# Analysis of the digital information literacy skills of geoscientists at the Geological Survey of Namibia


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# Declaration

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Signed by candidate Date:30-06-2023

# Dedication

To my parents!

Another extra mile travelled with me!

To my namesake, Martin Darren Livingstone Katengela

# Acknowledgement

First and foremost, I thank God for His blessings that have seen me this far, even when I struggled with ‘writer's block’, here and there, I managed to overcome it and sail through.

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# Abstract

In the context of Namibian geosciences, the relationship between digital information literacy skills and the geoscientists is not evidenced by literature. Thus, the purpose of the study was to critically analyse the digital information literacy skills of the geoscientists working at the Geological Survey of Namibia (GSN) in the Ministry of Mines and Energy. The study used the six frames presented in the Association for College and Research Libraries (ACRL) Framework of Information Literacy for Higher Education (2016) as a theoretical framework that underpinned the study. Pragmatism paradigm was used as a philosophical lens to examine geoscientists' digital information literacy skills. A convergent parallel mixed methods approach was used and a case study research design to provide in-depth analysis of the digital information literacy skills. The study collected quantitative data via online questionnaire surveys with 32 (60%) geoscientists. Qualitative data were collected using semi-structured interviews from purposively sampled managers (7) and librarians (3) within GSN, and auto-ethnography was used as a secondary qualitative data collection method since the researcher is a senior librarian at the institution and, thus, a good source of data. The study had four critical questions which explored geoscientists digital information literacy skills, challenges and gaps in acquiring and enhancing these skills, services offered and strategies that can be used in the acquisition and enhancement of digital information literacy skills of geoscientists. The study findings revealed from the questionnaire survey that geoscientists are moderately high and highly skilled in the different six frames of the ACRL framework. GSN managers, auto-ethnographer and librarians regarded the geoscientists as being fairly skilled in digital information literacy. The study found, lack of digital information literary trainings, collaborative spaces, motivation and professional support, funding and inability to use new technologies as key challenges experienced by geoscientists. However, the study results revealed that, the library and various divisions are providing support services to geoscientists to acquire these skills. The study concluded that digital information literacy skills trainings, better funding opportunities and a need-based instructional plan can be put in place as strategies to advance these skills. To aid in the quest for DIL skills by geoscientists, the study recommended further specialised digital information literacy skills trainings, establishment of community of practice, intentional funding for capacity development and investing in relevant digital infrastructure.



**Key words:** digital information literacy skills, geoscientists, Geological Survey of Namibia

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# List of acronyms

| | | |
|---|---|---|
| ACRL | - | Association of College and Research Libraries |
| AI | - | Artificial Intelligence |
| ALA | - | American Library Association |
| BGR | - | Bundesanstalt für Geowissenschaften und Rohstoffe |
| CIL | - | Communications in Information Literacy |
| DIL | - | Digital Information Literacy |
| DKIS | - | Department of Knowledge and Information Stewardship |
| EDN | - | Earth Data Namibia |
| *f* | - | Frequency |
| GEOCOM | - | Communications of the Geological Survey of Namibia |
| GSN | - | Geological Survey of Namibia |
| ICTs | - | Information Communication Technologies |
| IFLA | - | International Federation of Library Associations and Institutions |
| IoT | - | Internet of Things |
| IRs | - | Industrial Revolutions |
| LIS | - | Library and Information Science |
| M | - | Mean |
| MME | - | Ministry of Mines and Energy |
| MOOCs | - | Massive Open Online Courses |
| NBC | - | Namibia Broadcast Cooperation |
| NESEIC | - | National Earth Science and Energy Information Centre |
| NGOs | - | Non-Governmental Organisations |
| OPAC | - | Online Public Access Catalogue |
| SD | - | Standard Deviation |
| SDGs | - | Sustainable Development Goals |

| | | |
|---|---|---|
| UCT | - | University of Cape Town |
| UK | - | United Kingdom |
| UNESCO | - | United Nations Educational, Scientific and Cultural Organization |
| USA | - | United States of America |

# Chapter 1: Introduction and background

## 1.1 Introduction

Digital information literacy skills are one of the key skills of being a global citizen, understanding how technology and electronic information works and effectively utilising the technology and information to meet one's needs. The fourth industrial era has resulted in disruptive digital technologies that have drastically transformed lives and how work is performed. Kivunja (2014:2) noted that with the plethora of information formats in the 21st century, employees will be required to manage both physical and digital information daily; and thus, will need to have the appropriate competencies. The digital information landscape has dramatically altered the way people live and work, leading to the need for a set of skills to fully participate in and benefit from a digital information-based economy (Sparks, Katz & Beile, 2016:2).

The rapid acceleration of industry 4.0 brought a lot of changes including the change from traditional librarianship to digital librarianship or blended librarianship, interestingly this change has ushered the introduction of online information provision services in many libraries even more so during coronavirus (COVID-19) pandemic lockdowns and restrictions (Chigwada & Chisita, 2021:5). As a result, a research library such as the National Earth Science and Energy Information Centre (NESEIC) under the Geological Survey of Namibia (GSN) was not an exemption. The integration of advanced technologies like connectivity, artificial intelligence, robotics and machine learning in the workplace requires employees with dynamic skills and a commitment to continuous capacity development and learning. Employers now seek adaptable and tech-savvy employees who can keep up with the ever-evolving and changing digital landscape (De Stefano & Wouters, 2022:iii).

In the age of the 4th industrial revolution, there is an increased need for a skilled workforce (Kivunja, 2014:2). The demand in the job market calls for employees to be constantly self-aware of their digital information literacy abilities and to seek out ongoing professional development as needed, in order to keep up with the rapidly changing workplace landscape and take advantage of new technological advancements (Fallon, 2020:2451). Although the need to master information literacy skills have been around for decades, now there are differences in the form of information

and how to get information needed, because it continues to evolve and become more complex as time goes by (Mardani & Silalahi, 2021:198). Due to this evolvement and complexity, information literacy skills and digital literacy is intertwined. Thus, digital information literacy can be referred to as the capability to utilise information and communication technologies to locate, comprehend, assess, produce, and share digital information, which necessitates both cognitive and technical proficiency (Becker, 2018:1).

Technology has advanced to such a high level that the skills professionals need to acquire are closely intertwined (Noll, 2017:5). As information literacy is advancing in many regions globally, digital literacy is simultaneously advancing as well. Consequently, professionals who have mastery of digital skills are seen as those who can competently, efficiently, effectively, and ethically utilise technology to fulfil the information requirements of their personal, civic, and professional lives (International Federation of Library Associations [IFLA], 2017). Being digitally literate leads to the creation of an informed society, which is considered to be an enlightened, knowledgeable, and literate society. Institutions, organisations, and industries rely on information and research outcomes as their foundation and source of competitive edge.

The fast-evolving work environment and the dynamic and sometimes unpredictable information ecosystem in which people work and reside require new approaches for effectively navigating the digital information landscape in order to address real-life information-based problems (Association of College and Research Libraries [ACRL], 2015). Institutions such as libraries are regarded as the information hub of many governments, private and Non-Governmental Organisations (NGOs). These play a critical role in improving outcomes linked to the Sustainable Development Goals (SDGs), by promoting universal literacy, access to information in multiple formats, advances in digital inclusion and the preservation of the world's documentary heritage (Ross, 2021).

Institutions like the NESEIC library exists to benefit the staff members such as the geoscientists as individuals and professionals, through provision of timely and accurate information services and guidance. Due to the voluminous presence of online information, employees would need to be skilled to dive through these silos of information, hence NESEIC involvement in literacy skills provision is vital. This is where the library and librarians play a major role in reskilling and upskilling the workforce in terms of digital information literacy, by conducting surveys and

identifying information literacy skills gap in the Ministry of Mines and Energy (MME). Moreover, although this is not an embedded service in the day-to-day work, training, or program of geoscientists, this has become a role the library plays in supporting users with various and necessary skills.

Gill et al. (2016:338) argues that to be relevant in the society, there is a need to evaluate and analyse geoscientist roles in global poverty eradiation, facilitating sustainable development and recognising their importance of communicating with policy makers, administrators and other disciplines engaged in facilitating development. The link between being digitally literate and facilitating sustainable development within the society cannot be overlooked because the two compliments each other. For professionals to perform their duties effectively, they need to follow established standards to provide efficient and effective services (Chigwada & Chisita, 2021:4). One of those standards or skills per se, is to be information literate, as highlighted in the ACRL Framework for Information Literacy for Higher Education (ACRL, 2017:3).

Today's workforce has evolving roles, so there is a need for reskilling, cross-skilling, and upskilling using various strategies that library managers can use to encourage their staff and patrons to be well-equipped. To meet the United Nations Sustainable Development Goals (SDGs) and to thrive in the Fourth Industrial Revolution (4IR), different knowledge and skills such as the digital information literacy skills are needed in the workplace. The reskilling, cross-skilling and upskilling in digital information literacy will help workers engage in lifelong learning and allow them to become the flexible, easily trainable workforce that business leaders have been calling for (Head et al., 2013:75).

The 21st century has been labelled the information age because of the explosion of information and the abundance of information sources (Solmaz, 2017:940). Due to the advancement in technology and disruption in global events due to global pandemics such as COVID-19, emergence of 4IRs and other disruptive innovations, the roles of geoscientists have evolved significantly necessitating them to be effectively equipped with digital information literacy skills. Furthermore, to deliver effective information services to meet the diverse and dynamic information needs of patrons such as geoscientist, there is a call for all librarians that work in specialised libraries to strategically rethink their information literacy practices in order to equip their users with competencies and skills of their users. This demand has prompted the need for a critical analysis

of the digital information literacy (DIL) skills of geoscientists at the Geological Survey of Namibia.

## 1.2 Context of the study

The Ministry of Mines and Energy (MME) is geographically located in Windhoek, the capital city of Namibia, with other four small branches countrywide, namely Tsumeb, Lüderitz, Orandjemund and Swakopmund outstations (see Figure 1). MME was formed as per the constitution of the Republic of Namibia to protect the country's diverse geological, mineral, and energy resources and guarantee their contribution to the nation's socio-economic growth (Schreiber & Nguno, 2008:1). The Ministry of Mines and Energy is home to the Geological Survey of Namibia, which promotes understanding and awareness of Namibia's geological resources through scientific mapping and research and the use and dissemination of high-quality research data (Ministry of Mines and Energy, 2021).

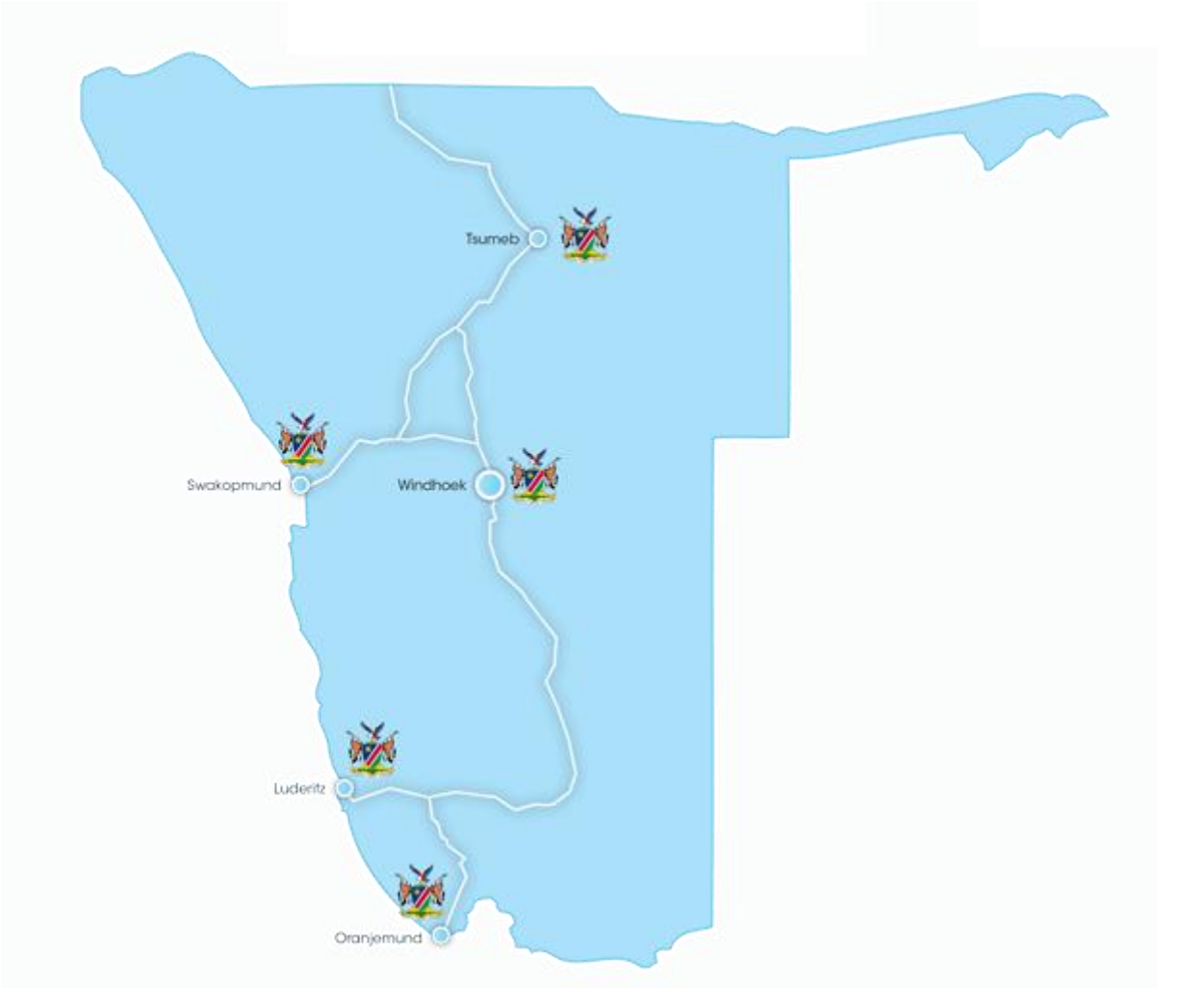


**Figure 1.1: Namibian Ministry of Mines and Energy branches countrywide (Ministry of Mines and Energy, 2022)**

The Geological Survey of Namibia (GSN) is a directorate within the Namibia Ministry of Mines and Energy (MME). It was established in early 1900s in Namibia (formally known as South West Africa by then) and its offices were set up in Windhoek in 1903 (Schreiber & Nguno, 2008:2). Making it one of the many oldest geological surveys in the world. The main aim of establishing a geological survey was to carry out geological research and to oversee early mining and exploration research and activities in Namibia (Schreiber & Nguno, 2008:1). The directorate is further divided into six divisions, namely Regional Geoscience, Economic Geology, Geophysics, Geochemistry, Engineering and Environmental Geology as well as Geo-Information division.

Today GSN is a modern research institute, and the core tasks are mapping, mineral exploration, geophysics, geochemistry, research and geoengineering. Some departments also deal with regulatory functions, geohazards, education, environment, water resources and land use planning (Schneider, 2016:1). Research data are accessible through databases and are disseminated in both digital and conventional forms (Schreiber & Nguno, 2008:1). Both the National Earth Science Museum and the National Energy and Earth Science Information Center fall under GSN.

Geological survey libraries are classified as research libraries with unique features because they are subject specific. NESEIC unique collections covers areas spanning from earth sciences, energy, sustainable development, and other interdisciplinary fields that cut across these areas. They offer unique collections which are not limited to, geological survey reports and bulletins, field trip guidebooks, topographic maps, field notebooks, geological books, theses, and dissertations (Foote, 2010:53). The NESEIC serves the MME staff members, mineral investors, students, and the general public with an interest in Namibian geology and energy sectors. NESEIC has two librarians on a full-time basis, two librarians on contractual basis and two technical assistants. Services provided are not limited to collection and preserve information, ensure accessibility, training and inter-lending services amongst others. MME staff members are the primary users of the library, pointing out geoscientist as the larger population that uses the collection extensively because they deal with research on a daily basis (Ministry of Mines and Energy, 2021). As the larger population of staff members of the ministry utilises this library, it becomes more vital to critically analyse the staff members' digital information literacy skills, for better service provision, access and utilisation of these resources.

## 1.3 Background of the study

Namibia is a medium-sized country of 824,295 square kilometres with a population of just over two and a half million (Schreiber & Nguno, 2008:2). Namibia is well known for its breath-taking natural landscapes and scenery beauty and many more. Its geology ranges from hot desert with the tallest dune in the world, mountains, rivers just to mention but a few. In addition, Namibia is rich in mineral resources such as zinc, copper, gold, uranium, and it well known alluvial diamonds from the floor of the Atlantic Ocean.

The country currently has 19 ministries, including the Ministry of Mines and Energy (MME). The Ministry of Mines and Energy has a long-term goal of giving all citizens of Namibia access to the country's geological, mineral, and energy resources for sustainable economic growth, equal advantage, and prosperity. Its mission is to develop policies and laws that regulate the mining and energy industries effectively, create knowledge and information about resources, and offer services to encourage investment for sustainable economic growth and benefit all Namibians (MME, 2021).

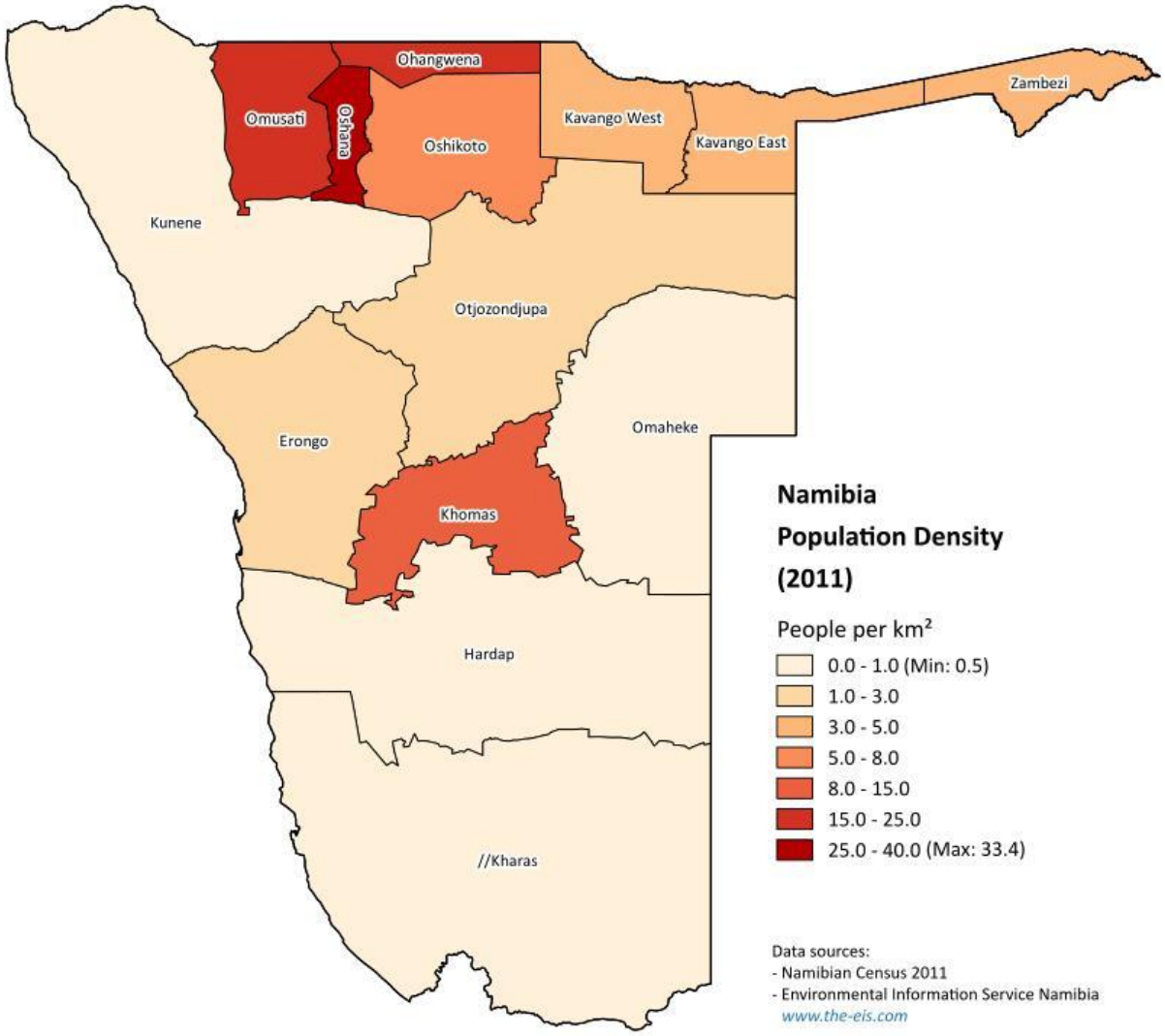


**Figure 1.2: Namibia population density according to political regions (Picard, 2021)**

### 1.3.1 National Earth Science and Energy Information Centre (NESEIC)

The Geological Survey of Namibia is located in the Ministry of Mines and Energy Building in Windhoek, along with other Directorates such as the Directorates of Mines, Energy, Energy Funds, Diamond Affairs, and Administration and Finance. The Geological Survey of Namibia is an essential player in the development of Namibia's mineral and geological resources and in advancing sustainable growth while considering the neighbouring communities. It is one of the oldest geological surveys, dating back to the 19th century, and has had a significant impact on Namibia's geology throughout its history. National Earth Science and Energy Information Centre (NESEIC) under Geo-Information Division, is a specialised geoscience reference library.

