduate students at KNUST locate information.
iv. To assess how undergraduate students at KNUST appraise the accessed information.
v. To establish whether undergraduate students at KNUST ethically and legally use information.
vi. To investigate the problems undergraduate students at KNUST face in finding and using information effectively and efficiently.

The researcher developed 12 research questions based on the objectives to guide the study.

The theoretical framework used in this study is Kuhlthau's Information Search Process (ISP) model (Kuhlthau, Heinström & Todd 2008), which provides six stages in which the information search process occurs. The stages are initiation, selection, exploration, formulation, collection, presentation. This study grouped the model into three categories: initiation and identification, exploration and formulation, and collection and presentation.

The literature relevant to information literacy was reviewed and presented. The literature review focused on the evolution of information literacy, its definitions, and other related literacies. This was followed by a review of relevant research pertaining to the understanding of information literacy, identification of information needs, location of information, appraisal of information, ethical and legal use of information, and challenges associated with finding and using information by undergraduate students in line with the objectives of this study.

The study utilised a qualitative research approach. Semi-structured interviews and observation were used as data collection instruments to elicit data from undergraduate students KNUST. A total of 70 undergraduate students, comprising ten representatives from each of the colleges in the university, participated in the study.

7.3 Key findings

The findings are summarised as follows:

7.3.1 The concept of information literacy

The findings of the participants' understanding of information literacy revealed that they understood information literacy in several ways. They understood or perceived information literacy as learning to read and write or being educated, a way of searching, accessing, evaluating, and using information, and understanding and using information to make decisions and solve problems. Additionally, they understood information literacy as the knowledge and use of ICT tools, and the knowledge of how information is created and how it should be communicated.

7.3.2 Identification of information needs

The findings showed the students identified a need for information when attending to academic activities such as assignments, research projects, laboratory work, internships, and examinations. They also needed information to make decisions, solve problems, and broaden their knowledge base. The apparent lack of information on some issues and the need for information for leisure, curiosity, and clearing up doubts were other reasons that triggered their information needs.

7.3.3 Locating information

The study's findings revealed that the Internet, libraries, librarians, and other individuals were the participants' primary sources of information to retrieve the information they needed for their academic endeavours. The participants mostly retrieved electronic books, printed textbooks, journals, and videos, from the library, but more often the Internet. The findings further revealed that the participants employed the use of keywords, phrases, Boolean operators, book titles, tables of contents of books, the library catalogue, class numbers, and contact with experts as their search strategies to search for information from Google, Google Scholar, YouTube, Medscape, online databases, the library, and other individuals.

7.3.4 Appraisal of information

The findings revealed that the participants understood information appraisal as assessing, evaluating, examining information, and verifying information sources. The participants appraised information to ascertain its quality, usefulness, relevance, truthfulness, credibility,

validity, accuracy, and authenticity. The participants used accuracy, authority, objectivity, currency, purpose, and appropriateness as indicators to appraise the information resources they came across.

7.3.5 Ethical and legal use of information

The findings show that the participants understood how to use information ethically and legally. They indicated that information should be appropriately acquired and used. Participants mentioned quoting, paraphrasing, and summarising as strategies to ensure the appropriate use of information. The study also revealed that the participants knew what was involved in citing sources and how to cite correctly. Some participants mentioned using Mendeley and Google Scholar citation buttons as tools to create or generate their references in the American Psychological Association (APA) and Harvard citation styles. Additionally, the results showed that the participants understood plagiarism and knew how to avoid plagiarising other people's works by employing plagiarism checkers, citing, paraphrasing, summarising, quoting, seeking approval from copyright owners, and avoiding verbatim copying.

7.3.6 Challenges in finding and using information

The study's findings revealed several challenges in searching for, finding, and using information. Participants mentioned the lack of computer and information searching skills, poor and unstable Internet connectivity, unavailability of information, and payment and login requests for information resources. Other challenges mentioned were information overload and untrustworthy information, unwillingness to share information, unresolved problems, unfavourable library opening hours, and unsolicited advertisements.