The primary goal of NESEIC is to gather, offer, and encourage the proper use of comprehensive, accurate, and up-to-date scientific, mining, and energy information for its varied client base. Its mission is to connect users with high-quality information and services by supplying resources on earth science and energy to advance Namibian society (Ministry of Mines and Energy, 2021). The geoscientist within GSN do research and generate report as well publications on their findings, the NESEIC library act as central place where this information can be kept and accessed by all who are searching for information on Namibian geology (Robert, 2015:3). In addition, the library serves the geoscientist with relevant information for their day-to-day research and quest for knowledge. The library offers services such as e-resource trainings, circulation services, and historical archival geological data services though curation services.

## 1.4 Research problem

The International Federation of Libraries Association [IFLA] (2017) reported that there is evidence of declining trust in digital spaces such as the internet, due to an increase in cybercrime and inadequate online privacy. This causes users to disconnect, not connect at all, or limit their activities or seek safe spaces. In addition to the problems posed by the digital spaces, there is an increase in misinformation, disinformation, fake news, and stories of antisocial behaviour being used to justify censorship by governments and others.

Whilst possessing digital information literacy skills leverages the impacts of all the problems that comes with the new digital information platforms, some professions are still lagging in terms of digital information literacy skills. A study carried out by Roberts (2013:180), primarily focused

on information retrieval knowledge of users using NESEIC databases and identified a gap in information literacy skills of the users, a decade later this is still the case specifically with digital information literacy skills gap. In the Namibia geosciences context, the symbiotic relationship between digital information literacy skills and the geoscientists is not yet known.

As observed by the researcher, a librarian at NESEIC, Geological Survey of Namibia geoscientist digital information literacy skills competencies in their work tend to be limited as they find it difficult to manage their information when using digital platforms and resources. Similarly, from the literature, little has been written on the digital information skills possessed by geoscientist and how it serves as an enablement in their daily professional work. Limited or no known studies have been conducted on digital information literacy skills of geoscientist at the Geological Survey of Namibia to be specific or Namibia in general. By virtue of the researcher working at the NESEIC Library and through surveys conducted on the required knowledge and skills, it has been observed especially during the pandemic when researchers have to work virtually that the geoscientists had limited digital information literacy skills. Hence the study analyses the digital information literacy skills of the geoscientist within GSN.

## 1.5 Objective of the study

The main objective of this study is to critically analyse the digital information literacy skills of the geoscientists within the Geological Survey of Namibia.

## 1.6 Critical questions

The following critical questions were generated to address the study's objective:

1.6.1 What digital information literacy skills do the geoscientist possess?

1.6.2 What challenges or gaps do geoscientists have, if any, in relation to digital information literacy skills?

1.6.3 What support services are provided by GNS to enhance digital information literacy skills of geoscientists?

1.6.4 What are some of the strategies that can be employed to support the acquisition and enhancement of digital information literacy skills of geoscientists?

## 1.7 Significance of the study

Bejaković and Mrnjavac (2021:10) alluded that, without digital literacy skills, it becomes impossible to participate in the economy and the digital society effectively, particularly with the digital transformation that the world of work is experiencing. This can still be said for digital information literacy skills today. The criticality of digital information literacy skills of the geoscientist cannot be overemphasised, be it nationally or globally (Gill et al, 2016:339). There is a dire need to equip geoscientists with relevant digital information literacy skills. Taking that into consideration, geoscientists will be able to add their contribution on supporting and facilitating sustainable development and lifelong learning which is critical for a developing country such as Namibia.

The study aims to provide a critical analysis of digital information literacy skills of geoscientists and how the Geological Survey of Namibia library (National Earth Sciences and Energy Information Centre [NESEIC]) can support the advancement of digital information literacy skills of geoscientists within the directorate. The findings of this study will help with the enhancement of the services provided by the library in order to cater for the information needs of geoscientists. It is the hope of the study that the findings will be useful not only within the GSN geoscientist but to the geoscientist within other Ministry departments, and other Geological Surveys elsewhere in the continent and overseas. This study will also contribute nuances and fresh ideas to the body of knowledge on digital information literacy skills of geoscientists within Namibia and beyond.

## 1.8 Definition of relevant terms

This section explains the definition of terms according to their use in the study.

### 1.8.1 Information literacy

Information literacy involves a combination of skills that encompass the reflective process of finding information, understanding the production and value of information, and using that information to create new knowledge and participate ethically in educational communities (Association of Research and College Libraries [ACRL], 2016:8).

### 1.8.2 Information literacy competency

Information literacy competency refers to a combination of information literacy and competency that encompasses a combination of knowledge, skills, and attitudes related to recognizing the need

for information, finding it, evaluating and managing it, applying it, and ethically and legally synthesising, using, and communicating it. (Anunobi & Udem, 2014:67).

### 1.8.3 Digital information literacy

The ability to function in a knowledge society through the appropriate use of information and communication technology to solve information problems, including the ability to research, organise, and synthesize information through digital technology and having a fundamental understanding of the ethical/legal issues surrounding the use of such information (Sparks, Katz & Beile, 2016:3-4).

### 1.8.4 Digital information literacy skills

Digital information literacy skills are the skills that enables individuals to use information and communication technologies to find, understand, evaluate, create, and communicate digital information, an ability that requires both cognitive and technical skills (Sparks, Katz & Beile, 2016:3-4).

### 1.8.5 Geoscientists

In the context of the study, geoscientists refer to employees in the fields of the earth sciences, its atmosphere, and its oceans to characterize its materials, understand the processes that shape it, and to unravel its history (Shar, 2013).

### 1.8.6 Information management

Information management is regarded as the process of designing, developing, managing, and using information with insight and innovation, with a sole purpose of supporting decision making and creating value for individuals, organisations, communities, and societies (Bawden & Robinson, 2018:293).

## 1.9 Overview of methodology

The primary focus of research design is on the various frameworks for data collection and analysis (Bryman, 2016:37). Understandably, these include the significance attached to understanding behaviour and its meaning in its specific social context. To make clear distinction between the two, Creswell and Creswell (2018:13) defines research method as a technique for collecting data and involves specific instruments for collecting data. The study employed a convergent parallel mixed

methods approach with a pragmatic worldview which allows the collection of qualitative and quantitative data in order to analyse the digital information literacy skills of geoscientists. A case study research design was used for an in-depth analysis of the digital information literacy skills of the geoscientist at the National Earth Science and Energy Information Centre within the Geological Survey of Namibia. Data was collected using semi-structured interviews for qualitative data collection and self-administered questionnaires to collect quantitative data. The population of the study consisted of a total number of 53 geoscientists and four librarians working at the Geological Survey of Namibia. Purposive sampling was used to select participants for the semi-structured interviews whilst a census was used to collect quantitative data through a questionnaire from all the geoscientist working at GSN. The study employed autoethnography with the study's researcher as a data collection agent.

## 1.10 De-limitations of the study

Delimitations are the limitations consciously imposed by the researcher. They are concerned with the definitions that researchers choose to designate as the boundaries or limits of their work in order to keep the study's goals and objectives from becoming difficult to achieve (Dimitrios & Antigoni, 2019:157). This study was delimited to the Geological Survey of Namibia. In addition, the study was delimited to librarians and geoscientists within the Geological Survey of Namibia and excludes geoscientist working in other directorates within the Ministry of Mines and Energy or other ministries in Namibia. The researchers' experience and affiliation to NESEIC library made it an appropriate choice as a research site for the study.

## 1.12 Organisation of the minor dissertation

This minor dissertation is comprised of five chapters. Chapter 1 introduced the research topic and provided a thoroughly background of digital information literacy skills and how it relates to employees' professional duties in their day-to-day work life. This was then followed by a contextualised background and setting of the research study, which is the Ministry of Mines and Energy's Directorate of Geological Survey of Namibia and its' National Earth Science and Energy Information Centre. In addition, the study's research problem was presented and the justification of carrying out the study. Literature reviewed in the introduction informed the study's research problem, objectives and critical questions. Furthermore, Chapter 1 also comprised of the significance of the study, a brief snippet of the research methodology and limitations and

delimitations of the study. Conceptual framework, empirical and conceptual studies on digital information literacy skills were reviewed in Chapter 2. Chapter 3 covered the research designs, methods, and instruments used to collect and analyse data. Chapter 4 summarises and present findings from the data. Chapter 5 presents deliberations of the study's main findings in addressing the study's main objective and critical questions. Chapter 5 also outlined conclusions and recommendations as well as closing remarks of the study. The last section consisted of references and appendices to the study.

## 1.13 Chapter summary

This chapter laid out the study's foundation and provided the background into the analysis of digital information literacy skills of the geoscientist within the Geological Survey of Namibia. A gap in literature was identified by Roberts (2013:180) that information literacy skills of the users at NESEIC was lacking, a decade later this is still the case specifically with digital information literacy skills gap. This user statistics included the geoscientists. As a result, the purpose of this study is to critically analyse the geoscientists' digital information literacy skills which informed the study objectives and critical questions. In addition, the chapter provided the significance of the study which is to provide a critical analysis of digital information literacy skills of geoscientists and how the Geological Survey of Namibia can support the advancement of digital information literacy skills of geoscientists within the directorate. The research importance was justified, the scope of the study and an outline of the organisation of the research project. Limitations and delimitations that might affect data collection processes were also highlighted in this chapter. The next chapter presents the literature review and supporting conceptual framework for the study.

# Chapter 2: Theoretical framework and literature review

## 2.1 Introduction

The purpose of examining the existing literature is to gain a clearer understanding of the problem at hand and to determine its importance. Conducting a literature review is an effective way of choosing or narrowing down a topic, as it explores what has already been studied in a particular field. This reduces the possibility of selecting an irrelevant or out-of-date topic or focus (Roestenburg, Strydom, Fouché, & De Vos, 2014: 123). Creswell and Creswell (2018:79), helpfully suggest that it is important for studies to add to the existing knowledge on a topic, and the literature section in research proposals typically follows a structure that begins with the broader problem and gradually focuses on the specific issue that will be addressed in the study's methods. This is no different to this study. The chapter aims to construct and source information surrounding digital information literacy skills of geoscientists within the Geological Survey of Namibia (GSN). In addition, it aims to critically analyses information and identify any possible gaps that exist in the literature, which will prompt further research (Moola, 2015).

This study sought to analyse the digital information literacy skills of geoscientists within the Geological Survey of Namibia, and literature surrounding the digital information literature skills were reviewed. This chapter is divided into two sections, the first part of this chapter brings forth the theoretical framework that underpins this study, whilst the second part of the chapter presents the review of existing literature according to themes that emanated from the study objective and critical questions in order to direct the study focus.

## 2.2 Theoretical Framework

Theory is a set of principles that explains a set of phenomena. In the social sciences, De Vos, Strydom, Fouché and Delport, (2011:37) defined theory as universally presented in the form of words, i.e., sentences or statements most often called empirically tested propositions that, if not yet tested, are at least potentially testable. These propositions are integrated into an interconnected set of statements with the aim of comprehending, explaining, and forecasting the behavior of a particular phenomenon or phenomena within a specific field of study or practical area. By understanding the meaning and role of theory in research, it further helps with understanding the

theoretical framework and the conceptual framework. As differentiated by Kivunya (2018: 46-47), a conceptual framework is developed through the researcher's own thoughts and ideas about the study, while the theoretical framework consists of other scholars' theoretical perspectives that the researcher considers to be relevant to the study and particularly useful in the data analysis and interpretation process.

To expand to this, Ngulube, Mathipa and Gumbo (2015:45), posits that a conceptual framework shows the relationship between concepts and their impact on the phenomenon being investigated, and they provide understanding, rather than offering a theoretical explanation. On the contrary, the theoretical framework helps with the substantiation of the argumentation and the justification of what is presented in the findings and recommendations (Kivunya, 2018:48). Given the differentiation between the two, this study used a theoretical framework as a lens to look through the research problem in a pragmatism paradigm.

The Association of College and Research Libraries Framework for Information Literacy for Higher Education has been adopted as the theoretical framework that underpinned the study. The ACRL framework was developed by Association of College and Research Libraries (ACRL), a division of the American Library Association (ALA). It was adopted by the ACRL Board on 11$^{th}$ January 2016, and it was intended as a revision of the prior ACRL Information Literacy Competency Standards for Higher Education. The framework is strongly influenced by the idea of metaliteracy, which sees information literacy as a comprehensive set of abilities in which individuals are both consumers and creators of information and can effectively participate in collaborative environments. It necessitates interaction with the information environment on behavioural, affective, cognitive, and metacognitive levels (ACRL, 2015:8).

The framework is made of six frames that present the big ideas, which are deliberately described at a high level, through which to view digital information literacy with a hope to draw the emphasis toward how these ideas are internalised by the information users (Sparks, Katz & Beille, 2016: 8). The following six frames of the ACRL Framework offer core conceptual ideas about the nature of information literacy: (a) authority is constructed and contextual, (b) information creation as a process, (c) information has value, (d) research as inquiry, (e) scholarship as conversation, and (f) searching as strategic exploration (Pitts & Leihner-Quin, 2019:32) (see Figure 2.1). These frames reflect a more integrative organisation of the DIL skills encompassed by the original standards,

because they have taken a less fragmented and more comprehensive approach to information literacy and, by extension, DIL. The framework states that each frame consists of an introductory statement, knowledge practices, which show how learners can deepen their understanding of these information literacy concepts, and dispositions, which outline ways of addressing the emotional, attitudinal, or value-based aspect of learning (ACLR, 2015: 2). These are essential ideas that must be understood in order to achieve true proficiency within a specific field, profession, or area of knowledge.

ACRL defined 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 (ACRL, 2016: 8). The definition can be applied to any type of information, oral, print, or digital, and to people who have or do not have Internet access. Thus, it was chosen to aid in the study the digital information literacy skills of geoscientists.

The ACRL Information Literacy Standards for Higher Education Task Force underwent a significant revision of the framework in 2013 and 2014. The ACRL standards were extensively updated to incorporate current perspectives on topics like the creation and dissemination of knowledge, the rapidly evolving global higher education and learning environment, and the shift from information literacy to information fluency. The definition of information literacy was expanded to encompass a range of literacies, including transliteracy, media literacy, digital literacy, and others (Eleanor & Watstein, 2014).

The field of information literacy in libraries is constantly emerging and evolving. Given these developments, it is clear that it is necessary to explore a new theoretical framework consisting of assumptions, principles, rules, and more that integrates the ideas that make up the broad concept of information literacy (Eleanor & Watstein, 2014). The purpose of the ACRL Framework for Information Literacy is to encourage cooperation between librarians and faculty in various disciplines, recognizing that information literacy is not solely the responsibility of the library (Berman & Kudem, 2017:24). The results of this study enhanced the knowledge and comprehension of the DIL skills of geoscientists. This will enable librarians, training officers, and senior researchers to make informed decisions on how to provide additional training or enhance the skills of geoscientists and create educational programs to help them become digitally

information fluent based on realistic expectations.

In selecting the ACRL Framework, several factors were taken into account. Firstly, the Framework views information literacy as a continuous aspect of learning throughout a student's academic journey and as intersecting with other academic and social learning objectives (Kuden & Braund-Allen, 2017: 2). Although the framework originated from academic settings, it was selected for this study because the Geological Survey of Namibia (GSN) is a research institute where practicing geoscientists are considered as researchers. Information literacy at a professional level is experienced at a broader level (Abdi, 2017:56). This broader context allows professionals to have the chance to encounter and recognize more varied information experiences occurring in different workplaces to their current ones that are unique to those work environments due to their organisational culture, thus using the ACRL framework fits this purpose of analysing digital information literacy skills of geoscientists within GSN.

Secondly, the framework is not a set of static and iterative skills that users are required to possess but a set of broader key concepts that can be grasped in order to develop genuine expertise within a discipline or profession. Furthermore, the framework is widely used globally and well documented in the literature. Foster (2017:12) argued that information literacy must be approached from a more comprehensive viewpoint, as a set of abilities that aid individuals in collaborating and recognising workplaces as social structures.

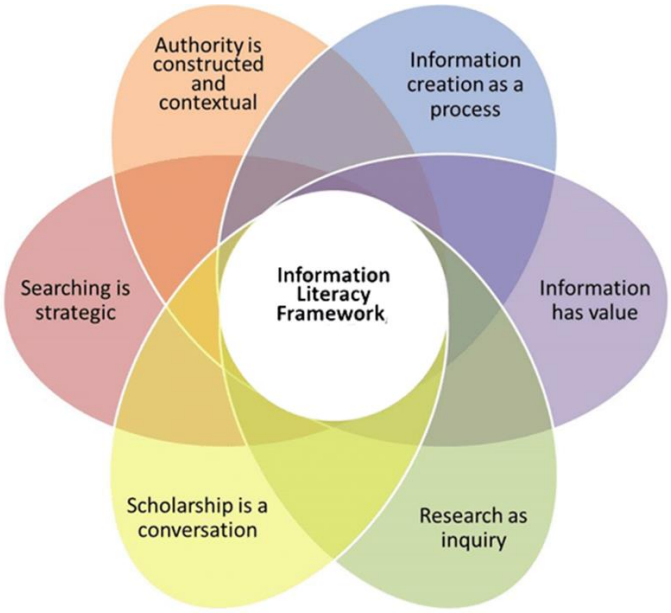


**Figure 2.1: The ACRL Framework for Information Literacy and the six major frames (Burress et al., 2015)**

## 2.3 Literature review

The literature review is made up of themes emanating from the objective of the study and the critical questions which are, researcher digital information literacy skills need, services offered by research libraries in terms of digital information literacy skills, challenges faced by geoscientists in terms of digital information literacy skills and frameworks that support the analysis of digital information literacy skills of a workforce. The literature review is also informed by the theory supporting this study.

### 2.3.1 Digital Information Literacy (DIL)

Literacy is regarded as the ability to rea and write. To understand DIL, it is important to understand information literacy in general. The concept of information literacy (IL) was first put forth by Peter Zurkowsky in 1974 and has undergone significant development and improvement over the course of 30 years. Despite the challenges, IL has continued to strive for recognition and success. According to Solmaz (2017:939), information literacy is the set of skills needed to discover, retrieve, analyse, and use information. In today's information-driven society, advancements have

elevated the significance of information as a valuable asset in the global economy. Historically, Yoram (2004:103) defined digital literacy as a survival skill in the digital era. Zurkowsky's definition also delved deeper into the concept of digital literacy, stating that it involves a set of skills and tactics utilized by individuals in digital settings. By utilizing various forms of digital literacy, users are able to enhance their performance and effectively navigate challenges and difficulties encountered in this unique medium (Yoram, 2004: 103).

Furthermore, the IFLA Recommendations on Media and Information Literacy (2011) defined digital literacy as encompassing the awareness, attitudes, and abilities required to identify when and what information is necessary; locate and access that information; critically evaluate and organise it once found; and utilise it in an ethical manner. The definition expands beyond just communication and information technologies to include learning, critical thinking, and interpretive competencies across both professional and educational settings.

Digital information literacy and information literacy skills are related concepts. As a result of the widespread use of social media, blogs, wikis, mobile devices, online communities, cloud computing, and massive open online courses (MOOCs) for communication, creation, and information sharing, information literacy has undergone a significant transformation (Macky and Jacobsen, 2014). These practices change into a kind of metaliteracy which expands traditional information literacy skills to include the collaborative aspects and the sharing of information and knowledge, thus the metaliteracy involves the reinventing of the existing information literacy (Noll & Brown, 2018:3).

According to Reddy, Sharma and Chaudhary (2020:84) defined DIL as the ability to use digital technology to search for, locate, analyse, and synthesize information resources, evaluate their credibility, apply appropriate citation methods, adhere to legal and ethical considerations, and develop research questions in a precise, effective, and efficient manner. This definition of digital information literacy ties in well with the one adopted by ACRL framework of Information literacy and tackled the same faces of information literacy and integrating digital tools.

In literature, the United States (US) dominates the publications in the landscape of digital information literacy skills. Tokarz and Bucy (2019: 245) carried out a content analysis of articles published in Communications in Information Literacy (CIL) and concluded that information

literacy is a global concept; however, US authors and journals dominate the global landscape and they recommended that US should make more space for others to join the conversation. In Africa, although the concept is quite not fairly new, literature on digital information literacy skills is not that much, but must be noted that, literature on information literacy alone is well represented. Furthermore, Audrin and Audrin (2022:7396) eloquently stated that, in the past two decades, the number of publications related to digital literacy has grown at an almost exponential rate. While this abundance of research output is advantageous as it increases knowledge in the field, it also presents a significant challenge for scholars. With such a large number of studies, it becomes difficult to comprehend the field of research and to gain a comprehensive understanding of its unique aspects and areas of focus.

### 2.3.2 Researcher's DIL skills needed in the 4th industrial revolution

As technology continues to rapidly evolve and play an even greater role in society, DIL has become a crucial aspect of success in both personal and professional life. It enables individuals to effectively find, use, and create information in order to make informed decisions and contribute to the information economy in a responsible and ethical manner (Sparks, Katz & Beille, 2016: 30). DIL is crucial in today's digital age where information is constantly accessed and processed through technology. It involves an interactive process of seeking, evaluating and using information with digital tools and media in various settings, including the workplace, education, and personal life, influencing one's understanding and decision-making (Sparks, Katz & Beille, 2016: 10).

Additionally, there have been an increase in the information found on the internet, they all have a purpose and a context, and some are more helpful than the others depending on the information needs at hand**.** In many cases this pose a challenge to researchers because of the possibilities of information overload as well as misinformation. The ability to acknowledge information that contradicts one's beliefs and adjust one's perspective accordingly is crucial for personal growth and transformative learning in the workplace (ACRL Student Learning and Information Literacy Committee, 2017:14). The first frame posits that beginners may need to rely on the general basic indicator of authority such as publication type, author credentials whilst experts recognise school of thoughts or discipline specific paradigms, this is because authority is constructed and contextual (ACRL, 2016:12).

The fourth industrial revolution is characterized by the widespread use of advanced technologies such as artificial intelligence (AI), drones, 3D printing, the internet of things (IoT), and various other internet-connected devices, used in a smart and connected environment to achieve organisational objectives (Ayinde & Kirkwood, 2020: 152). Harnessing these resources to create information cannot be underestimated. It has to be noted that, although that is the case, a digital information literate person needs to recognize that, information creation is a process on its own. The fourth frame of the ACRL framework asserts that the format of information dissemination is crucial, with emphasis on the overall process of creating, producing, and distributing information rather than the specific method used to disseminate the content (ACRL, 2016:4).

In addition, going back in times, Chandra (2009:45) observed that the 4th Industrial revolution is not mere characteristics of technologies but the concatenation of technologies to ease the tasks done. The ICTs digital resources, networks and tools, influences the way in which geoscientists investigate and navigate the real world, the way they organise and communicate what they know, and how they think (Chandra, 2009:45). The workforce is involved in information creation especially the researchers, hence the need to be skilful in the process of information creation process as suggested by the ACRL Framework. This help researchers to be able to engage in research dialogues and communications in their workspace. Workplace is as a platform for practice, interaction, and socio-cultural affinity with the environment, and it is context-related, thus being context-dependent, conversations play a crucial role in facilitating learning through practical experience (Jinadu & Kaur, 2014:62). Additionally, these studies: Malanga and Chigona (2018:4); Dabengwa (2018:7); Naveed and Rafique (2018:1) have emphasized that possessing strong DIL skills can help individuals to be more effective in their personal, professional and educational lives. Moreover, having strong DIL skills can also increase one's ability to participate in a global, digital economy and to engage in lifelong learning.

As researchers, geoscientists are required to possess skills to engage in dialogue with other peers and to communicate their research impact to the community (public). The fifth frame of the ACRL Framework emphasises the importance of collaboration and dialogue among communities of scholars, researchers, and professionals, in advancing knowledge and understanding. Through ongoing discussions and interactions, new insights and discoveries emerge and evolve over time, enriching the collective understanding and reflecting the diversity of perspectives and

interpretations. This requires researchers to develop familiarity with the understanding and familiarity with the source of evidence, methods and modes of discourses in the field which helps novice learners to engage in the conversation.

The 4th industrial era presents us with digital technologies that have dramatically transformed our lives as well as the libraries. Kivunja (2015) indicated with the plethora of information formats in the 21st century, employees will be required to manage information daily; and thus, will need to be prepared. This shift in the digital landscape has created a need for individuals to have a more advanced set of skills and abilities in order to effectively navigate and use digital information in both their personal and professional lives, to be able to participate in ongoing discourse and knowledge creation within their communities (Sparks, Katz & Beile, 2016:2). This highlights the need for individuals to have not only physical access to digital tools, but also the necessary digital information literacy skills to use them effectively and ethically. Without these skills, individuals may struggle to navigate the digital information landscape, putting them at a disadvantage in the digital economy (IFLA, 2017:1).

The dramatic rise in the quantity of information available in various formats has resulted in a heightened need for the capacity to critically evaluate the credibility of different types of information resources (Solmaz, 2017:940). This has resulted in the increasing importance of digital information literacy. The need to properly evaluate information is not new to the digital age; it has always been essential to successful learning, even before the information revolution (Nikou & Avakare, 2021:2; Mishra, 2018: 77).

There were no specific studies that analyse geoscientist digital information literacy skills in the global south, specifically in Southern Africa as well as in Namibia. Most reviewed articles emanated from other analysis that were carried out to map out the information literacy skills of information professionals or students. In an exploratory study carried out by Wellings and Casselden (2019:789), mixed method approach was used to explore the workplace information seeking behaviours of engineers and scientists. The study did not look into skills of these engineers or geoscientist; however, they concluded that both respondents use Google to search for information and to take it further, engineer ask assistance from librarians while scientist explore subject specific information sources on their own.

### 2.3.3 Challenges and opportunities of DIL

This section presents the challenges experienced by the workforce in their digital information literacy experiences.

#### 2.3.3.1 Challenges

The fourth Industrial Revolution (IR) rapid developments in today's smart environments are unavoidable. Despite information literacy having a positive impact on lifelong learning, lack of relevant skills to use the information effects are detrimental to the organisation. As narrated by Sparks, Katz and Beile (2016:1) not only can an inability to effectively utilize information result in billions of dollars in losses for businesses, but it can also be linked to a reduced quality of life.

However, in today's digital age where there is unrestricted access to information that can be readily published and altered, the capacity to properly evaluate and assess information has become a "critical skill" for researchers and information consumers. The challenge of determining the reliability and authenticity of information, as well as the professional standards in its presentation, are the primary difficulties in evaluating information (Yoram, 2004:103).

A study that focused on 1st year undergraduate students' digital information literacy skills in Higher education Institutions, revealed that students did not demonstrate adequate DIL skills due to various challenges (Malanga & Chigona, 2018, 4). One of the challenges encountered was the lack of DIL policies, this was accounted to the dearth of literature on DIL to inform policy decisions on how to develop digital information literacy skills for citizens in the country in general and students in higher education institution. The development of DIL in developing countries in the Global South is not well conceptualised compared to the countries in the Global North (Malanga & Jorosi, 2018: 7; Noll, 2017:32), thus the challenges of researchers in these countries are more or less the same.

Most reviewed articles are pointing toward information literacy skills or digital information literacy skills of undergraduate students in institutions of Higher Educations neglecting the postgraduate students or researchers (du Bruyn & Fourie, 2017:1). Du Bruyn and Fourie (2017:1) carried out a survey case study that employed a mixed method approach to explore the needs of engineering postgraduate researchers for advanced research information literacy skills. Quantitative data were analysed using descriptive statistical analysis while qualitative data were

analysed using thematic analysis. Their findings inspire a proposal of the framework for advanced research information literacy skills to help academic librarians curb the challenges facing researchers in terms of information literacy skills.

In addition to the challenges presented by Malanga and Chigona (2018:4), are worthy noting. They noted that, the lack of digital information literacy of the workforce may be attributed to the lack of digital information literacy skills training in the university curriculum. As a result, when students are transitioning to the workplace, they lack digital information literacy skills, affecting their productivity at the workplace. Dabengwa (2018:176) concluded that the absence of a formal learning curriculum and training resources in academic libraries has resulted in a reliance on individual research, library training sessions, and peer-to-peer instruction as means to acquire competencies that are currently lacking. As a result, the library fails their mandate of making sure that users are trained and equipped with relevant skills.

Mbatha (2015:49) conducted a survey to assess and audit the digital literacy skills of civil servants in selected government departments in South Africa, and conclusions suggest that inadequate efforts are being made to equip civil servants with the necessary digital literacy abilities to enhance service delivery. It is important to consider the unique learning context of each environment and design information literacy programs that are tailored to meet the specific needs and challenges of each setting (Dabengwa, 2018:178). This will help ensure that individuals can effectively apply the skills they have acquired and make full use of the information resources available to them in their workplace.

In another study contacted at University of Cape Town by Noll (2017:31) the disparities between those who have access to and are competent with technology, and those who do not, can lead to unequal access to opportunities and information, and can perpetuate existing social and economic inequalities. It is therefore crucial to address this digital divide by providing opportunities for individuals to develop the necessary digital information literacy skills to fully participate in the digital world.

#### 2.3.3.2 Opportunities

Digital information literacy and lifelong learning provide individuals with the necessary skills and knowledge to effectively navigate and use digital tools and information, enabling them to

continuously grow and adapt in a constantly evolving digital environment (Solmaz, 2017: 940). This shift has emphasized the need for libraries to provide information literacy education that focuses on the skills, competencies, and attitudes necessary for individuals to effectively navigate the digital landscape and be successful in the information society (Rafi, JianMing & Ahmad, 2019: 203).

In the 21st century, libraries must adapt to the Fourth Industrial Revolution and incorporate cutting-edge technologies such as the Internet of Things, artificial intelligence, big data, and computers into their information products, services, and marketing strategies in order to cater to user needs (Chigwada & Chisita, 2021: x). Consequently, these changes digital literacy has become a widely studied topic for connecting people, participation in government and public affairs (Rafi, JianMing & Ahmad, 2019: 203). From a positive point of view, the technology simplified the work we do, and this requires skills to carry out those duties effectively. With regards to accessibility, it is crucial for academic libraries to be aware of the various types of effort that users aim to minimize and find ways to enable them to do so. This ultimately aims to enhance their information-seeking experience, increase their interest in using library services through online or mobile platforms (Hashim et al., 2022:8).

These technological advancements have also created new opportunities for lifelong learning and have allowed individuals to seek out knowledge and information on their own terms, at their own pace, and in ways that meet their specific needs. This shift in the way individuals access and consume information has required academic libraries to adapt their services to keep pace with changing user demands and behaviours. By providing access to digital resources and technologies, as well as training and support in their use, academic libraries can play a vital role in fostering digital literacy and empowering individuals to take control of their own learning and development.

### 2.3.4 Support available to researchers for the acquisition of DIL skills

According to Widén et al. (2021:28), professionals are part of a larger information landscape of a team or even an organisation which affects their construction of digital information literacy skills. As such, necessary support is needed to aid in the enhancement and acquiring of digital information literacy skills. The subsections present support available to researchers for the acquisition of DIL skills in the workplace environment.

#### 2.3.4.1 Digital information literacy skills training

The landscape of research and research libraries is changing. Library and Information science specialists act as education ambassadors and cultural agents that shapes the field of modern technological lines (Rafi, JianMing & Ahmad, 2019: 204). This they do to cultivate the researcher's digital information literacy skills. Much has not changed lately when the 4th Industrial era has taken the centre stage of everything. A study by Naveed and Rafique (2018:8) looked at information literacy in a scientist's workplace and found out that an overwhelming majority of the participants perceived information literacy training as important to the workplace. Furthermore, the study suggested that having training in these areas would help individuals develop their digital literacy skills and improve their ability to find and use information efficiently. The focus on information discovery and management, as well as online databases and information retrieval, highlights the importance of organization and effective use of information in the digital age.

Special libraries foster lifelong learning by equipping the workforce/ researchers with information literacy through ages and information literacy is regarded as a cornerstone of lifelong learning. Many professional societies recognize the need for their members to have lifelong learning skills and provide courses, seminars, conferences, and other learning opportunities. A primary goal of information literacy is to train individuals in the development of skills that will support their careers and other needs throughout their lives (Kuden & Braund-Allen, 2017:2).

#### 2.3.4.2 Research support

To effectively carry out the research process, researchers need to be supported in their searching capabilities. In a study carried out on research support in academic libraries in Zimbabwe, (Pasipamire, 2015:61) posited that high-end research support has been heralded as an opportunity for academic librarians to move away from 'life support' to a more critical role in the new higher education environment. Although research support takes many forms, libraries and librarians emerged as the top tiers when it comes to research support.

#### 2.3.4.3 Collaboration and partnership

The collaboration between researchers and research librarians leads to a positive change in education and promotes the sharing of knowledge. By incorporating principles of scientific literacy into their educational programs, librarians can better provide students with an understanding of the

intricate information landscape, equipping them with the ability to think critically and navigate information successfully, both in science and beyond, throughout their lives. (Berman & Kudem, 2017:24).

In the global north, collection development, plays a significant role in library research support. Information literacy, however, does not. This might be attributed to the digital literacy skills level of the researcher in global north which is higher compared to global south. A recent study in the United Kingdom (UK) analysed the involvement of researchers with institutional support, specifically focusing on libraries and information literacy. The results showed that despite significant investments in library support for information literacy, researchers were not inclined to participate in library-led training for information skills. They expressed confidence in their understanding of both general and specialized tools related to their research field, as well as their ability to identify appropriate references for their specific research projects (Parker, 2015: 3).

#### 2.3.4.4 Harnessing of digital tools

With the advancement of technology, the technological language has become increasingly important for the use of multidimensional digital tools, web-based searching, advanced research techniques, and data collections (Rafi, JianMing & Ahmad, 2019: 202-203). Researchers are therefore presented with an opportunity to become more active participants in all aspects of new public, social and political life through digital literacy. Recent studies have highlighted that the low utilisation of digital library resources for improving teaching and learning among users is due to their perceived usefulness and ease of use compared to web-based resources. In as much as library users are required to harness digital tools, Hergaty et al. (2010:183) argued that it is necessary for institutions to regularly evaluate their infrastructure in order to take advantage of the benefits of reliable access to the newest web technologies, while also acknowledging the ongoing requirement for secure access. The continual development of infrastructure remains a slow process in public institutions in many countries, which pose a challenge to DIL skills uptake.

On another study to explore employer perceptions of critical information literacy skills and digital badges, Raish and Rimland (2016:87) revealed that digital information literacy and metaliteracy skills are valued in the workplace and as a result employers would like more detailed representations of their subordinate skills; and digital badges are a possible way to showcase how

professionals are learning these skills. This presents a unique way for librarians to analyse their user if they possess these skills.

#### 2.3.4.5 Mentorship programmes

Research or individualised support can also come in a form of mentorship programs by senior researchers in an organization or mentorship programs in place. Individualised support is the degree to which a leader acts as a mentor and responds to employees' individual learning needs (Ahmad & Widén, 2018:1817). To foster digital information literacy skills of subordinates, delegating, intellectually stimulating and supportive leadership behaviours are some of the strategies that leaders can employ. Sorknes et al. (2017:22) noted that effective mentorship is critical to the success of early-stage investigators, and has been linked to enhanced mentee productivity, self-efficacy, and career satisfaction. An empirical study was carried out in Taiwan by Wu (2019:676) that looked at the proficiency of information literacy effect on the workplace outcomes. A questionnaire was used to collect data from full time employees who worked for one year and above. The study found out that self-efficacy and information literacy skills can positively affect creativity which in a long run impact work performance, however the study results did not reveal whether there is a direct correlation between information literacy self-confidence and workplace performance. Digital revolution is one of the trends and challenges geology librarians are continuing to prepare their users for a lifetime of learning, work to standardise the various electronic resources (Joseph, 2001:65). Relevant literature was reviewed and several gaps, opportunities and challenges were identified. Much of the reviewed literature emanated from the academic point of view and the larger chunk is from the global north countries. Although this study will unearth the digital literacy skills of the geoscientist, literature argued that little has been done at workplaces to tackle the challenges faced by civil servants. Hence, the importance of carrying out study using the Geological Survey of Namibia as a case study. Information literacy is a crucial topic globally, as we live in a time of overwhelming information it is essential for individuals to be information literate in both their professional and personal lives (ACRL, 2017:17).

## 2.4 Chapter summary

In summary, the chapter presented the theoretical framework that underpinned the study as well as the literature review. This chapter presented the ACRL Information Literacy Framework for Higher Education (2016) as the theoretical framework that underpinned the study as the lens to

look through geoscientists' digital information literacy skills. The ACRL Framework for Information Literacy was deemed fit for this study because it envisions information literacy as extending the arc of learning throughout users' professional careers and as converging with other academic and social learning goals. Furthermore, it was chosen because it is widely presented in literature and used globally, and it is not a not a set of iterative skills but rather interrelated concepts. Secondly, the literature review cover themes that emanated from the study objective and the four critical questions which are, digital information literacy, researchers' digital information literacy skills needed to function in the $4^{th}$ and $5^{th}$ IR, challenges and opportunities of DIL in the workplace, support offered by libraries as well as best practices in upskilling and reskilling the workforce. Various studies from different part of the world were reviewed. The next chapter presents the study's research design and methods.

# Chapter 3: Research design and methods

## 3.1 Introduction

Research methodology is a systematic inquiry to solve a problem that is developed within a particular paradigm with associated epistemological assumptions (Pickard, 2013:325). Sileyew (2019) simplified research methodology as a path through which researchers need to conduct their research. This chapter presents the path that the researcher will travel to conduct the study. The chapter presents and describes the research paradigm, approach, and design used in conducting the study, and the rationale behind choosing them. The chapter also presents the research methods, which includes the outline of the study population, how the population was sampled and data collection methods as well as research instruments and data analysis. The chapter further discusses ethical considerations that the researcher followed in conducting this study. This was done to address the study's research objective which is to critically analyse the level of digital information literacy skills of the geoscientists within the Geological Survey of Namibia (GSN).

To achieve this objective the research was guided by the following critical questions:

- What digital information literacy skills do geoscientists possess?
- What challenges or gaps do geoscientists have, if any, in relation to digital information literacy skills?
- What support services are provided by GNS to enhance digital information literacy skills of geoscientists?
- What are some of the strategies that can be employed to support the acquisition and enhancement of digital information literacy skills of geoscientists?

## 3.2 Research paradigm

According to Maree (2016:52), paradigms represent what we think about the world, but cannot prove. Although worldviews and paradigms are used synonymously, Creswell and Creswell (2018:5) presents the worldviews as the general philosophical foundations that the researcher brings to a study (Creswell & Creswell, 2018:5) Paradigms are considered as both conceptual and

practical tools used to address specific research questions. They serve as heuristics in social research and have different perspectives on the axiology, ontology, epistemology, methodology, and rhetoric of research (Kaushik & Walsh, 2019:230). Apart from other paradigms such as positivist and constructivism, theorists sought more practical and inclusive research methods that would allow a combination of techniques to shed light on the actual behaviours of participants, the underlying beliefs that drive these behaviours, and the potential outcomes of certain actions., thus using pragmatism for their research (Kivunya & Kuyini, 2017:27).

Although there are several paradigms, this study chose pragmatism paradigm as a lens to look through the research problem. Creswell and Creswell (2018:28) defined pragmatism as a paradigm that prioritises the results, actions, circumstances, and impacts of research rather than the preceding conditions. Pragmatism is considered as the foundation of mixed methods approach because it draws highly from both qualitative and quantitative research approaches (Yule, 2019:105). The focus in pragmatism is on practical applications, what is effective and finding solutions to problems. Rather than emphasizing methodology, the main aspects of research are the problem being studied and the questions asked about it.

Bustamante (2019:167) opined that, pragmatism paradigm can be utilised in a case study to provide a comprehensive, in-depth examination of a particular, specific, and defined phenomenon occurring in real-life circumstances. Any set of methods that contributes to a better understanding can be employed in this approach. This gives freedom to the researcher to choose the methods, techniques and procedures that best meet their purpose of the study and the need to achieve their research objective. Viewing the principle of actionable knowledge as a starting point for research, researchers can develop research agendas anchored in respondent experiences and, hence, ensure the research is of practical relevance (Kelly & Cordeiro, 2020:2). For this study, the researcher used the pragmatism paradigm since the researcher is working in the research institute in order to explore and understand the connections between knowledge and action in context of digital information literacy skills. Knowing in this sense, has the potential to transform practice of digital information literacy skills at GSN. The researcher therefore employed the pragmatic paradigm to better understand the research problem and address the study's critical questions by means of mixing quantitative and qualitative approaches. In addition, pragmatism was more suitable than other major philosophical approaches to probe this 'inner world' of organisational processes as

first, it emphasises that knowledge is based on experience; and second, it encouraged the researchers to analyse organisational digital information literacy practices through experience as well as action (Kelly & Cordeiro, 2020:3).