7.4 Conclusions

This section provides conclusions based on the study's objectives and the themes derived from the study's findings.

7.4.1 Conception of information literacy

The participants in the study understood information literacy differently. Firstly, they understood it as literacy, i.e., reading, writing, or education. They articulated this understanding with words and phrases such as *read*, *write*, *understand*, *make meanings*, *being educated*, and *level of knowledge.* Secondly, the participants understood information literacy as access to and use of information, including evaluation, organisation, and dissemination of information. Students used words like *discovery, gain, obtain, find, get, gather, identify, understand, search, locate, use, evaluate,* and *transmit* to highlight this particular understanding. Some level of personal or individual effort was inherent to this understanding, which was expressed through the participants' use of the phrase and word *one's ability* and *skill*. Thirdly, information literacy was conceived as the ability to understand knowledge acquisition, how to solve problems, and make decisions. Fourthly, participants understood information literacy as having some knowledge of ICT. From the participants' perspective, an information-literate person should be able to use the various ICT tools without difficulty. Fifthly, information literacy was conceived as knowledge about how information is created. From the participants' perspective, information-literate individuals must know how information is created or produced and how using that information will create more or new knowledge. Finally, information literacy was understood as information communication. According to the participants, an information-literate person must also know how to communicate the information after use. The participants used the words *distributing, passing on,* and *disseminating* to articulate this perception.

7.4.2 Identification of information needs

The participants were motivated to look for information for different reasons, the first being their academic endeavours. The participants required information for their assignments, projects, laboratory work, research, internships, and examinations. Secondly, the participants sought information to assist in decision-making and problem-solving. Thirdly, the participants sought information to broaden their knowledge base. They expressed this desire with phrases such as *knowing more or understanding something.* Fourthly, the participants required information due to a lack of or inadequate information about a topic or difficulty understanding a situation. To highlight this inadequacy, the participants used words and phrases such as

clueless, do not know something, or *do not understand*. Fifthly, the participants were encouraged to look for information to satisfy their curiosity, clear up doubts, and get updated on events around them. Finally, the constant need for information motivated the participants to seek information, as illustrated by their use of phrases such as, *everyday, every second,* and *all the time*.

7.4.3 Location of information

The participants mentioned three primary information sources: the Internet, the library and librarians, and other individuals. Firstly, the participants predominantly used the Internet to retrieve electronic books, journals, and videos. They mostly used Google, Google Scholar, YouTube, Medscape, and the online databases subscribed to by the library to access the needed information. The participants used keywords, phrases, Boolean operators (AND, NOT, and OR), book titles, the tables of contents of books, and their lecturers' recommendations to access the needed information online. Secondly, the participants turned to the library and the librarians. The participants used the library catalogue, call numbers, and book titles as tools to locate books in the library. Finally, the participants also relied on individuals with experience and knowledge in their area of specialisation as a good source of information.

7.4.4 Information appraisal

The participants in the study understood information appraisal differently. Firstly, they understood information appraisal as information assessment referencing the information's quality, informational value, usefulness, relevance, truthfulness, credibility, validity, accuracy, and authenticity. Secondly, they understood information appraisal as information evaluation. The students evaluated by identifying, analysing, reviewing, differentiating, scrutinising, separating, and distinguishing the information resources they encountered. Finally, the participants understood information appraisal as examining and verifying information sources. These participants appraise information by examining, verifying, thinking critically, and assessing available resources. Only a few participants provided responses on how they evaluate information, and they pointed to accuracy, authority, objectivity, currency, purpose, and appropriateness as standards to appraise information.