## 3.3 Research approach

Creswell and Creswell (2018:3) defined research approach as the overall plan for the study and extends from the study's broad philosophical assumptions through to research method details relating to data collection, analysis and interpretation of findings. This study employed a convergent parallel mixed methods approach to analyse the digital information literacy skills of geoscientist. A convergent parallel mixed method approach as put by Creswell and Plano-Clark (2018), entails that the researcher concurrently carry out both the quantitative and qualitative elements at the same stage of the research process. Similarly, Creswell and Creswell (2018:247) views convergent parallel mixed methods as a strategy where the researcher gathers both quantitative and qualitative data, analyses them independently, and then compares the results to determine if they support or contradict each other.

The study sort to find out the digital information literacy skills that geoscientists possess as well as challenges they are facing and gaps in these skills if there is any which necessitated the use quantitative approach, to allow more geoscientists to participate in the study. On the other hand, the study sort to establish the support services available to geoscientist as well as strategies to be put in place to enhance geoscientist digital information literacy skills which called for the use of qualitative approach, to get an in-depth understanding. Given the need to use both approaches, this study therefore used convergent mixed method approach to understand these skills in more depth without having to choose either qualitative or quantitative approach thus going beyond the qualitative and quantitative approach divide. Therefore, integrating these two approaches in the mixed method approach helps to minimise the limitations of either approach.

## 3.4 Research design

Research designs are types of inquiries for conducting research studies and inquiries, they provide a systematic approach for the researcher to follow and guide the procedures and techniques used in a particular research project (Creswell & Creswell, 2018:3). A case study research design was used to provide an in-depth evidence or analysis of digital information literacy skills of

geoscientists at Geological Survey of Namibia (GSN). Case study design is commonly used in various fields, especially in evaluation, where the researcher carries out a comprehensive analysis of a case, which can be a program, event, activity, process, or one or more individuals (Creswell & Creswell, 2018:14). A case study is characterised by boundaries, and in this case, the study will focus on the geoscientists working at the GSN) with digital information literacy skills as a unit of analysis. Multiple sources of data and multiple data collection methods were employed within a mixed methods approach. By employing a case study design, the researcher seeks to understand in-depth a phenomenon in its context, which is digital information literacy skills of geoscientists at GSN.

## 3.5 Research methods

This section presents the research tools and techniques that were employed to collect data for the study. According to Ullah and Ameen (2018:54) research methods mainly relate to the tools and techniques related to collection and analysis of data (such as questionnaires, interviews, etc.).

### 3.5.1 Population

A population as defined by Maree (2016:164) is the group consisting of the sample units relevant to the research questions. The population of this study included all the geoscientists working under the Geological Survey of Namibia, Ministry of Mines and Energy. The population of the study includes all (53) geoscientists from all five subdivisions and satellite stations and four librarians working at the Geological Survey of Namibia as depicted in Table 3.1 below.

### 3.5.2 Sampling

Sampling is the technique of selecting units from a population of interest so that by analysing the sample, we can accurately generalise our findings back to the population. According to Bickman and Rog (2009:293), the purpose of sampling is to generate a sample that addresses the research questions. Curry and Nunez-Smith (2015:204) opined that the sample should be developed with attention toward both representativeness for the quantitative component (to enhance generalisability) as well as depth and richness of data for the qualitative component (to enhance credibility). This study uses both non-probability and probability sampling methods.

This study employed purposive sampling for the semi-structured interviews. Pickard (2013:64)

describe purposive sampling as the process of careful selecting information rich case to study it in-depth. According to Curry and Nunez-Smith (2015:204), the purposive sampling techniques are generally intended to generate depth of information (hence enhancing credibility) to address a defined research question.

The managers within GSN were purposively selected because they have an extensive understanding of the geoscientists they are working with and supervising on a daily basis as depicted in Table 3.1. Not only their extensive understanding and experience, but these managers are also geoscientists that have worked at the Geological Survey of Namibia for a number of years, their account and reflectivity will help in establishing the need and best practices that their subordinates need. Librarians working at the National Earth Science and Energy Information Centre, that support geoscientist with information were also purposively sampled, out of the staff members working at the Centre, only librarians (three) who interact with geoscientists were selected to provide information with regards to the support rendered to geoscientist to support the digital information literacy skills of geoscientists (see Table 3.1). To find out the digital information (DIL) skills, challenges and needs of the geoscientists, a census was used for the quantitative phase and questionnaire was sent to all geoscientists (see Table 3.1). A census is the study of the whole population and data about all individual units are collected in the population (Lavrakas, 2008). Since the population of geoscientists was relatively small (see Table 3.1), the researcher resorted to involving all geoscientists to form part of the sample in-order to get the maximum response rate.

**Table 3.1: Population and sample for GSN managers, librarians and geoscientists**

| Division/ Directorate | Geoscientists | | | | Librarians | Number of purposively sampled geoscientists and librarians |
|---|---|---|---|---|---|---|
| | Deputy Executive Directors/ Director/ Deputy Director | Chief Geoscientists | Senior Geoscientists | Geoscientists | | |
| Directorate Executives | 2 | - | - | - | - | - |
| Economic Geology | 1 | 1 | 4 | 2 | - | 1 |
| Regional and Mapping Geology | 1 | 3 | 10 | - | - | 2 |
| Geo-Information | 1 | 1 | 2 | - | 4 | 5 |
| Geophysics | 1 | 2 | 4 | 3 | - | 1 |
| Geochemistry and Laboratory | 1 | 2 | 4 | 3 | - | 1 |
| Engineering and Environment Geology | 1 | - | 3 | 1 | - | - |
| **Total** | **8** | **9** | **27** | **9** | **4** | **57/ 10** |

### 3.5.3 Research instruments

Research instruments are tools used to collect data. The study utilises three instruments, questionnaires, semi-structured interviews and auto-ethnography to collect data to address the study's main objective and critical questions. These different ways of gathering information can supplement each other, therefore allowing for triangulation of data collected from these multiple instruments.

#### *3.5.3.1 Questionnaires*

A questionnaire is a research tool consisting of a series of questions designed to gather responses from participants in a standardised way. (Nayak & Singh, 2015:185). Questionnaires have become widely used in mixed methods research, particularly among smaller-scale researchers, as they can incorporate the benefits and overcome the drawbacks of research that solely operates within either

the quantitative or qualitative paradigm (Young, 2016:166). The questionnaire questions were guided by the ACRL Framework of Information Literacy in order to analyse digital information literacy skills of the geoscientists. Online-based *Google Form* questionnaire survey was developed. Questionnaire was then pre-tested, to see if there is any discrepancies and ambiguity in the way questions were presented. They were then sent through the GSN geoscientists email list requesting them to complete the questionnaire and constant reminders were sent to geoscientists. According to Creswell and Creswell (2018:153) software programmes facilitate data collections into organised spreadsheets for data analysis, reducing data entry errors, which made this method of data collection fit for purpose. To maximise the response rate, the researcher encouraged participants to participate in the study through going to the participants offices but maintained that the participation was voluntary.

The good part of using an internet web-based questionnaire is that one tailor made email can be sent to the Geological Survey of Namibia geoscientists email list once without sending individual emails, thus making questionnaires economical and time saving. Questionnaires also provide standardised answers because there is little room for the data to be affected by interpersonal factors. Web-based questionnaires enhance data accuracy and eliminate human error when handling research data because the questionnaire in Google forms feeds to an excel sheet automatically. Moreover, questionnaires can offer little opportunity for the researcher to check the truthfulness of the answers given by the respondents (Johnson & Christensen, 2019:99). Hence the study used more than one data collection instrument.

#### *3.5.3.2 Semi-structured interviews*

Interviews are a dialogue between an interviewer and interviewee on a specific topic of interest. They can be carried out in person, through virtual means, over the phone, or as a focus group with six to eight participants in each group (Creswell & Creswell, 2018:188). Nieuwenhuis (2016:93) narrated that semi-structured interview guide is a set of detailed and developed questions used to guide the researcher during qualitative data collection process. In this type of interview, the interviewee is given the opportunity to expand on their thoughts and provide more in-depth responses on the topics raised by the researcher. The answers are open-ended, and more emphasis is placed on the interviewee providing elaboration on points of interest. In semi-structured

interviews, the interviewer also has a clear list of issues to be addressed and questions to be answered. This allows some flexibility in the order of the topics or questions asked guided by the main research objective and research questions. Through the semi structured interviews, the researcher observes the world through the eyes of the participants as a valuable source of information (Nieuwenhuis, 2016:93). Semi-structured interviews center around specific themes, but they are conducted in a more conversational style compared to structured interviews, which follow a strict format of predetermined questions. This flexibility is beneficial when participants cannot be directly observed and provides more freedom for both the researcher and the interviewee (Creswell & Creswell, 2018:188). The researcher has the ability to delve deeper into any intriguing topics that come up during the interview, allowing the participant to provide a more comprehensive account. The semi-structured interview approach combines both closed- and open-ended questions, frequently accompanied by supplementary inquiries such as "why" or "how." Semi-structured interviews also have limitations, such as researcher bias and can be labour intensive (Creswell & Creswell, 2018:188).

An invitation including a consent form and information sheet (see Appendix 4 and 6) was sent to purposively sampled participants before the interview. The consent form also required permission from research to record the interviews. The information sheet aimed to explain and give further explanation of what digital information literacy entails and an expansion of the ACRL Framework for Information Literacy framework. This helped participants acquaint themselves before the interview. Interviews were conducted face-to-face and the researcher made sure that all Ministry of Mines and Energy COVID-19 guidelines were adhered to, to protect both the researcher and the participants.

#### *3.5.3.3 Auto-ethnography*

Auto-ethnography is considered a personal method of qualitative research that involves self-reflection, written examination, introspection, and connections to larger societal, cultural, and political interpretations of the meanings derived from personal experience (Fourie, 2021:198). Ellis, Adams and Bochner (2011:10) add that auto-ethnography is a technique aimed at examining and thoroughly examining the personal experiences of a researcher with the goal of comprehending a specific context, cultural perspective, or custom. On contrary, Méndez (2013:284) argued that it

can be challenging to determine the extent to which the accounts presented in autoethnographies accurately depict actual conversations or events, versus those that are purely fictional creations of the authors. Another criticism is that autoethnography represents a worldview of those in power, such as narrating about special libraries written by librarians based on the experience of library leaders, not uses themselves, which present potential bias in research (Poerwandari, 2021:313). To minimise these biases, the researcher did not only present his mere single voice but a collective voice through diary journaling to present account of conversations and self-observation. Triangulation with other methods such as interviews and questionnaires also addressed the potential of biases in auto-ethnography.

Fourie (2021:5) argues that relying solely on traditional techniques such as focus groups, interviews, and questionnaires is insufficient for librarians and information scientists to fully understand people's experiences, needs, and information-seeking behaviours, in order to develop effective and suitable services and information solutions. Therefore, for this study, the researcher has chosen auto-ethnography as secondary data collection method. The intricacies of human lives and interpersonal relationships require a deep understanding, which can only be achieved if the researcher becomes an integral part of the research process, serving as the research instrument themselves (Pickard, 2013:141). The researcher used the narrative auto-ethnography journaling to document experiences and skills of geoscientists and librarians. Narrative ethnographies are written accounts that are structured as narratives, incorporating the ethnographer's personal experiences into the depiction and analysis of the experiences and perspectives of others.

### 3.5.4. Validity and reliability

Creswell and Creswell (2018:251) in quantitative research, validity refers to the extent to which meaningful and useful inferences can be made from scores obtained using a particular instrument. In contrast, in qualitative research, validity refers to the methods or strategies that researchers employ to demonstrate the reliability of their findings and to establish their credibility with readers, such as triangulation of data sources. A valid measure or instrument is one that accurately assesses what it is designed to measure (Maree, 2016:164). To ensure validity, the researcher used multiple data collection methods such as questionnaires, auto-ethnography and semi-structured interviews and triangulate the collected data to ensure and establish validity. To increase the reliability and

credibility of data, questions in the interview schedule were prepared before-hand to maintain focus during the interview and target the heart of the topic under discussion.

On the other hand, reliability has to do with the consistency or repeatability of measure or an instrument (such as, questionnaires). High reliability is achieved when a measure or instrument consistently yields the same results if the research is repeated using the same sample (Maree, 2016:164). Reliability was ensured through making sure that the questionnaire survey is clear, understandable, and unambiguous and simple to complete by the participants. Reliability was considered by the researcher during interview sessions by taking notes to avoid data loss and misinterpretation and researcher also recorded the interviews (with permission of participants) to ensure that the information was captured accurately. Furthermore, reliability was ensured by the researcher, by keeping a journal or a diary to record all the personal experiences and encounters with the geoscientists. Pre-testing is the process of validating the survey instrument and its measurements. To ensure that results from the study are reliable and valid, instruments were pre-tested by the researcher, in order to identify all loopholes and ambiguities in the questionnaire and the interview schedule before actual data collection process. Internal consistency and variance of the data set was tested using the Cronbach's Alpha test to ensure reliability.

#### *3.5.3.1. Pre-testing the data collection instruments*

Pre-testing involves administering a data collection instrument to a small group of participants from the study population in order to identify any issues or problems with the instrument. This is done to evaluate the reliability and validity of instruments so to find possible solutions prior to actual data collection. In essence, the purpose of pre-testing is to ensure that questions in the questionnaire and interview schedule measures what they supposed to measure as stipulated in the research objective and critical questions. By conducting a pre-test, the researcher can guarantee that the questions posed in the data collection instrument are clearly worded and that the available response options are comprehensive, relevant, and non-overlapping (Creswell & Creswell, 2018:38).

The interview guide was pretested with managers (who are geoscientist by profession) but not part of the sample and the questionnaire survey was pre-tested with geoscientists working at Mining

Directorate. Participants that took part in the pre-test process were purposively selected. The researcher conducted the pre-test with Mining Directorate because both the Geological Survey of Namibia and the Mining Directorate perform the related or complimentary functions. Consequently, the Mining Directorate is more accessible to the researcher than the other directorates within the institution.

## 3.6 Data collection

In a mixed method research, data was collected using various data collection methods from quantitative and qualitative approach within a case study design. In a case study design, multiple sources of data and multiple data collection methods are very likely to be used (Punch, 2014:123). This study collected both qualitative and quantitative data concurrently in line with convergent parallel mixed methods approach. Qualitative data were collected using semi-structured interviews from purposively sampled seven GSN managers and three librarians within GSN. Questionnaire survey was utilised to collect data from geoscientists using a census and lastly auto-ethnography was used as secondary data collection method, as the researcher is a senior librarian at the institution and thus a good source of data. For the quantitative phase the questionnaires were distributed to all the geoscientists working at the GSN. Qualitative data was collected through semi-structured interview and auto-ethnography. The semi-structured interviews were conducted with the GSN management and the library staff members working at National Earth Science and Energy Information Centre (NESEIC). Data was collected from November 2022 and ended early January 2023.

## 3.7 Data analysis and presentation

Since the study involves both qualitative and quantitative data, analysis of quantitative and qualitative results were merged to complement each other to provide insights into the problem at hand (Creswell & Plano Clark, 2018:218). Interpretation entails making sense of the data that the researcher has collected from the participants. Consequently, interpretation requires careful and fair judgement because the same data can be interpreted in different ways. Quantitative data collected through questionnaires was analysed using Microsoft Excel. Qualitative data collected through interviews and auto-ethnography was analysed using thematic content analysis. Creswell and Creswell (2018:219) helpfully suggest that thematic content analysis should focus on the

identifying important information in the data and classifying it into themes. Themes were guided by the four study's critical questions and supporting theory. Triangulation was used to integrated data collected from questionnaires, interviews and auto ethnography.

In presenting the findings of quantitative data, tables were utilised to display the frequencies, percentages, mean, and standard deviation. The mean serves as a measure of central tendency and provides a representation of the average scores, while the standard deviation is a measure of variability that quantifies the spread of scores around the mean (Babbie, 2021:425). A high standard deviation of more than one means that values are generally far from the mean, while a low standard deviation within 0 indicates that values are clustered close to the mean (Grove, Burns & Gray, 2013:555). Internal consistency and variance of the data set was tested using the Cronbach's Alpha test. The outcome of a Cronbach's Alpha test is typically reported as a number between 0 and 1. A score of 0.7 or higher is considered acceptable and indicates a high level of reliability (Dlamini, 2020:62). According to George and Mallery (2003), Cronbach's Alpha value above 0.90 indicates excellent internal consistency, above 0.80 is good, above 0.70 is acceptable, above 0.60 is questionable, above 0.50 is poor, and below 0.50 is unacceptable.

## 3.8 Limitations of the study

Study limitations are factors that have the potential to impact the validity or reliability of the results but are often beyond the control of the researcher. These limitations are closely tied to the research design, restrictions imposed by the statistical model, financial constraints, or other reasons (Dimitrios & Antigoni 2019:156). The geoscientists' low response rate to online questionnaires, was one of the limitations for the study. To address this, the researcher tried to send reminders to participants and print the questionnaires and hand deliver them to the offices but encouraged respondents to fill in the online questionnaire for smooth data analysis process. Another limitation that the researcher faced was the managers limited availability to participate in the interview as well as some who are working from home due to COVID-19. The researcher tried to accommodate all cases and was flexible to the managers' schedules.

## 3.9 Ethical considerations

Ethical considerations are a critical aspect of all research studies, and researchers must be mindful of the ethical implications of their work. It is imperative that all researchers consider the ethical

dimensions of their research and act accordingly. Ethics are considered to be the norms or standards of behaviour that are accepted within a particular discipline or social group, based on a set of moral values and principles. Moreover, ethics are the principles and guidelines that helps us uphold the things we value (Johnson & Christensen, 2019:99). The study complied with all the ethical considerations stipulated in general research ethics as well as the relevant institutions research policy because data was collected from human subjects. The researcher applied for ethical clearance first from the University of Cape Town (UCT), through the Ethics Review Committee of the Department of Knowledge and Information Stewardship (DKIS), and from the Ministry of Mines and Energy before embarking on data collection (see Appendices 7 and 8).

After applying for and receiving data collection approval from the Ministry of Mines and Energy, Geological Survey of Namibia Directorate to collect data from geoscientists, a consent form was sent to the participants who participated in the interview to consent to participate in the study. The same process was done to the respondents that answered the questionnaire through consenting indirectly when they decided to participate on not to participate in the questionnaire survey (see Appendix 1).

### 3.9.1 Anonymity and confidentiality

Ensuring anonymity and confidentiality are crucial steps in safeguarding participants from potential harm and these measures help to protect the privacy and sensitive information of participants, reducing the risk of negative consequences. (Fleming & Zegwaard, 2018:210). Anonymity refers to not collecting data that can identify personal information of participants (Badampudi et al., 2022:3). To ensure anonymity, the questionnaire did not capture any personal identifiers. Confidentiality refers to the protection of raw data by only publishing aggregated results that cannot be linked back to an individual or organisation (Badampudi et al., 2022:3). In this study, confidentiality was ensured by keeping interview participant's identity known only to the researcher, but the data was de-identified and the identity was kept confidential. Pseudonyms were used in the presentation of interview participants by using their profile designations (e.g., GSN Manager and Librarian) rather than using their real names.

### 3.9.2 Informed consent

Informed consent can be referred to a contract between the researcher and participants. Informed consent aims to fully inform participants on what is expected from participants, how the data will be used and consequences thereof, the participants then consent by signing to take part in the study, including understanding their rights to access to their information and the right to withdraw at any point in the study (Fleming & Zegwaard, 2018:210). Since the participation in the study was voluntarily, research participants were fully informed about the study's objective, procedures and risks involved in participating in the research study through the informed consent form that was sent before the actual interview took place (see Appendix 6). An informed consent was also embedded in the questionnaire to allow respondents to consent before they participate in the study.

## 3.10 Chapter summary

The study used pragmatist paradigm as a philosophical lens to shed light on the digital information literacy skills of the geoscientists, and it employed a convergent parallel mixed methods approach to explore the digital information literacy skills of the geoscientists. A case study research design was used to provide an in-depth evidence or analysis of digital information literacy skills of geoscientists at GSN. The study population included 53 geoscientists, 13 managers and three (3) librarians working at GSN. Qualitative data was collected using semi-structured interviews from purposively sampled managers and librarians within GSN. Questionnaire survey was utilised to collect data from geoscientists using a census and lastly auto-ethnography was used as the researcher is a senior librarian at the institution and thus a good source of data. Qualitative data were analysed using thematic content analysis and *Microsoft Excel* was used to analyse quantitative data from the questionnaire survey. Data collection instruments were pre-tested to enhance their reliability and validity. Ethical considerations are addressed in this chapter and ethical clearance was sought from the DKIS Ethics Review Committee and from Geological Survey of Namibia. Furthermore, the chapter acknowledges the limitations of the chosen research methods such as low response levels from geoscientist, and strategies employed to mitigate such limitations. The next chapter presents the research findings.