7.4.5 Ethical and legal use of information

The participants understood ethical and legal use of information as the appropriate use of information, citation of sources, and avoiding plagiarism. According to the participants, respecting original owners' rights, seeking permission from the authors to use particular information, avoiding pirated information, acquiring information correctly, not using the information to hurt or blackmail people, and using information for academic purposes constitutes the proper use of information. Secondly, the participants understood citation as acknowledging sources, referencing information, and crediting authors or sources. The participants could also cite their sources, particularly in the American Psychological Association (APA) and Harvard citation styles. Finally, the participants understood plagiarism as using someone's work without acknowledging, citing, giving credit, or seeking permission. The participants mentioned plagiarism checkers, correct citing, paraphrasing, summarising, quoting, seeking approval from copyright owners, and not copying verbatim as things to do to avoid plagiarism.

7.4.6 Challenges in finding and using information

The participants were faced with a host of challenges in the process of searching for and using information. The first challenge was inadequate knowledge of computers and information-searching skills, leading to students wasting time searching for the needed information. The second challenge was poor, unstable, or a complete lack of internet connectivity. The third challenge was the unavailability of information, while the fourth challenge was information overload and untrustworthy information. The fifth challenge was payment and login requests for information sources. The sixth challenge was an unwillingness to share information, and the seventh was the non-resolution of information-seeking problems. Participants reported that their information needs were often not met. The eighth challenge was unfavourable library opening hours, and the ninth and final challenge was unsolicited advertisements that popped up unannounced, wasting considerable time for the participants. These challenges must be addressed and resolved to enable students to search for, access, and use information efficiently and effectively.

7.4.6.1 Overall conclusion

This study aimed to investigate the information literacy competencies and proficiencies of undergraduate students of KNUST. The study was guided by research objectives and questions. The study highlights the diverse understandings of information literacy among participants, who effectively identified their information needs and used various sources such as the Internet, libraries, librarians, and individuals. The participants demonstrated different approaches to appraising information, focusing on criteria like accuracy, authority, objectivity, currency, purpose, and appropriateness. They also recognised the importance of ethical and legal information use, particularly the correct usage and citation to prevent plagiarism. However, several challenges hindering access to and use of information were identified, indicating areas for improvement in supporting information literacy.

7.5 Recommendations

Based on the study's findings, implementing the following recommendations would improve undergraduate students' information literacy competencies and proficiencies at KNUST.

7.5.1 Information searching skills training

Information access relies on good information-searching skills. Even though some participants indicated their use of keywords, phrases, Boolean operators, and catalogues to search on the Internet and in the library, a good look at their responses indicated that the searches were not properly carried out. These participants' information searching skills were limited to just entering a keyword or phrase or sometimes combining the keyword or phrase with a Boolean operator into a search engine, mainly Google, to search for their information needs. The participants also mentioned inadequate searching skills as one of the challenges they face in searching for information. In light of this, it is recommended that the library should continually organise training sessions in information searching skills to equip students with the necessary skills, such as defining information needs and developing search strategies to search for the information they need efficiently.

7.5.2 Awareness and use of e-resources

The findings indicate that students relied more on Google to meet their information needs than the e-resources subscribed to by the library. Therefore, the library should intensify its awareness campaigns about the availability of electronic resources. Besides the usual first-year library orientation, formal library training sessions, seminars, and lectures should be organised and targeted at all university undergraduate students, possibly at college, faculty, and departmental levels. Additionally, the library could distribute leaflets, brochures, and flyers to all university undergraduates to promote the use of its resources. Since publicity bridges the gap between ignorance and knowledge, the information in these materials should be simple, concise, and precise. The library's efforts to create awareness of its resources could be boosted by faculty involvement. Faculty can do this by referring students to the library resources.

7.5.3 Knowledge and preparedness of librarians at KNUST

The study revealed that some of the participants were not information literate. These participants could not correctly search for the needed information. Some did not know how to evaluate information sources, and some could ethically and legally use information. Therefore, librarians' knowledge, preparedness, and willingness are crucial in training students to become information literate. Librarians at KNUST should acquire the requisite training and be fully prepared and equipped to provide information literacy training for the students. Training can be done in-house through on-the-job training, seminars, and workshops.