# Chapter 4: Presentation of findings

## 4.1 Introduction

This chapter presents the study findings for a study that sought to explore digital information literacy skills of geoscientists in Namibia. The study employed parallel mixed methods approach and case study research design to carry out an in-depth analysis of digital information literacy skills of geoscientist within Geological Survey of Namibia (GSN). To address this objective, four critical questions were used:

- What digital information literacy skills do geoscientists possess?
- What challenges or gaps do geoscientists have, if any, in relation to digital information literacy skills?
- What support services are provided by GNS to enhance digital information literacy skills of geoscientists?
- What are some of the strategies that can be employed to support the acquisition and enhancement of digital information literacy skills of geoscientists?

The study collected data via semi-structured interviews with GSN management and librarians at National Earth Science and Energy Information Centre (NESEIC), questionnaire with geoscientist and auto-ethnography which collectively address the objective of the study. Quantitative data collected through questionnaires were analysed using Microsoft Excel. Descriptive statistics were used for questionnaire data and qualitative data collected through interviews, and auto-ethnography data were thematically analysed, the findings are presented using tables, graphs and pie charts.

## 4.2 Response rate

An online-based *Google Form* questionnaire (see Appendix 1) was administered to a population of 53 geoscientists. A total of 32 (60%) geoscientists completed the questionnaire. Other geoscientists did not complete the questionnaire due to their unavailability during the data collection period which was November 2022 to early January 2023. Wu, Zhao and Fils-Aime

(2022:2) reported that the average online survey response rate in the educational-related fields is 44.1%, which means the response rate attained from the questionnaire was acceptable and above the general average. Moreover, the questionnaire was one of three data collection instruments this study used for data collection in order to triangulate the data from these instruments. Ten semi-structured interviews (see Appendices 2 & 3) were conducted with GSN management (7) and NESEIC librarians (3). While auto-ethnography was conducted with the researcher who is also a librarian at GSN.

## 4.3 Presentation of the findings

This section presents data collected through three data collection instruments: questionnaire survey, semi-structured interviews and auto-ethnography (see Appendices 1, 2 & 3). The findings are presented in six sub-sections: biographical information; digital information literacy skills of geoscientists; challenges and gaps encountered by geoscientists; the support offered to enhance digital information literacy of geoscientists; strategies to support the acquisition and enhancement of digital information literacy skills of geoscientists; and, general comments and observation. The percentages in this section are rounded off to the nearest percent for better presentation.

### 4.3.1 Biographical information

This section presents the background information of GSN geoscientists, managers and NESEIC librarians. Geoscientists' data was captured through a questionnaire, GSN managers' and librarians' biographical information was captured through a semi-structured interviews and biographical information for the researcher was captured through the auto-ethnography guide.

#### *4.3.1.1 Biographical information for geoscientists*

The questionnaire survey asked geoscientist about their division, their job title, their years working at GSN and their highest educational qualification (see Appendix 1). Figure 4.1 presents the respondents' division from all six divisions within GSN. The majority (37%) of the respondents were from the Regional and Mapping Division. The least respondents (6%) were from Environment and Engineering Division, a minor division in the GSN.

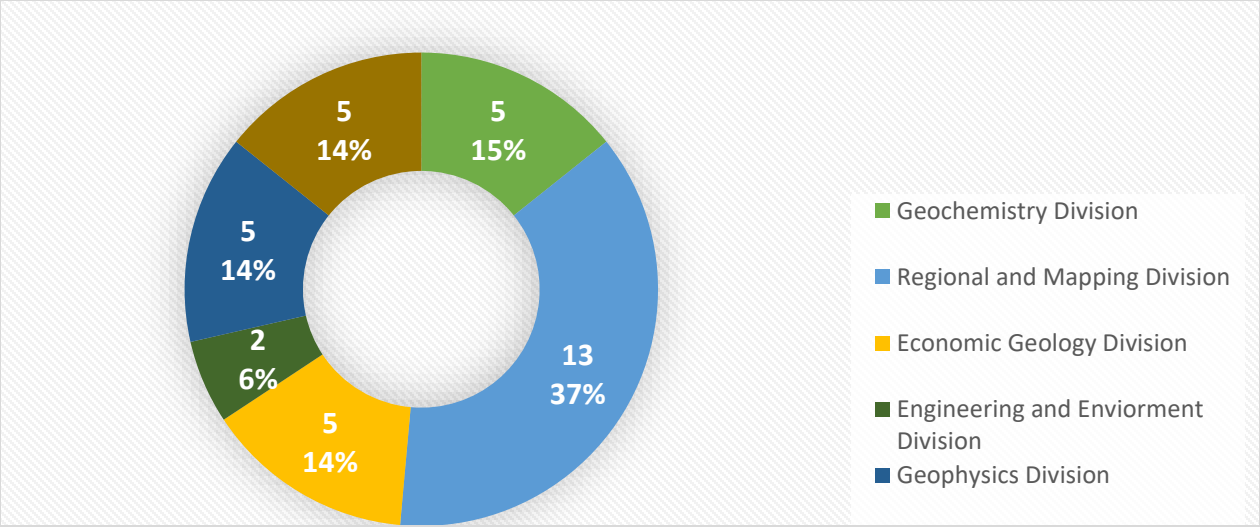


***Figure 4.1: Geoscientists' division (N=32)***

Respondents in the questionnaire were also required to indicate their job titles. Figure 4.2 shows the breakdown of geoscientists' job titles. The majority (55%) of respondents were senior geoscientists and all nine (28%) geoscientists responded to the questionnaire. None of the Deputy Directors, Directors and Deputy Executive Director completed the questionnaire however this group was interviewed as part of GSN management.

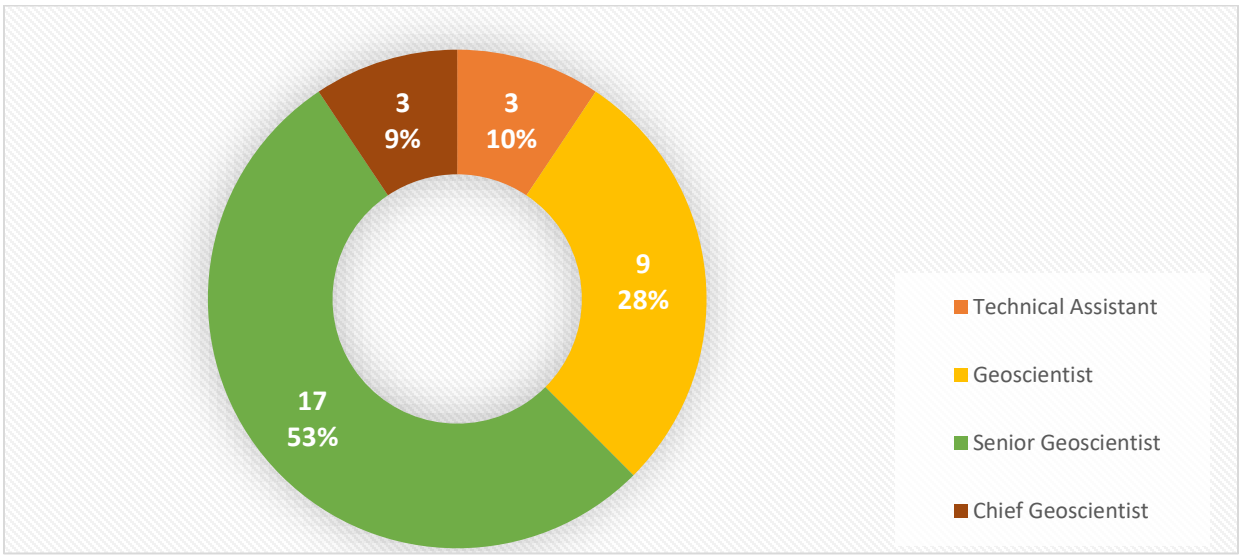


***Figure 4.2: Geoscientists' job title (N=32)***

Figure 4.3 presents the number of years geoscientists have been employed at GSN. The majority (40%) of the respondents have been employed at GSN for 6-10 years, giving the impression that their experiences can be instrumental to the study through inputs shared in the questionnaire due to their vast experience at GSN. This was followed by 0-2 years (33%) while those with 11 years and above all scored below 10%.

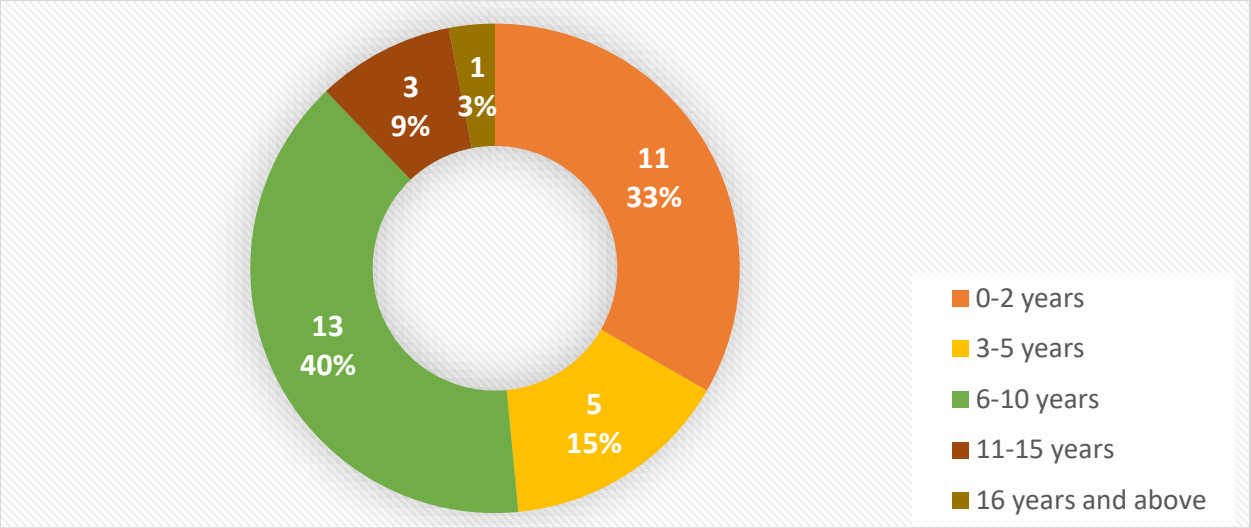


***Figure 4.3: Geoscientists number of years working at GSN (N=32)***

Lastly, geoscientists were asked to indicate their highest educational qualification. This was vital to aid in effectively analysing their digital information literacy skills. Figure 4.4 shows the geoscientists' highest qualifications and bulk (63%) of the geoscientist hold an Honours degree. Whilst 28% had Master's degrees.

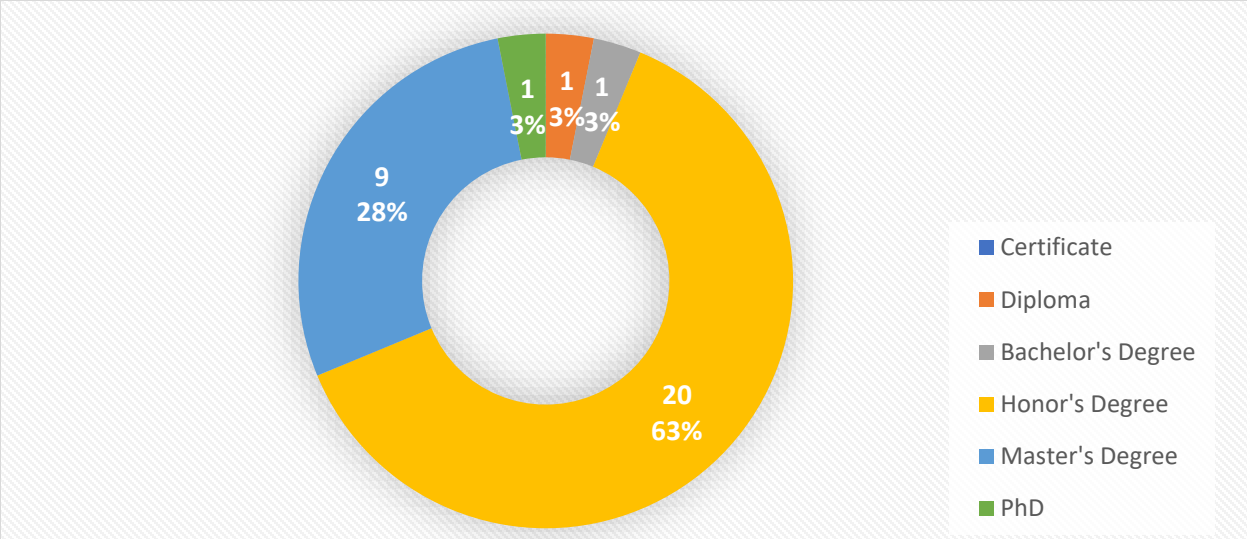


***Figure 4.4: Geoscientists highest level of qualification (N=32)***

#### *4.3.1.2 Biographical information for GSN managers and librarians*

The biographical information for GSN managers consisted of several aspects such as: their division, number of years in service, and their awareness of digital information literacy skills (see Appendix 3). Table 4.1 shows that most GSN managers have been in service for 15 years or more and each with three or more subordinates. When managers and librarians were asked if they were aware of digital information literacy skills, they all indicated that they were knowledgeable and interview schedule further probed about what skills they thought were encompassed in digital information literacy; prominent skills mentioned were research writing, publishing, advanced technological and communication skills.

**Table 4.1: Biographical information for GSN managers**

| Participant | Division | Years in service | Subordinates |
|---|---|---|---|
| **Manager 1** | Geoinformation Division | 20 | 3 |
| **Manager 2** | Geoinformation Division | 18 | 3 |
| **Manager 3** | Geochemistry and Laboratory Division | 17 | 7 |
| **Manager 4** | Geophysics Division | 15 | 8 |
| **Manager 5** | Regional and Mapping Geology | 35 | 8 |
| **Manager 6** | Regional and Mapping Geology | 23 | 15 |
| **Manager 7** | Regional and Mapping Geology | 4 | 4 |

Table 4.2 depicts biographical information for interviewed librarians. All interviewed librarians are holders of Honours degree in Library and Information Sciences (LIS). Librarians were asked about their interaction with geoscientists (see Appendix 3). Since geoscientists are the primary users of the NESEIC library, all librarians indicate that they interact with geoscientists daily through various platforms such as emails, face-to-face and telephonically.

**Table 4.2: Biographical information for NESEIC librarians**

| Participant | Position | Years in service | Academic qualification |
|---|---|---|---|
| **Librarian 1** | Librarian | 3 | BA. Hons in LIS |
| **Librarian 2** | Librarian | 3 | BA. Hons in LIS |
| **Librarian 3** | Senior Librarian | 8 months | BA. Hons in LIS |

#### *4.3.1.3 Background information for the researcher*

As a secondary qualitative data collection method for the study, the researcher used auto-ethnography to document lived experiences to understand the geoscientists' digital information literacy skills. The researcher was guided by two questions to determine the background knowledge of working with geoscientists and the number of years working with geoscientists at NESEIC Library. The researcher is a librarian at GSN and has worked as a librarian for three years at the NESEIC Library and has an honours degree in LIS and in Higher Education Teaching and

Learning. The researchers' day-to-day encounter with geoscientists and managers revealed that they reasonably understand digital information literacy because most think it only entails searching library Online Public Access Catalogue (OPAC) and using e-resources. Although this is included in the sixth frame of the ACRL framework, 'searching as a strategic exploration' frame, it is part of the larger framework of digital information literacy skills. Furthermore, the librarians understood what digital information literacy skills are.

### 4.3.2 Geoscientists' digital information literacy skills

The study's first critical question sought to explore geoscientists' digital information literacy skills. Data for this critical question was collected via the questionnaire with geoscientists, interviews with GSN managers and Librarians and auto-ethnography with the researcher (see Appendices 1,2,3 & 5). Using a Likert scale, geoscientists were asked to rate the extent to which they were proficient in digital information literacy skills as presented in the six frames of ACRL Framework for Information Literacy Framework for Higher Education (2016:8) (see Section 2.2 in Chapter 2). The scale had five competency levels: no level (0), low level (1), average level (2), moderate high (3) and high level (4). Results for this section are presented according to the six frames of the ACRL Framework (2016:8). Tables were used to present findings according to frequency (*f*), percentage (%), mean (M) and standard deviation (SD). The mean (M) is a measure of central tendency, it provides an average of the scores, whereas the standard deviation (SD) is a measure of dispersion around the mean and measures variability in the data (Babbie, 2021:425). A high standard deviation means that values are generally far from the mean, while a low standard deviation indicates that values are clustered close to the mean. Internal consistency and variance of the data set was ensured through the use of the Cronbach's Alpha test. The results of Cronbach's Alpha are usually between 0 and 1 with an acceptable reliability score being 0.7 and higher (Dlamini, 2020: 62).

#### *4.3.2.1 Authority is constructed and contextual*

The findings presented in Table 4.3 represent the competency level in knowledge practices and dispositions according to Frame 1 (authority is constructed and contextual) of the ACRL Framework used in this study. In terms of 'dealing with varied and sometimes conflicting

perspectives' and 'identifying authority of different sources,' the majority of the respondents (81% and 84% in total, respectively) indicated that they are between average and moderately high competency in these skills. Interestingly, 50% (M=3.3 and SD=0.731) of the respondents indicated that they are highly skilled in 'applying a critical eye to information before usage'. This question item had a high Cronbach's Alpha test, of 0.857 which indicates a good internal consistency.

**Table 4.3: Authority is constructed and contextual (N=32)**

| Statements | Level of competence | | | | | | | | | | Cronbach's Alpha= 0.857 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0(None) | | 1(Low) | | 2(Average) | | 3(Moderate high) | | 4(High) | | Mean | STDEV |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | M | SD |
| **Dealing with varied and sometimes conflicting perspectives.** | 0 | 0% | 1 | 3% | 7 | 22% | 19 | 59% | 5 | 16% | **2.8** | **0.718** |
| **Identifying authority of different sources.** | 0 | 0% | 0 | 0% | 7 | 22% | 20 | 62% | 5 | 16% | **2.9** | **0.671** |
| **Applying a critical eye to information before usage.** | 0 | 0% | 0 | 0% | 5 | 16% | 11 | 34% | 16 | 50% | **3.3** | **0.731** |

### *4.3.2.2 Information creation as a process*

Geoscientists were asked to rate their competence in the area of 'information creation as a process'. Table 4.4 indicates that most geoscientists rated themselves as having a moderate and high levels of competence in this area. For example, in 'understanding different methods of information dissemination' a total of 88% (M=3.257 and SD=0.741) rated themselves as having a moderately high and high level of competence in this item.

With regards to this question item, GSN managers and librarians also shared their view, whether geoscientists had skills in this frame. Although geoscientists rated themselves moderate to high competence in tis frame, one librarian stated that "*geoscientists tend to be heavily reliant on librarians as their search engines rather than guides*". Additionally, interviewed managers

indicated that geoscientists are efficient in information creation. However, one GSN manager explained that:

> *I can say from this division; geoscientists are skilled in terms of searching and finding information using digital platforms; with other divisions, I reserve my comments because the questions they ask...is like they don't have an idea of these skills.*

**Table 4.4: Information creation as a process (N=32)**

| Statements | Level of competence | | | | | | | | | | Cronbach's Alpha= 0.810 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 (None) | | 1 (Low) | | 2(Average) | | 3(Moderate high) | | 4(High) | | Mean | STDEV |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | M | SD |
| **Matching an information need with an appropriate product.** | 0 | 0 % | 2 | 6 % | 8 | 25% | 11 | 34% | 11 | 34% | **3** | **0.907** |
| **Understanding that creation of information can take different modes and formats** | 0 | 0 % | 2 | 6 % | 4 | 12% | 14 | 44% | 12 | 38% | **3.171** | **0.857** |
| **Understanding different methods of information dissemination.** | 0 | 0 % | 1 | 3 % | 3 | 9% | 15 | 47% | 13 | 41% | **3.257** | **0.741** |
| **Accepting the ambiguity surrounding the potential value of information creation expressed in emerging formats or modes.** | 0 | 0 % | 1 | 3 % | 11 | 34% | 11 | 34% | 9 | 28% | **2.852** | **0.857** |

None of the geoscientists indicated that they do not have any level of competency in any of the knowledge dispositions in this frame. However, a few geoscientists 4 (18%) indicated that they have a low-level of competency in this frames' dispositions. This question item had a high Cronbach's Alpha test, of 0.810 which indicates a good internal consistency.

### *4.3.2.3 Information has value*

The first critical question also probed from geoscientists about their skills in the third frame of the ACRL framework (2016) 'information has value'. Most of the respondents (53%) indicated that,

in terms of 'respecting the original idea of others', they have a high level of competency (M=3.37; SD=0.807) (see Table 4.5). While only less than 20% in total regarded themselves as having a low level of competency or none in 'contributing to the information marketplace rather than consuming only', however this question item had a high variance (SD=1.05) was recorded for the second disposition.

The study also probed via ethnography if geoscientists possessed digital information literacy skills. The researcher noted that, some geoscientists are skilled in the area contributing to the information marketplace such as publishing of their research articles and technical reports. Furthermore, the researcher also observed that, geoscientists publish in-house, in the Communication of the Geological Survey of Namibia and bi-annually newsletter of Geological Communications Newsletter (GEOCOM). This question item had a low Cronbach's Alpha test of 0.670 which indicates a low internal consistency.

**Table 4.5: Information has value (N=32)**

| Statements | Level of competence | | | | | | | | | | Cronbach's Alpha= 0.670 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 (None) | | 1 (Low) | | 2(Average) | | 3(Moderate high) | | 4(High) | | Mean | STDEV |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | M | SD |
| **Respecting the original ideas of others.** | 0 | 0% | 1 | 3% | 4 | 13% | 10 | 31% | 17 | 53% | **3.37** | **0.807** |
| **Contributing to the information marketplace rather than consuming only.** | 1 | 3% | 4 | 13% | 9 | 28% | 10 | 31% | 8 | 25% | **2.68** | **1.105** |
| **Inclined to examine one's information privilege.** | 0 | 0% | 2 | 6% | 8 | 25% | 13 | 41% | 9 | 28% | **2.88** | **0.866** |

### *4.3.2.4 Research as inquiry*

The fourth frame in the ACRL (2016) is 'research as inquiry'. Most knowledge dispositions had a mean score of more than three, an indication that the respondent's digital information literacy skills in this item are moderately high (see Table 4.6 summary). Majority (97%) of the respondents indicated a moderately high level of competence in the following knowledge dispositions,

‘considering research as an open-ended exploration and engagement with information’ with M=3.2 and SD=0.759, ‘value persistence, adaptability, and flexibility’ with M=2.97 and SD=0.821. Only 18% of the geoscientists in total, indicated that in all the knowledge disposition had low level of competence. Overall, respondents rated themselves as most having a moderately high competency (28%) and at times high competency (50%) for 'following ethical and legal guidelines in gathering and using information'. This was expected as most geoscientists are involved in various research activities at GSN. This frame had a high Cronbach’s Alpha of 0.890, which indicates a good internal consistency for this question.

In relation to this frame, managers and librarians were asked whether geoscientists possessed relevant digital information literacy skills. Two librarians explained that geoscientists who are currently studying are better positioned with digital information literacy skills they added that this was evident in their research work, day-to-day work and interaction with librarians. One manager indicated that “we deal with research every day and I can say geoscientists are good at it”.

**Table 4.6: Research as inquiry (N=32)**

| Statements | Level of competence | | | | | | | | | | Cronbach's Alpha= 0.890 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 (None) | | 1 (Low) | | 2(Average) | | 3(Moderate high) | | 4(High) | | Mean | STDEV |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | M | SD |
| **Considering research as an open-ended exploration and engagement with information.** | 0 | 0% | 1 | 3% | 4 | 13% | 15 | 47% | 12 | 38% | **3.2** | **0.759** |
| **Value intellectual curiosity in developing questions and learning new investigative methods.** | 0 | 0% | 1 | 3% | 10 | 31% | 11 | 34% | 10 | 31% | **2.94** | **0.872** |
| **Maintaining an open mind and a critical stance.** | 0 | 0% | 1 | 3% | 6 | 19% | 14 | 44% | 11 | 24% | **3.11** | **0.795** |
| **Value persistence, adaptability, and flexibility.** | 0 | 0% | 2 | 6% | 6 | 19% | 16 | 50% | 8 | 25% | **2.97** | **0.821** |
| **Seeking multiple perspectives during information gathering and assessment.** | 0 | 0% | 1 | 3% | 7 | 22% | 10 | 31% | 14 | 44% | **3.17** | **0.857** |
| **Seeking appropriate help when needed.** | 0 | 0% | 2 | 6% | 6 | 19% | 10 | 31% | 14 | 44% | **3.11** | **0.932** |
| **Follow ethical and legal guidelines in gathering and using information.** | 0 | 0% | 0 | 0% | 7 | 22% | 9 | 28% | 16 | 50% | **3.82** | **0.788** |
| **Demonstrate intellectual humility.** | 0 | 0% | 1 | 3% | 9 | 28% | 11 | 24% | 11 | 24% | **3.02** | **0.857** |

### *4.3.2.5 Scholarship as conversation*

Research in professional fields such as geology takes a discursive practice without seeking discreet answers to complex problems (ACRL, 2016:20). Table 4.7 presents the responses to the 'scholarship as conversation' knowledge disposition responses from geoscientists. The majority of the respondents rated themselves moderately high to high level of competency for dispositions such as 'recognising ongoing scholarly conversation' (M=3; SD=0.85), 'recognising that scholarly conversations take place in various venues' (M=3; SD=0.87). A high variance of one or more was recorded in the findings for 'seeking out conversations taking place in my research area' and 'suspending judgment on the value of a single piece of information'. This question item had a high Cronbach's Alpha test, of 0.900 which indicates an excellent internal consistency of this question.

**Table 4.7: Scholarship as conversation (N=32)**

| Statements | Level of competence | | | | | | | | | | Cronbach's Alpha= 0.900 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0(None) | | 1(Low) | | 2(Average) | | 3(Moderate high) | | 4(High) | | Mean | STDEV |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | M | SD |
| **Recognising ongoing scholarly conversation** | 0 | 0% | 1 | 3% | 6 | 19% | 15 | 47% | 10 | 31% | **3** | **0.85** |
| **Seeking out conversations taking place in my research area.** | 0 | 0% | 4 | 13% | 7 | 22% | 11 | 34% | 10 | 31% | **2.8** | **1.07** |
| **Recognising that scholarly conversations take place in various venues.** | 0 | 0% | 1 | 3% | 5 | 16% | 16 | 50% | 10 | 31% | **3** | **0.87** |
| **Suspending judgement on the value of a single piece of information** | 0 | 0% | 5 | 16% | 6 | 19% | 14 | 44% | 7 | 22% | **2.5** | **1.03** |
| **Understanding the responsibility that comes with entering the conversation through participatory channels.** | 0 | 0% | 4 | 12% | 9 | 28% | 14 | 44% | 5 | 16% | **2.65** | **0.872** |
| **Value user-generated content and evaluate contributions made by others.** | 0 | 0% | 2 | 87% | 7 | 22% | 15 | 47% | 7 | 22% | **2.91** | **0.830** |
| **Recognising that systems privilege authorities and that not having a fluency in the language and process of a discipline disempowers my ability to participate and engage.** | 0 | 0% | 4 | 12% | 3 | 9% | 16 | 50% | 8 | 25% | **2.91** | **0.900** |

### *4.3.2.6 Searching as strategic exploration*

Table 4.8 showcases the responses for 'searching as a strategic exploration' frame. Of note is that majority (84% in total) of the respondents indicated that with regards to 'understanding that first attempts at searching do not always produce adequate results' they are moderately high or have a high level of competence (M=3.37 and SD=0.71). In this frame, respondents rated themselves as having a moderately high and high level of competency apart from 'exhibiting mental flexibility and creativity', where the majority (78% in total) rated themselves as having average and

moderately high level of competency with a low mean (M=2.94) and standard deviation (SD=0.725). This question item had a high Cronbach's Alpha test, of 0.830 which indicates a good internal consistency of this question.

**Table 4.8: Searching as strategic exploration (N=32)**

| Statements | Level of competence | | | | | | | | | | Cronbach's Alpha= 0.830 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0(None) | | 1(Low) | | 2(Average) | | 3(Moderate high) | | 4(High) | | Mean | STDEV |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | M | SD |
| **Exhibiting mental flexibility and creativity.** | 0 | 0% | 1 | 3% | 7 | 22% | 18 | 56% | 6 | 19% | **2.94** | **0.725** |
| **Understanding that first attempts at searching do not always produce adequate results.** | 0 | 0% | 0 | 0% | 5 | 16% | 11 | 34% | 16 | 50% | **3.37** | **0.731** |
| **Realising that information sources vary greatly in content and format and have varying relevance and value, depending on the needs and nature of the search.** | 0 | 0% | 0 | 0% | 6 | 19% | 12 | 38% | 14 | 43% | **3.25** | **0.741** |
| **Seeking guidance from experts in the field.** | 0 | 0% | 3 | 3% | 3 | 9% | 6 | 18% | 11 | 34% | **3.08** | **0.981** |
| **Recognising the value of browsing and other serendipitous methods of information gathering** | 0 | 0% | 1 | 3% | 4 | 12% | 14 | 43% | 13 | 40% | **3.22** | **0.770** |

The study also probed from librarians whether geoscientists possess the relevant digital information literacy skills (see Appendix 3). All three interviewed librarians indicated that geoscientists are fairly skilled in 'searching as strategic exploration'. These were the same sentiments expressed by the researcher during auto-ethnography. The researcher (auto-ethnographer) noted that the geoscientists are fairly skilled, and majority have the basic information literacy which allows them to identify, find, evaluate and apply various sources of information in various formats. Integration of digital information literacy skills in the workplace is also partially done, although it depends on the role the geoscientist holds. Senior geoscientists and chief geoscientists integrated digital information literacy skills to some extent, however once

a geoscientist goes up the ladder to deputy director level or higher there is a sense that digital information literacy skills are not a priority because of their job requirements as these roles are mostly administrative rather than research focused.

GSN managers were also asked based on their experiences supervising geoscientists, whether they possess the relevant digital information literacy skills (see Appendix 2). The GSN managers indicated that only some geoscientists possess the necessary digital information literacy skills. For instance, one manager indicated, "*yes, most of the geoscientists that we have are young, and they are educated…as they have senior degrees such as Master's and Ph.D. I can say they have the key skills*". Some participants maintained that geoscientists possess digital information literacy skills because of their work as it requires these skills. One manager indicated that "*geoscientists create and store data digitally, derive report and share it with the whole directorate or outside clients; thus, I can say they possess digital information literacy skills*". Interviewed librarians were further asked to mention some of the digital information literacy skills that they think are vital for geoscientists. They indicated that the most critical digital information literacy skills are research and communication skills, and that these skills as enable them to navigate through emerging digital platforms. One interviewed librarian indicated, "*I expect geoscientists to be highly skilled in strategic searching and research skills*".

In summary, findings from questionnaires revealed that, across all frames, majority of geoscientists rated their digital information literacy skills as moderately high and high level of competency. Results from interviewed GSN managers and librarians indicated that geoscientists are fairly skilled in some frames such as 'searching as strategic exploration'. Whilst same sentiments were shared through the autoethnography that geoscientists are fairly skilled when it comes to digital information literacy skills. Results from interviewed librarians, GSN managers and auto-ethnography results indicated that writing, research and communication skills are some of the critical digital information literacy skills that are needed in the workplace.

### 4.3.3 Digital information literacy skills challenges and gaps

This section presents findings for the study's second critical question, which sought to establish the challenges that geoscientists might have in acquiring digital information literacy skills. This

question was asked from all four data collection groups (Geoscientists, GSN managers, Librarians & Researcher – see Appendices 1, 2, 3 & 5). In addition, the question also sought to find out if any gaps currently exist in enhancing geoscientists' digital information literacy skills.

Geoscientists were asked in the questionnaire to indicate, through a multiple response question, the challenges they thought are hindering their acquisition of digital information literacy skills (see Appendix 1). More than 40% of geoscientists in the questionnaire found 'lack limited integration of digital information skills in the workplace environment' and 'lack of collaborative spaces' as the top two challenges (see Figure 4.5). Librarians were asked through a semi-structured interview to provide what the challenges they thought geoscientists were facing in acquiring these skills and what can be done to meet the identified gaps (see Appendix 3). This was crucial to understanding the current impediments hindering the provision of better services from improving geoscientist digital information literacy skills. Whilst using the same data collection method, GSN managers were asked to state whether their subordinates were facing challenges in acquiring and enhancing their digital information literacy skills. They were also asked whether these challenges are being addressed at the divisional level and who should be the key role players that could be involved in curbing the challenges (see Appendix 2).

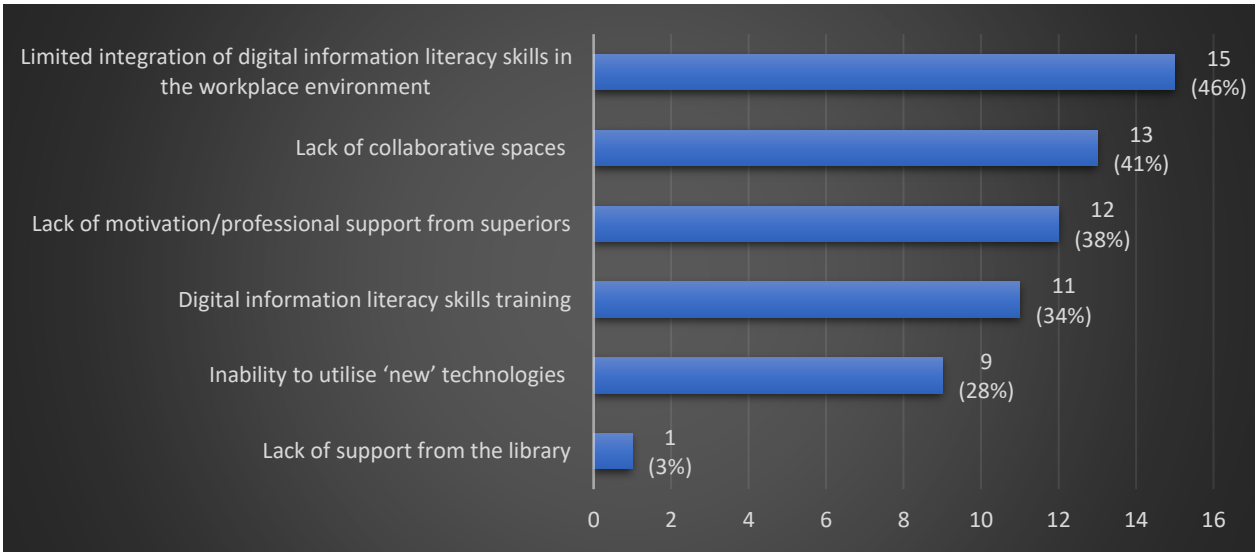


***Figure 4.5: Challenges or gaps that geoscientist face with regards to acquisition of digital information literacy skills***

The following sections highlight the different key challenges or gaps identified by study participants from the four data collection instruments.

#### *4.3.3.1 Digital information literacy skills training*

Findings from the questionnaire revealed that 34% of the geoscientists find lack of digital information literacy skills training a challenge in the acquisition of the digital information literacy skills (see Figure 4.5). One manager alluded that "*there are no structured guidelines or trainings that the library or the directorate use to enhance digital information literacy skills of geoscientists*". Four of the interviewed GSN managers indicated that training is vital for geoscientists to be skilled in digital information literacy skills. Whilst two librarians indicated that there is no working plan as to how managers and librarians will go about upskilling and reskilling geoscientists' digital information literacy skills.

Findings from the auto-ethnography also indicated that NESEIC library does not have a structured way of enhancing its' user's digital information literacy skills. Training is done on a need basis and/or when a user interacts with a digital literate librarian. The library in the past has done surveys to understand areas that geoscientist require training in or support but the responses to these are generally low and thus give librarian's no clear indication of areas that users need training on. Another observation from the auto-ethnographer is the lack of participation in library training initiatives from geoscientists.

A general sense from the study participants is that the library is viewed as the central space and thus is better equipped to train geoscientists in the acquiring and enhancing their digital information literacy skills. Only one geoscientist indicated that there was a lack of support from the library (see Figure 4.5). Interviewed librarians had mixed views on supporting geoscientists in acquiring relevant digital information literacy skills training due to funding available to do most of the activities and competing priorities. One librarian indicated that "*the library can only do much when it is supported by all Directorates within the Ministry because it is not only serving GSN staff members but all Ministry of Mines and Energy staff members, thus it becomes a*

*challenge to give sufficient support to geoscientists*". However, one librarian positively remarked that "*since we receive our budget from GSN, we try what we can do to support geoscientists*".

GSN managers, librarians and the researcher were asked to indicate who should be the key role players in curbing the challenges that are facing geoscientist and why. Four of the interviewed managers suggested that librarians should be the key role players in the digital information literacy training of geoscientists because they are the ones that work in the information space. Moreover, the rest of the interviewed managers and librarians suggested that GSN top management should be involved because that is where the decisions on funding and priority areas are decided. On the other hand, the researcher through the auto-ethnography agreed that the key role players that should be involved are GSN managers, librarians and geoscientists themselves, because they can better understand their needs and what they would require concerning the acquisition of digital information literacy skills.

#### *4.3.3.2 Lack of motivation and professional support from superiors*

Four managers indicated that one challenge facing geoscientists is that they do not have the drive and passion to upgrade their skills, especially when they are not engaged in formal studies such as studying towards a degree. One manager asserted that "*geoscientists lack the motivation to improve their skills through various means".* On the contrary, one participant noted funding related issues:

> *Even if geoscientists were willing to go for training, funding remains a stumbling block for them to acquire relevant skills. One would struggle to go through the bureaucracy to get a paper signed, prolonging the process and demotivating the person seeking to upgrade their skills.*

The auto-ethnographer also encountered a lack of motivation among geoscientists and a lack of support from superiors. Managers tend to encourage geoscientists to do research and publish their articles in reputable journals, however because there are no incentives for this, geoscientists tend to lose motivation and not publish unless this is part of their performance agreement. Furthermore, Figure 4.5 revealed that majority of geoscientists, 15 (47%), indicated that there was a limited

integration of information literacy skills in the workplace environment remains a challenge. Based on the researchers experience as a librarian, the researcher has noted this similar challenge as a lot of processes are still physical and not online or automated.

#### *4.3.3.3 Lack of collaborative spaces*

Following the lack of digital information literacy training, 41% (13) of geoscientists indicated that there is a lack of collaborative spaces for them to engage, which will then enhance their digital information literacy skills (see Figure 4.5). From the researchers' reflections, adding to the lack of collaborative spaces, there are no in-house efforts to bring geoscientists together to collaboratively work on projects that will enhance their skills, such as joint research or publishing an article together. However, GSN management is making an effort to bring geoscientists together for community outreach projects such as Namibia Broadcasting Corporation and GSN collaboration project and Federal Institute for Geosciences and Natural Resources (Bundesanstalt für Geowissenschaften und Rohstoffe or BGR) and GSN Digitisation project (BGR GSN). None of the interviewed managers or librarians indicated lack of collaborative spaces as a challenge.

#### *4.3.3.4 Inability to utilise 'new' technologies*

In the questionnaire, 28% (nine) of the geoscientists indicated that the inability to utilise new technology interfaces affects their digital information literacy skills. Librarians and auto-ethnography revealed that the inability to use e-resources hampers the effective use of information to produce quality scholarship. One of the interviewed librarians indicated that "*one of the challenges we are facing is that we spend a lot of time searching for articles for geoscientists when they supposed to search for themselves*". A GSN manager revealed that "*the inability to utilise new technology was attributed to the faulty hardware such as 'slow' computers. Also, there are few software licenses to access some high-tech software such as ArcGIS for maps*". This poses a challenge to the acquisition and enhancement of digital information literacy skills for geoscientists.

During the researchers autoethnographic reflection and experience in working with geoscientists, the researcher realised that some geoscientists cannot utilise local software such as Earth Data Namibia (EDN) that stores archival data and literature on Namibian geology, an in-house database. As such, this information needs to be used to produce a report in a day-to-day work of a

geoscientist; hence not knowing how to pull data from EDN becomes challenging. Since GSN is a research-intensive institute, geoscientists need know how to search the information using the ever-evolving e-resource interfaces such as *Elsevie*r or *EBSCO* that the library subscribes to or EDN. In supporting geoscientists, the researcher encountered some geoscientists who were struggling to download an article from these the databases an indication that some geoscientists might have limited digital information literacy skills.

In summary, geoscientists highlighted through the questionnaires that, they are experiencing a limited integration of digital information literacy skills in the workplace (GSN), and that there were limited or no collaborative spaces for research to partner. Similarly, lack of motivation and professional support was noted as one the challenges geoscientists regards as hampering their acquisition and enhancement of digital information literacy skills. Challenges such as lack of training, lack of support and motivation, lack of collaborative spaces and inability to use new emerging technology are some of the challenges and gaps that are hampering the uptake of digital information literacy skills. Interviewed librarians Both interviewed GSN managers and librarians' results revealed that managers and librarians should be the key role players in enhancing geoscientists digital information literacy skills, whilst results from the autoethnography also revealed that, both managers and librarians should be key role players but geoscientists should be the main key role players in enhancing their digital information literacy skills in the workplace.

### 4.3.4 Support services provided to geoscientists

The third critical question of this study sought to explore the support services provided by GSN and the library, in particular, to enhance the digital information literacy skills of geoscientists at GSN. This section highlights the different key support services and their relevance on digital information literacy skills as identified by study participants from the four data collection instruments. Librarians were asked through a semi-structured interview about the library's current services that could help geoscientists acquire or enhance their digital information literacy skills. This was crucial to understanding whether the library offers services that support geoscientist digital information literacy skills.