Additionally, librarians should try to attend local and international seminars, workshops, and conferences to stay updated on the latest developments in the delivery of library services and information literacy. Librarians should also learn the art of teaching, public speaking, and facilitation skills since knowledge and preparedness alone cannot ensure a successful implementation of an information literacy programme. Above all, all librarians in the KNUST library system should also avail themselves to teaching information literacy.

7.5.4 Library opening hours

Library conditions play a role in attracting users. The study revealed some participants were unhappy with the library's opening hours. This was mentioned as one of the challenges they face in accessing and using information. It is necessary to address the challenge of unfavourable library opening hours by extending their opening hours or, where necessary, operating a 24-hour service. With an extended service, all users can access the library at their convenience. The library can also make some of its services accessible off-campus when it cannot operate beyond its regular working hours.

7.5.5 Information literacy instruction

All the challenges and the inadequacies identified in this study can be addressed by providing information literacy teaching for the students. Therefore, the library should initiate the necessary steps to reintroduce the dormant information literacy course into the curriculum so that all undergraduate students will be equipped with the skills to search, access, evaluate, and use information ethically.

7.5.6 Information and Communication Technology (ICT) infrastructure

The study revealed a lack of computer knowledge among some of the participants. Additionally, poor and unstable Internet connections were reported as one of the challenges the students face in their daily Internet use. Therefore, the university management through UITS should improve the university’s ICT infrastructure to mitigate these challenges. There should be adequate computers at the university’s various libraries and ICT centres for students who cannot afford to buy their own. Basic computer literacy skills training should be offered for those who are not computer literate. The internet infrastructure should be expanded beyond the lecture halls and libraries to residences, hostels, and homestels. Expanding the Internet infrastructure should also be accompanied by an increase in bandwidth to increase Internet speed, ensuring fast and easy access to information online. Provisions should also be made to install an uninterruptible power supply for the servers and switches at the university.

7.5.7 Suggestions for further research

The study recommends exploring the following research areas:

i. Since the population of this study was undergraduate students at KNUST, future studies can explore the information literacy competencies of postgraduate students at the same tertiary institution to ascertain whether they are more information literate than their undergraduate peers.
ii. The sample size and the method made it very difficult to generalise the study's results to other undergraduate students. A comparative multi-campus study with undergraduate students using a quantitative approach, which allows results to be generalised to the entire study population, and a bigger sample size, can, therefore, be conducted.

7.5.8 Implications for theory and practice

The findings suggest expanding theoretical frameworks of information literacy to accommodate the diverse ways individuals understand and engage with information. Theories should consider personal, contextual, and experiential factors influencing information literacy. The varied approaches to appraising information highlight the need for theories to integrate a broader range of appraisal criteria. Existing models could be refined to include the specific criteria identified by participants, such as accuracy, authority, objectivity, currency, purpose, and appropriateness. The emphasis on the ethical and legal use of information, particularly regarding citation and plagiarism prevention, underscores the importance of incorporating these aspects into theoretical models. Theories should address the ethical dimensions of information use comprehensively. The challenges identified by participants call for a theoretical understanding of the barriers to information access and use. Theories should explore socio-economic, technological, and institutional factors that impact information accessibility.

Educational programmes should be designed to address the diverse understanding of information literacy. Training should be personalised, catering to different learning styles and needs, ensuring that all aspects of information literacy are covered comprehensively. Libraries, educational institutions, and information providers should ensure that a wide range of information sources are accessible and promoted. Librarians and information professionals should be equipped to guide users in navigating these diverse sources effectively. Practical

training should focus on developing participants' skills in appraising information using the identified criteria. Workshops and modules should be created to teach users how to evaluate information based on accuracy, authority, objectivity, currency, purpose, and appropriateness. Emphasising the ethical and legal use of information in educational curricula can help foster a culture of integrity. Practical sessions on proper citation practices and the consequences of plagiarism should be incorporated into information literacy training. Institutions should identify and mitigate the challenges hindering information access and use. This could involve improving technological infrastructure, providing financial support, enhancing library services, and ensuring equitable access to information for all users.

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APPENDIX A

INTERVIEW SCHEDULE

Overall objective: The study's general objective was to identify the information literacy competencies and proficiencies of KNUST undergraduate students.

Information literacy conception

*Objective**:*** To ascertain the different conceptions of information literacy among undergraduate students of KNUST.

a. What is your conception of information literacy? (What is your understanding of the term "information literacy"?)

b. How long have you been familiar with the concept of information literacy?

c. Information literacy can be called many different things. What terms do you use, and what terms are more meaningful for you?

Identification of information needs

Objective: To ascertain how undergraduate students of KNUST identify their information needs.

a. How do you identify your information needs? (When do you think you really need information?)

b. Can you please tell me why you use information?

Location of information

Objective: To investigate how undergraduate students of KNUST locate information.

a. What strategies do you employ to identify and locate the relevant information sources you need?
b. Do you use appropriate commands such as Boolean operators, truncation, and advanced search instructions to retrieve information?
c. Please illustrate how you search for and retrieve information you need for a particular assignment.

Appraisal of information

Objective: To assess how undergraduate students of KNUST appraise/evaluate the accessed information

a. What is your understanding of the term "information appraisal" or "evaluation"?
b. How do you appraise/evaluate the information you access?
c. What parameters or criteria do you use to check for an information resource's quality, validity, currency, and credibility?
d. Could you tell me what gives you confidence about the information you access?

Ethical and legal use of information

Objective: To establish whether undergraduate students of KNUST ethically and legally use information.

a. What is your understanding of the ethical and legal use of information?
b. How do you ethically and legally use information?
c. What is your understanding of plagiarism?
d. What do you do to avoid plagiarism?
e. What is your understanding of citation?

f. Do you cite the sources you use in your assignments?

g. If "Yes," How do you cite the source you use in your assignments?

Problems faced in finding and using information

Objective: To investigate the problems undergraduate students face in finding and using information effectively and efficiently.

a. What problems or challenges do you face in finding and using information?

Thank you.

APPENDIX B

OBSERVATION GUIDE

Location of information

Objective: To investigate how undergraduate students of KNUST locate information.

What strategies do students employ to identify and locate the relevant information sources they need (Online or within the library)?

Task 1: Observe how undergraduate students seek information at the circulation desks, reference desks, electronic information centres, computer terminals, and shelves at the various libraries in the university.

Task 2: Do they use appropriate commands such as keywords, phrases, Boolean operators, truncation, wildcards, catalogues and librarians for the retrieval information?

Problems faced in finding and using information

Objective: To investigate the problems undergraduate students face in finding and using information effectively and efficiently.

Task: Observe challenges the students face in finding and using information.

APPENDIX C

PERMISSION LETTER

Request for permission to conduct research at Kwame Nkrumah University of Science and Technology

"Information literacy competencies and proficiencies of undergraduate students at the Kwame Nkrumah University of Science and Technology (KNUST)"

12/5/2022

The Secretary

Humanities and Social Sciences Research Ethics Committee (HuSSREC)

KNUST

Dear Sir/ Madam,

I am doing research with Professor TB Van der Walt, a professor in the Department of Information Science towards a PhD at the University of South Africa. I am seeking permission to invite undergraduate students from this university to participate in a study entitled "Information literacy competencies and proficiencies of undergraduate students at the Kwame Nkrumah University of Science and Technology (KNUST)".

The aim of this study is to investigate the information literacy skills, competencies and proficiencies of undergraduate students at the Kwame Nkrumah University of Science and Technology (KNUST).