Librarians indicated that they offer various support services to geoscientists: reference query services, research support services, digital literacy training, dialogic spaces like webinars and seminars, and research publishing trainings. One of the librarians indicated that "*the library offers many research support services on referencing, literature reviews and writing skills"*. Another librarian discussed that "*the library engages geoscientists in various webinars and seminars that aims to encourage geoscientists either to publish more or ways to communicate their research or field work findings"*. All three librarians were adamant that the services that the library provide supports geoscientists acquisition of digital information literacy skills.

Meanwhile using the same data collection method, GSN managers were asked to state whether their specific division's support geoscientists and whether the services NESEIC Library provides were helpful to their subordinates in relation to acquiring and/or enhancing their digital information literacy skills. All interviewed GSN managers indicated that they support their geoscientists in their divisions. The managers expressed that they could only go the extra mile in supporting geoscientists if funds are available. Divisions within GSN also support geoscientists to acquire digital information literacy skills in various aspects such as, sending geoscientist to formal training, seminars and workshops when funds are available. For example, one manager revealed that "*annual performance agreements have areas specifically for employees to indicate the skills they want to acquire in that particular financial year; if funds are available, then they can be afforded the training they require*". Although most of the managers highlighted that they provide support as funding allows, one manager maintained that geoscientists need to explore various ways to support each other to upskill and reskill: "*to support each other in a community of practice and to learn by practicing rather than waiting for training*". Findings from auto-ethnography also agreed with this as there are opportunities which geoscientists can make use of to gain the wide range of digital information literacy skills. During a community outreach and advocacy project (NBC and GSN collaboration, BGR GSN collaboration, UNESCO and MME collaboration and many more) in which geoscientists collaborated in radio and TV communications activities; the geoscientists gained communication skills highlighted in Frame 5 of the ACRL framework 'scholarship as conversation'.

GSN managers were asked whether the services that NESEIC offers helps geoscientists to improve their digital information literacy skills (see Appendix 2). Managers positively indicated that, they have observed that the services that the library offer, helps geoscientists to enhance their digital information literacy skills. One interviewed GSN managers discussed that "*the library services although they are geared toward information provision and what the library is offering, some of the services such as digital literacy trainings and webinars are a tool that equip our geoscientists with these skills"*. However, one librarian hesitated that, "*not all services add value to the acquiring or enhancing geoscientists digital information literacy skills of geoscientists, it really depends on what the geoscientist is desiring to learn*".

To effectively analyse whether the services offered by the library enhance geoscientists' digital information literacy skills, geoscientist were asked how they access the library. This was critical, to baseline their response to the next question, on whether the services offered meant anything to their acquisition or enhancement of their digital information literacy skills. Figure 4.6 indicates that majority (38%) of the respondents' access and use the library through online and physically visiting the library, whilst there was an equal distribution of those that use either physical library only or online library only, giving an indication that geoscientists use the library in various ways.

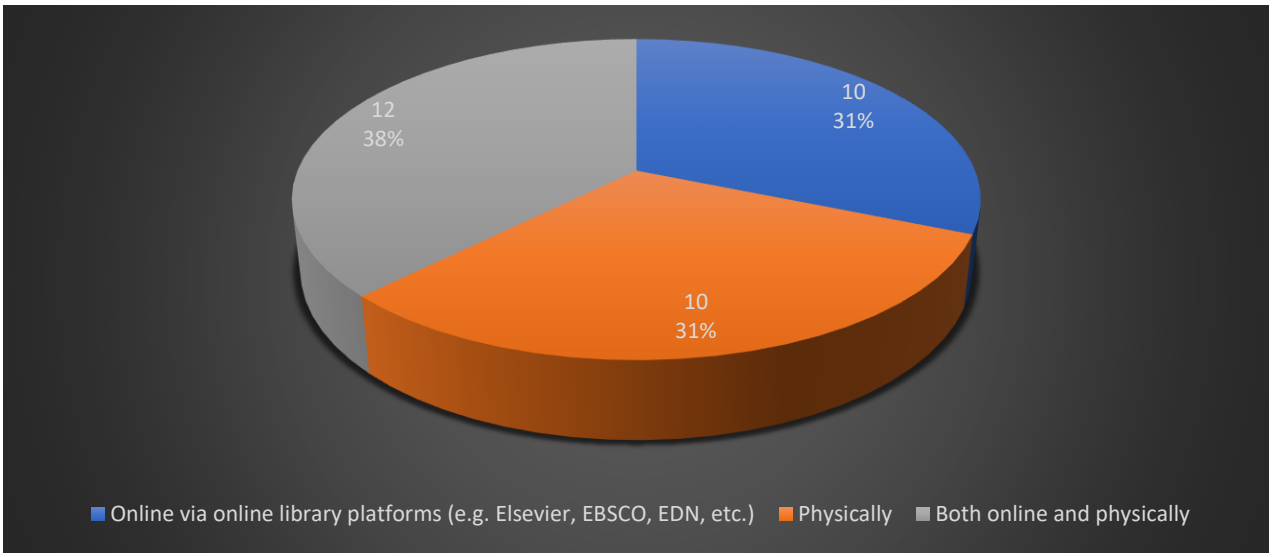


***Figure 4.6: NESEIC accessibility mode by geoscientists (N=32)***

Geoscientists were then asked, based on their experience of using the library, whether the services offered by the library enhance their digital information literacy skills. Geoscientists were asked, in a multiple response question, to indicate which service offered by NESEIC Library enhances their digital information literacy skills (see Appendix 1). Most of geoscientists (75%) pointed out that 'Digital library services' enhance their digital information literacy skills (see Figure 4.7). Eighteen (56%) geoscientists indicated that 'Digital information literacy training' improves their digital information literacy, which contradicts the training being rated high as a challenge in Section 4.3.3.1. Only 12 geoscientists indicated that they benefited from reference services.

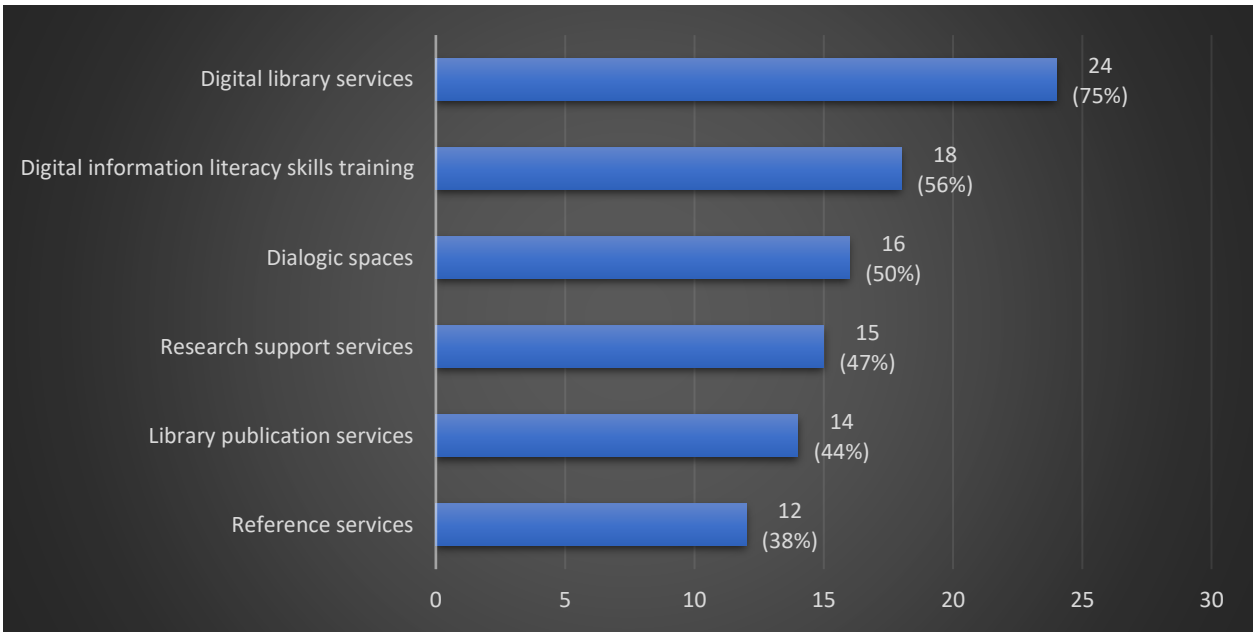


***Figure 4.7: Services offered by NESEIC Library to enhance digital information skills of geoscientists***

Most of the geoscientists 26 (81%), agreed that the services add value to improving their digital information literacy skills. In comparison, six geoscientists (19%) said they are unsure if the services add value to their digital information literacy skills. From the researchers' observations, most of geoscientist use the online platform rather than the physical library, a trend that was further promoted by the COVID-19 pandemic restrictions. The researcher also noted that the library is

struggling to promote remote support when geoscientists are in the field, especially because geoscientists are used to librarians searching and findings articles for them (see Section 4.3.2).

In summary, majority of geoscientists agreed that support services provided by NESEIC library adds value to their digital literacy skills. NESEIC Library offer various support services to geoscientists such as: reference query services, research support services, digital literacy training, dialogic spaces like webinars and seminars, and research publishing trainings. GSN managers maintained that their divisions support geoscientists to some extend with relevant trainings and workshops. Furthermore, GSN managers indicated that support services provided depends on the availability of resources such as funds and technology favourable environment. On the other hand, auto-ethnography revealed that trainings undertaken are not structured, and the training are done on a need basis and/or when a user interacts with a digital literate librarian.

### 4.3.5 Strategies to support the acquisition and enhancement of digital information literacy skills

This section presents the findings that address the study's fourth and last critical question, which sought to explore what strategies can be employed to support the acquisition and enhancement of digital information skills of geoscientists at GSN. This critical question was asked from Librarians and GSN managers through semi-structured interviews (see Appendices 2 & 3). Meanwhile, the researcher through auto-ethnography was also required to share some strategies that can be put in place to enhance the geoscientist's digital information literacy skills (see Appendix 5).

The research participants proposed a wide range of strategies. One of the strategies proposed was the monitoring and evaluation of progress made toward the enhancement of digital information literacy skills at GSN. One of the GSN managers indicated that "*to ensure that geoscientists are equipped with relevant skills, monitoring and evaluation of progress should be made a priority*". Study participants noted that this would enable both the librarian and the managers to track what they have achieved and areas of improvement. On the other hand, interviewed librarians indicated that the library team must develop a digital information literacy skill training plan and formalise the trainings. One manager helpfully suggested that "*more emphasis should be placed on digital information literacy skills training because research is made easier when you are a digital*

*information literate person*". This is in line with GSN priority area of strengthening research and innovation to stimulate investment in mining and energy sectors in Namibia.

Through personal reflections from auto-ethnography the researcher highlighted that GSN can improve the geoscientists digital information literacy skills through investing in fifth generation (5G) technology, that will be able to handle the pressure of work that geoscientist do. Investing in relevant technology will help motivate geoscientists as currently slow computers and lack of software licences do the opposite. The researcher further noted that the library team need to carry out an advocacy to raise awareness of digital information literacy skills to all geoscientists at GSN. A librarian indicated that "*if we get new computers and databases are updated, our users will benefit a lot because we end up carrying out searches that they were supposed to do, simply because, user computers are not working*". Improving the infrastructure, starting from the library and the laboratories that geoscientist use will assist geoscientist in their quest for digital information literacy skills especially in the sixth frame of the ACRL framework 'searching as a strategic exploration'. In a long run, having the right people, process, and infrastructure and skills in place to enhance productivity and reduce costs.

To conclude, interviewed GSN managers suggested that training, monitoring and evaluation of progress made toward the enhancement of digital information literacy skills at GSN need to be a priority. Interviewed librarians indicated that the library team needs to develop a digital information literacy skill training plan and formalise the trainings. Furthermore, results from auto-ethnography and interviewed librarians emphasised that, investing in relevant and current technology as well as improving the infrastructure at GSN so to provide a conducive environment where the geoscientist can either develop or/and enhance their digital information literacy skills of geoscientists.

### 4.3.6 General comments and observations

The GSN managers, geoscientist and librarians were asked if they had any general comments in relation digital information literacy skills of geoscientists (see Appendices 1, 2,3 & 5). This section presents comments and observations by the researcher not mentioned elsewhere. A GSN manager

concluded that "*the library is trying much to upgrade the skills of geoscientists, we could only wish that geoscientists would respond positively to the call*". On the other hand, one librarian commented that "*the topic is a very intriguing one, waking the librarian team to make the library useful tool in pioneering the conversations of reskilling geoscientists with digital information literacy skills*". A geoscientist indicated that "*there is need to forge collaborations that actually benefit staff of GSN and not collaborations that seek to only use staff for logistical purposes*".

In the same accord, the auto-ethnographer noted his reflections and general observations in relation to digital information literacy skills of geoscientists at GSN. The researcher observed that the area of geoscience is a diverse area, and geoscientists have different specialities, as such, getting digital information literacy skills across would not be an easy route for librarians who also need to be experts in multiple areas in the disciple so effectively support users.

## 4.4 Chapter summary

This chapter presented the study findings derived from geoscientists via questionnaire, GSN managers, librarians via semi-structured interviews and auto-ethnography with researcher. The objective of the study was to analyse digital information literacy skills of geoscientists and four critical questions were developed to address the research objective. The first critical question explored digital information literacy skills that geoscientists possess. The study found that geoscientists generally regarded themselves as having a moderately high and high level of competency throughout the ACRL six frames of information literacy. Majority of the frames recorded a good internal consistency for the questions with more than 0.8 Cronbach's Alpha value for most questions in this critical question

The study probed study participants about challenges or gaps that geoscientists experience in relation to digital information literacy skills. Challenges such as lack of digital information literacy skills training; lack of motivation and professional support from superiors; limited or no collaborative spaces; and the inability by geoscientists to utilise new technologies were raised as the key challenges hampering the acquisition of digital information literacy skills. The study also sought to establish the support services offered by GSN for geoscientists to acquire relevant digital

information literacy skills. Findings revealed that geoscientists used the library and acknowledged its support in enhancing their digital information literacy skills through the use of digital library services and skills trainings. Lastly, the fourth and last critical question explored the strategies that can be put in place to enhance geoscientist digital information literacy skills. The ability to monitor and evaluate digital information literacy progress; raising awareness of digital literacy services offered by the NESEIC Library; creating a digital information literacy skill training strategic plan; increasing the funding and investment in relevant technologies and software to aid the advancement of geoscientists' digital information literacy skills. The next and final chapter presents the conclusions drawn from the study's findings and study recommendations.

# Chapter 5: Discussion of main findings, conclusions and recommendations

## 5.1 Introduction

The previous chapter focused on the presentation of qualitative and quantitative data collected through semi-structured interviews with purposively sampled Geological Survey of Namibia (GSN) managers and librarians, questionnaire responses from GSN geoscientists and researchers' auto-ethnography. This chapter discusses main findings based on the study's main objective, four critical questions, conceptual framework supporting the study and reviewed literature. Based on the discussion of the main findings, conclusions are drawn and recommendations are made.

The main objective of the study was to analyse the digital information literacy skills of geoscientist within GSN. To address this objective, four critical questions were adopted:

- What digital information literacy skills do geoscientists possess?
- What challenges or gaps do geoscientists have, if any, in relation to digital information literacy skills?
- What support services are provided by GNS to enhance digital information literacy skills of geoscientists?
- What are some of the strategies that can be employed to support the acquisition and enhancement of digital information literacy skills of geoscientists?

## 5.2 Discussion of findings

The discussion of the study's main findings was crafted according to the themes from the study's critical questions and the conceptual framework that underpinned the study, Association of College and Research Libraries (ACRL) Framework for Information Literacy for Higher Education (2016).

### 5.2.1 Geoscientists' digital information literacy skills

Geoscientists' digital information literacy (DIL) skills are discussed according to the six frames of the ACRL Framework of Information Literacy for Higher Education (2016), namely authority is

constructed and contextual; information creation as a process; information has value; research as inquiry; scholarship as conversation; and searching as a strategic exploration. Across all six frames of the ACRL Framework of Information Literacy in Higher Education (2016), the study findings in Section 4.3.2 of Chapter 4 reported that across all six frames, majority of geoscientists rated their digital information literacy skills as being moderately high and high level of competency.

In the first frame, 'authority is constructed and contextual', the findings show that majority of the surveyed geoscientists have average to moderately high level of competency this frame. However, only few geoscientists indicated that they have high competence in this frame. This might be attributed to the fact that, geoscientists are still trying to keep up with the exponential growth of digital information, hence the average to moderately high level of competence in this frame. In a similar study by Mahmood et al. (2022:2098) their results revealed that digital information literacy skills of participants were good to a moderate level, however, they were not confident in applying advanced searching options. Study findings showed in Table 4.3 (Chapter 4) that half of the questionnaire survey respondents are highly skilled in 'applying a critical eye to information before usage'. As reported by literature (Nikou & Avakare, 2021:2; Mishra, 2018:77), the need to properly evaluate information is not new to the digital age; it has always been essential to successful learning, even before the information revolution. In another study, Solmaz (2017:940) reported that the exponential growth of information in various formats has also created the need for the ability of the user to critically evaluate diverse forms of information resources.

In the second frame, the study findings shows that geoscientists are moderate high to high level of competence (88% in total) in the frame 'information creation as a process' (see Table 4.4 in Chapter 4). Similarly, findings from interviewed geoscientists revealed that geoscientist are skilled in the area of information creation, this is due to the fact that geoscientists search and access information using digital platforms at GSN. Given the positive findings from geoscientists, findings from auto-ethnography and librarians interviews reported that geoscientists are fairly skilled, and majority only have the basic information literacy which allows them to identify, find, evaluate and apply various sources of information in various formats. This is because a digital information literate person needs to be able to function in a knowledge society through the appropriate use of information and communication technology (ICT) to solve information

problems (Sparks, Katz & Beile, 2016:3-4). This is because the appropriate use of ICTs is sometimes not evident for some of the geoscientists hence, they can be regarded as having some digital information literacy skills. So, while information literacy encompasses the skills and processes involved in processing information, digital information literacy refers to individuals' knowledge, mindset, and proficiency in utilising digital technology tools to efficiently access information in various formats (such as text, video, and images) in a digital setting (Nikou, 2022:373). A study by Polizzi (2020:1) also agreed that functional and critical digital skills and knowledge of navigating internet and the digital environment need to complement the basic information literacy skills. The findings from auto-ethnography and interviewed librarians differs with those from geoscientists and GSN managers findings in this frame (information creation as a process), with this group regarding them as being less skilled. The librarians and the auto-ethnographer views are likely as a result of their encounter with geoscientist in the library or when requesting information while GSN managers and geoscientists themselves reflected from their everyday roles, these two different contexts may result in varied perspectives.

In the third frame, 'information has value', study findings from the auto-ethnography revealed that some geoscientists are skilled in the area 'contributing to the information marketplace' such as publishing of their research articles and technical reports or publishing in-house, in the Communication of the Geological Survey of Namibia and bi-annually newsletter of Geological Communications Newsletter (GEOCOM). In a similar study with librarians, Khan (2020:167) DIL skills of librarians in Pakistan was found to be low and recommended that due to the high demand for these skills that librarians need to acquire these skills to better support users. Findings of the study also indicated that majority of geoscientists are highly skilled in 'respecting the original idea of others. This is because majority of the surveyed geoscientists hold higher degrees such as Bachelor's and Master's degrees and having experienced rigorous referencing training and praxis in research, it is not surprising that geoscientists are highly skilled in referencing.

In the fourth frame 'research as inquiry', the study findings from the survey questionnaire indicated that majority of geoscientists have a moderately high level of competence, with only few acknowledging that in all the dispositions they have a low level of competence. These results reflect that geoscientists are proficient in engaging in research. A study by Sparks, Katz and Beile,

(2016:2) argued that lack of information skills proficiency is an overarching societal concern, in terms of impact on both personal and professional life. However, researchers from the developing countries, like Namibia, are often viewed as struggling to publish research and most of their articles are turned down by journals due to plagiarism claims and lack of English proficiency (Amarante et al., 2021:1663).

In addition, geoscientists rated themselves as mostly having a moderately high competency and at times high competency for 'following ethical and legal guidelines in gathering and using information'. This was expected as most geoscientists are involved in various research activities at GSN. These findings were supported by interviewed librarians who noted that geoscientists who are currently studying are better positioned with digital information literacy skills, an observation noted earlier. In addition, one interviewed manager also revealed that due to the geoscientist's exposure in research, they are highly skilled in this frame. Central to this study, Amarante et al., (2021:1663) study findings revealed that the underrepresentation of Southern researchers in research on development in the South might plausibly be attributed to deficiencies in research skills. As much as this is the case, this study proves that geoscientists are skilled in research as inquiry against the background of DIL skills, however this was a small study and, in a research focused institution which the case might be different for other institutions in the region.