The study will entail interviewing students to understand how they seek, access, evaluate and use information.

This findings of the study will assist the university and library management to formulate information literacy policies. In addition, the study will hopefully engender cooperation and collaboration between faculty and the university library in the provision of information literacy skills training for undergraduate students.

There are no risks attached to the study since participants will only respond to questions about their information literacy skills.

Yours sincerely

Edward Mensah Borteye
Senior Assistant Librarian

APPENDIX D

LETTER OF APPROVAL

Kwame Nkrumah
University of Science
and Technology, Kumasi

College of Humanities & Social Sciences

HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

Our Ref: HuSSREC/AP/72/VOL. 1

1st February,2023

Edward Mensah Borteye
Department of Information Science
University of South Africa (UNISA)

Dear Sir

LETTER OF APPROVAL

Protocol Title: Information literacy Competencies and Proficiencies of Undergraduate Students at the Kwame Nkrumah University of Science and Technology (KNUST).

Proposed Site: Ghana

Sponsor: Principal Investigator

Your submission to the Committee on Humanities and Social Sciences Research and Ethics Committee on the above-named personnel refers.

The Committee reviewed the following documents:

- A notification letter of **16th January, 2023** from the from the Department Information Science, University of South Africa
- A completed HuSSREC Application Form
- Participant Information Leaflet and Consent Form
- Research Protocol
- Questionnaire

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning **1st February, 2023 to 1st February, 2024** renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approval protocol.

Data gathered for the study should be used for the approved purpose only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you for your application.

Prof. Oswald K. Seneadza
CHAIRMAN

PMB UPO, KNUST, Kumasi **Tel:** +233 32 249 9705 **Email:** hussrec@knust.edu.gh **Website:** www.knust.edu.gh
Bankers: Ecobank, KNUST **Account Name:** CASS Research Fund **No.** 1441000860606

APPENDIX E

PARTICIPANT INFORMATION SHEET

Research title: Information Literacy Competencies and Proficiencies of Undergraduate Students at The Kwame Nkrumah University of Science and Technology (KNUST)

Researcher: Edward Mensah Borteye

Ethics clearance reference number: 62059203_CREC_CHS_2022
Research permission reference number (if applicable):

Dear Prospective Participant

My name is Edward Mensah Borteye a library staff member of the Kwame Nkrumah University of Science and Technology, Kumasi. Currently, I am working on my PhD at the Department of Information Science at the University of South Africa. My work deals with information literacy skills of undergraduate students. I would like to thank you in advance for taking the time to participate in this interview, which is aimed at collecting data regarding the information literacy skills and competencies of undergraduate students at KNUST. You have been selected to take part in this interview, and your participation is voluntary. This interview will take approximately 60 minutes, and you can opt out of the interview at any time. The study and this interview are designed purely for educational purposes and will not be used for any purpose other than what it is intended. The data will be analysed and interpreted by the researcher himself for academic purposes only and is completely confidential. As a participant, you do not have to mention your name during the interview session. The recordings will be stored on a password protected computer. After at least five years, the recordings will be

permanently deleted from the hard drive of the computer through the use of a relevant software programme.

For further information, please contact the researcher by one of the following methods:

Mobile No.: 0501346794

E-mail: edborteye1@gmail.com

Library, College of Engineering, Kwame Nkrumah University of Science and Technology, Kumasi

Should you have concerns about the way in which the research has been conducted, you may contact my supervisor via email at vdwaltb@unisa.ac.za or on phone via this number +27828286305. Alternatively, contact the research ethics chairperson of the Ethics Review Committee.

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

Edward Mensah Borteye

APPENDIX F

CONSENT TO PARTICIPATE IN THIS STUDY

I, ..., confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation. I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the interview. I have received a signed copy of the informed consent agreement.

Participant Name & Surname…… (please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature……..Date……

APPENDIX G

ORIGINALITY REPORT