In the fifth frame 'scholarship as conversation' majority of the geoscientists through the survey questionnaire rated themselves moderately high to high level of competency for dispositions such as 'recognising ongoing scholarly conversation' and 'recognising that scholarly conversations take place in various venues. Some studies highlighted lack of scientific networks (Amarante et al, 2021:1663) exposure to the outside world (Malanga & Chigona, 2018:4) and lack of opportunities hinders scholars to engage with other professions beyond their reach, hence making it difficult to acquire relevant skills in this frame. Other studies have shown that a workplace is regarded as a platform for practice, interaction, and socio-cultural affinity with the environment, and it is context-related, thus conversations are an important part of learning in practice (Jinadu & Kaur 2014:62). Conversating with other professions on current trends and interesting discoveries or research results against other colleagues affords others an opportunity to offer positive criticism for growth, hence it is deemed as an important aspect in this frame and in acquiring and enhancing

digital information literacy skills. Numerous studies have assessed DIL skills of different population groups and argued that such skills empower individuals with independent learning and critical thinking (Malanga & Chigona, 2018:4; Dabengwa, 2018:7; Naveed & Rafique, 2018:1).

Lastly, the study findings in the sixth frame 'searching as a strategic exploration' also showed that majority of the geoscientists rated themselves as having a moderately high to high level of competency apart from 'exhibiting mental flexibility and creativity', where the majority rated themselves as having average to moderately high level of competency. The findings of this study further highlighted, through the interviewed librarians, that geoscientists are fairly skilled in 'searching as strategic exploration'. This was because librarians carry out most of the geoscientists searching, hence the assumption that they are fairly skilled in this area. Surprisingly, for this frame, the findings from the auto-ethnography indicated that integration of DIL skills in the workplace is partially done, and partly depends on the role the geoscientist holds. Senior geoscientists and chief geoscientists integrated digital information literacy skills to some extent, however at a deputy director level or higher there is a sense that digital information literacy skills are not a priority because of their job requirements as these roles are mostly administrative rather than research focused.

In addition, findings from GSN managers revealed that despite them saying that geoscientists are skilled with digital information literacy skills, only some geoscientists possess the necessary digital information literacy skills. For example, one GSN manager posited that young geoscientists who recently graduated from universities are better equipped than the seniors. However, some GSN manager indicated that the that geoscientists create and store data digitally, derive report and share it with the whole directorate or outside clients; thus, they are regarded a digital information literate. The study also found, from interviewed librarians, that communication, strategic searching and research skills are the critical skills which are vital for geoscientists to enable them to navigate through emerging digital platforms.

### 5.2.2 Digital information literacy skills challenges and gaps

The study found some potential challenges and gaps that might hinder the acquisition and enhancement of digital information literacy skills of geoscientists. Findings from the questionnaire

survey revealed that there was limited integration of digital information literacy skills in the workplace. A plausible reason for these results could be that the harmonisation of all the processes in different frames are not well integrated in everyday work and lives of geoscientists. Interestingly, a study Nikou, De Reuver and Kanafi (2022:384) revealed that, there was no direct link between the integration of DIL skills in the workplace and the level of DIL skills of employees, however, their study acknowledged that digital information literacy is relevant in the workplace and may have a direct impact on employees' personal achievement and organisational performance.

The study findings from interviewed librarians indicated that NESEIC Library does not have a workable plan on how to train users on DIL skills. In this regard, despite geoscientists rating their skills moderate high to high level of competence (see Section 4.3.2 of Chapter 4), most geoscientists still pointed to DIL skills training as a challenge (see Figure 4.5, Chapter 4). This is because the digital landscape is ever changing, and continuous reskilling is always necessary at time to time. To substantiate this finding, auto-ethnography and interviewed GSN managers concurred with the librarians that there was no proper training done on DIL skills of geoscientists from the side of the library and from divisions where geoscientists are working under. In a similar study, Malanga and Chigona (2018:4), noted that the lack of digital information literacy of the workforce may be attributed to the lack of DIL skills training in the workplace. The study findings from geoscientists also revealed that there was a lack of collaborative spaces. This was further exuberated by the COVID-19 pandemic where connection and collaborating became centred and the need to breakdown silo's and provide space that allows engagement and partnerships. Lastly the study showed that geoscientists are not motivation to gain or enhance their DIL skills moreover they tend to experience limited professional support from their seniors.

To aid in curbing these challenges, the study found that the key role players that need be involved are GSN managers, librarians and geoscientists themselves, because they are better suited to understanding the geoscientists needs and what they would require concerning the acquisition or enhancement of DIL skills. As reported in literature, DIL skills are an important skillset in the digital age, managers and librarians may want to start by identifying which work groups or individuals require literacy training and instruction, and then provide specific and relevant training

or literacy interventions to help those who lack sufficient literacy (Nikou, De Reuver & Kanafi, 2022:384).

### 5.2.2 Support services provided to geoscientists

The study findings showed that the services provided by NESEIC library adds value to the geoscientists DIL skills. Geoscientists access and use the library through online and physically visiting the library, giving an indication that geoscientists access the library in various ways. Studies such as Rafi, JianMing and Ahmad (2019:203) also stated that libraries have gradually shifted focus from the fulfilling a social role to the growing importance of customer service, user needs and public relations, as such it matters how services and programmes are delivered to their intended audiences which are the library users. In the same sentiments, Hashim et al. (2022:8), revealed that, regarding ease of access, it is necessary for academic libraries (which is the same for also research institutes), to take note of the various types of effort that users prefer to minimise effort so to ultimately improve users' information-seeking experience that will boost their desire to utilise library services via online or mobile platforms.

#### 5.2.2.1 Digital information literacy skills training

The study findings from the interviewed librarians found that NESEIC Library offer various support services to geoscientists such as information literacy training sessions to aid in improving geoscientists skills. Mahmood et al. (2021:2108) also regarded training and attending short courses as a key ingredient in supporting the acquisition of digital information literacy skills. In light of this study findings, user training can never be under-estimated because it is the pillar on which majority of users acquire or enhance digital information literacy skills. The findings regarding training support also concurred with findings from the previous research. Naveed and Rafique (2018:1) noted that there is a critical need for making arrangements regarding DIL instruction program for in-service scientists.

Moreover, findings from GSN managers concurs with those from librarians. GSN managers respective divisions support geoscientists through training and workshops, which are carried out when funds are available and technology favourable environment. Earlier studies (Sparks, Katz &

Beile, 2016:2; Noll, 2017:31; Dabengwa, 2018:176) have highlighted the importance of technology in training and instruction of DIL skills. The concept of digital technologies and DIL skills goes hand in hand, thus this study findings from GSN managers emphasised the importance of technology and a favourable environment to effectively support geoscientist in the quest for these skills. Despite the training support offered at divisions and by NESEIC Library, study findings from the auto-ethnography revealed that there was no structured way of training geoscientists on digital information literacy skills, and the training that is done on a need basis and/or when a user interacts with a digital literate librarian. Based on the previous studies, balancing between transferring approaches from digital information literacy from the academic library to workplace context was found to be a challenge for librarians (Dabengwa, 2018:178) thus an area to be addressed so NESEIC Library can play a key role in terms of related services.

The study finding probed from interviewed librarians on the support that NESEIC Library offers. Interviewed librarians and auto-ethnography revealed that NESEIC Library offers research support to geoscientists which is not limited to reference query services, dialogic spaces like webinars and seminars, and research publishing trainings. These findings build on the existing evidence that high-end research support has been heralded as an opportunity for academic librarians to move away from 'life support' to a more critical role in the new higher education and related environments, which enables librarians to be embedded librarians (Pasipamire, 2015:61; Dlamini, 2020:87).

### 5.2.3 Strategies that can be employed to support the acquisition and enhancement of digital information literacy skills

Findings from the interviewed GSN managers found training, monitoring and evaluation of progress to be key towards the enhancement of digital information literacy skills at GSN and thus needs to be prioritised. Interviewed librarians indicated that the library team must develop a digital information literacy skill training plan and formalise the trainings. These findings concur with previous research by Chigwanda and Chisita (2021:4) which also revealed that for professionals to be effective in their roles there should be standards that should be adhered to, in-order to offer efficient and effective services. Hence, standardising trainings might help the library team made

an impact in reskilling and upskilling geoscientists. However, this is also dependent to having digital information literate librarians thus training the trainer is crucial as part of these strategies. As such, reskilling, cross-skilling and upskilling in digital information literacy will help workers engage in lifelong learning and allow them to become the flexible, easily trainable workforce that business leaders are calling for (Head et al., 2013:75), still relevant 10 years later.

Furthermore, results from auto-ethnography and interviewed librarians emphasised that, investing in relevant and current technology as well as improving the infrastructure at GSN can potentially contribute to the development or/and enhancement their digital information literacy skills of geoscientists. These findings concur with those from Hegarty et al. (2010:183), which argued that infrastructure at institutions should be continually reviewed, in order to capitalise on the benefits of consistent access for users to the latest web technologies, while recognising the ongoing need for security.

## 5.3 Conclusions

The study used the ACRL Framework of Information Literacy for Higher Education (2016) as a supporting theoretical framework which guided the study. The framework has been an instrumental tool in addressing the study's objective and critical questions. Various studies (Eleanor & Watstein, 2014; Berman & Kudem, 2017; Kuden & Braund-Allen, 2017) found that the framework helps with the broader context allowing professionals to have the chance to encounter and recognize more varied information experiences occurring in different workplaces. As such professionals are able to learn from different best practices that suits their workplaces. In addition, the framework helped the researcher to view digital information literacy skills from a more holistic perspective, as sets of skills that help people to work collectively, and with an understanding of workplaces as social constructs. Based on the discussion of findings in Section 5.2, the study draws the following conclusions relating to the four critical questions generated to address the study's research objective which aimed to critically analyse the digital information literacy skills of geoscientists at the Geological Survey of Namibia:

- Geoscientists regarded themselves generally as having a good level of competency throughout the ACRL six frames of information literacy. Based on their experiences, librarians, GSN mangers and auto-ethnography regarded geoscientists as fairly skilled in digital information literacy skills. In addition, geoscientists who are currently studying are better positioned with digital information literacy skills and this was evident in their research work, day-to-day work as well as their interaction with librarians. Majority have the basic information literacy which deals with information processing and have limited digital information literacy which is the awareness, attitude and ability of individuals to appropriately use and interact with digital technology (tools) to easily and effectively access information in different formats. The study found research and communication skills as key digital information literacy skills which can enable geoscientists to navigate through emerging digital platforms in the workplace.

- Lack of digital information literacy training opportunities for geoscientists emerged as a challenge from GSN managers and librarians. However, lack of collaborative spaces was also regarded as a key challenge hampering the acquisition of digital information literacy skills by geoscientists. Whilst the findings revealed that the library and the librarians are instrumental in equipping geoscientists with digital literacy skills, the study finding also revealed that the library is also facing challenges such as lack of funding to fund all the innovative initiatives for the library to upskill and reskill geoscientists. To aid in curbing these challenges, the study found that the key role players that need be involved are GSN managers, librarians and geoscientists themselves, because they can better understand their needs and what they would require concerning the acquisition of digital information literacy skills.

- In relation of support services, the study found that, geoscientists used the library and acknowledged its support in acquiring and enhancing their digital information literacy skills through the use of digital library services and skills trainings. Geoscientists access and use the library through online and by physically visiting the library, however, the

library is struggling in supporting geoscientists remotely. Majority of geoscientist use the online platform rather than the physical library, a trend that was further promoted by the COVID-19 pandemic restrictions. NESEIC Library offers various support services to geoscientists: reference query services, research support services, digital literacy training, dialogic spaces like webinars and seminars, and research publishing trainings, and these services that the library provide supports geoscientists in their acquisition and/or enhancement of digital information literacy skills. Divisions within GSN also support geoscientists to acquire digital information literacy skills in various aspects such as, sending geoscientist to formal training, seminars and workshops when funds are available. The study also found out that, internal and external collaboration with different stakeholders, who have expertise in this area, were instrumental in enhancing geoscientists digital information literacy skills in the area of scholarship as conversation and research as enquiry.

- The study also probed about strategies that can be employed to strengthen the digital information literacy skills of geoscientists. The ability to monitor and evaluate digital information literacy progress was found to be important by GSN managers. Integration of digital information literacy skills in the workplace at all levels needs to be considered as this will enable all geoscientists to effectively engage in their work effectively as work and research is becoming more digital. Other strategies that were found to be key include raising awareness of digital literacy services offered by the NESEIC Library and the need for a digital information literacy skill training strategic plan. Study participants also indicated the need for GSN management to increase the funding and investment in relevant technologies and software to aid the advancement of geoscientists' digital information literacy skills. The study findings also concluded that, there is need to forge collaborations that mutually benefit geoscientists

## 5.4 Recommendations

Based on the discussions and conclusions drawn from the study findings, the study makes the following recommendations:

### 5.4.1 Specialised digital information literacy trainings

NESEIC Library need to come up with a DIL training plan that is contextualised rather than a generic one. The librarians need to take a centre stage in spearheading the digital information literacy skill training to continuously reskill geoscientists. The ACRL framework for Information Literacy Skills (2016) provides a good foundation for structuring tailor-made training for different professional groups. Although the framework is used mainly in higher education institutions, it can also be customised to research intensive institutions such as GSN.

### 5.4.2 Community of practice (CoP) to foster professional support and motivation

There is a need to form a community of practice for geoscientists with common interest to motivate each other throughout the journey of acquiring digital information literacy skills. A community of practice can help facilitate geoscientists' growth in terms of geoscience discipline, such as writing and publications, communication skills, referencing skills, project management skills, etc. through good practices and norms within the discipline. Community of practice can build confidence in an individual researcher's approaches to problem solving, and a shared sense of belonging and create opportunities to collaborate in areas of shared interests. In a long run, this will foster collaboration and improve various aspects of geoscientists digital information literacy skills while motivating them to upskill and reskill continuously.

### 5.4.3 Intentional funding for digital information literacy initiatives

This study has shown that digital information literacy skills is essential for professional growth, as such intentional funding toward digital information literacy skills will assist in the quest for such skills by geoscientists. Librarians through the management and applying for various grants and financial opportunities presented by various organisations can request for funding for various professional training and seminars for these activities to play the critical role and be embedded in their support to the geoscientists.

### 5.4.4 Investing in relevant technology and improving infrastructure at GSN

Digital information literacy skills enable geoscientists to become essential players in the workforce and in a knowledge-based society where most of the information is digital. As such GSN management needs to invest in fifth generation technologies and improving library infrastructure to assist geoscientist in their quest for digital information literacy skills especially in the sixth frame of the ACRL framework 'searching as a strategic exploration'. In the long run, having the right people, processes, infrastructure and skills in place will enhance productivity and reduce costs for the GSN.

### 5.4.5 Further research

Further study should be undertaken to investigate different critical gaps that were highlighted in this study conclusions such as the implementation of a specialised DIL training and its integration in the workplace, as well as exploring DIL in the entire Ministry of Mines and Energy and in other specialists' groups.

## 5.5 Chapter summary and general conclusion and evaluation

The chapter presented the discussions of the main findings based on the study's main objective and four critical questions, theoretical framework of the study and reviewed literature. Based on the discussion of the main findings, conclusions were drawn and recommendations were made. To address the study's main objective and critical questions, the study used the convergent parallel mixed methods within a pragmatism paradigm and a case study design. Data was collected using different data collection methods to collect both qualitative (semi-structured interviews and auth-ethnography) and quantitative data (questionnaires). The ACRL Framework for Information Literacy for Higher Education (2016) was used as a theoretical framework supporting this study and it was instrumental in aiding the critical analysis of DIL skills of geoscientists at GSN. Informed by the ACRL Framework (2016), geoscientists proved that they are moderately high and highly skilled in the six frames of the Framework. However, the study further found out that GSN managers, auto-ethnographer and librarians posited that geoscientists are fairly skilled in these skills: communication, strategic searching and research skills, which were highlighted as critical

skills needed by geoscientists in the workplace. The study found that lack of DIL trainings, lack of collaborative spaces, lack of motivation or professional support from superiors, lack of funding and inability to use new technologies as some of the key challenges hindering the acquisition and improvement of digital information literacy skills by geoscientists.

The NESEIC library was regarded as playing a major role in upskilling and reskilling of geoscientists with digital information literacy skills, despite the funding challenges. The study further found out that NESEIC Library provides support services such as reference query services, research support services, digital literacy training, dialogic spaces like webinars, seminars, and research publishing trainings. Moreover, GSN managers also support their subordinates through various opportunities such as professional trainings and seminars. The study found that multiple strategies can be employed in the quest to improve geoscientists DIL skills such as, NESEIC Library devising a digital literacy training plan; GSN management forging collaborations; and increasing funding and investment in relevant technologies and software to aid the advancement of geoscientists' digital information literacy skills. The study further recommended that a specialised DIL skills trainings needs to be developed, establish geoscientists community of practice, intentionally and better funding for capacity development and improving relevant infrastructure and technology.

The study provided nuance and fresh contribution to the body of knowledge in the area of digital information literacy skills of geoscientists at GSN, Africa and beyond. It is the hope of the study that the findings are useful not only within the GSN geoscientist but to the geoscientist or other professionals within other Ministry departments, and other Geological Surveys elsewhere in the continent and internationally. The contribution of this study met with the global quest for many institutions to upskill, reskill and cross-skill their employees with relevant digital information literacy skills to effectively navigate the knowledge-based economy.

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# Appendices

## Appendix 1: Questionnaire for geoscientist at the Geological Survey of Namibia

## Analysis of digital information literacy skills of geoscientists at the Geological Survey of Namibia

My name is Martin V.S. Hipangwa and I am a Master of Library and Information Studies (MLIS) student in the Department of Knowledge and Information Stewardship at the University of Cape Town. I am currently carrying out an analysis of digital information literacy skills of geoscientists at the Geological Survey of Namibia (GSN). The study is being supervised by Dr Andiswa Mfengu. The objective of this study is to critically analyse the level of digital information literacy skills of the geoscientists within the Geological Survey of Namibia. The study is underpinned by the Academic and Research Libraries (ACRL) Information Literacy Framework (Academic and Research Libraries, 2016). As part of this study, I am conducting a survey with all geoscientists at GSN to get an in-depth understanding of digital information literacy skills of geoscientists working at GSN.

Please be assured that your participation in this study is anonymous and you will not be identified in any specific way. There are no foreseeable risks associated with this study, nor are there any direct benefits to you. Your responses will only be used for research purposes. Your participation in this study is voluntary, and you have the right to withdraw from the study at any time. The questionnaire will take approximately 15 minutes to complete.

[**To complete the questionnaire please click on this link:**
https://docs.google.com/forms/d/e/1FAIpQLSfvCiRbu56LPDO0M6VK4gKmwykutdtJ7c4rQfaG2e2iSWtM6A/viewform?usp=pp_url]

**Instruction:** Please respond to questions by providing responses in the spaces provided or ticking (√) the most applicable.

**Informed consent:**

☐ I agree to participate in this study and I understand the objective of the study. I am aware that my participation is completely voluntary and that there are no direct benefits to me for participating in this study.

**SECTION A: Background information**

1. What is your division of at Geological Survey of Namibia?

| **Division** | **Tick** |
|---|---|
| a) Geochemistry Division | |
| b) Regional and Mapping Division | |
| c) Economic Geology Division | |
| d) Engineering and Environment Geology Division | |
| e) Geophysics Division | |
| f) Geoinformation Division | |

2. Which of the following describes your job title?

| Position | Tick |
|---|---|
| a) Technical Assistant | |
| b) Geoscientist | |
| c) Senior Geoscientist | |
| d) Chief Geoscientist | |
| e) Deputy Director | |
| f) Director | |
| g) Deputy Executive Director | |

3. For how long have you been working at the Geological Survey of Namibia?

| **Years** | **Tick** |
|---|---|
| a) 0-2 years | |
| b) 3-5 years | |
| c) 6-10 years | |
| d) 11-15 years | |

| | |
|---|---|
| e) 16 years and more | |

4. What is your highest educational qualification?

| Qualification level | Tick |
|---|---|
| a) Certificate | |
| b) Diploma | |
| c) Bachelor's degree | |
| d) Honour's degree | |
| e) Master's degree | |
| f) PhD | |

**SECTION B: Digital information literacy skills possessed by geoscientists**

**Digital information literacy** is the ability to function in a knowledge society through the appropriate use of information and communication technology to solve information problems, including the ability to research, organise, and synthesize information through digital technology (Sparks, Katz & Beile, 2016:3-4).

The following statements show the different information literacy skills dispositions according to the ACRL Information Literacy Framework, please rate to what extent you are proficient in these skills.

**4=High level of competence** (extensive experience in the skill area)

**3=Moderate high level of competence** (good experience in the skill area)

**2=Average level of competence** (some experience in the skill area)

**1=Low level of competence** (little experience in the skill area)

**0=No level of competence** (no experience in the skill area)

**5. Authority is constructed and contextual**

| Statements | Level of competence | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| i)Dealing with varied and sometimes conflicting perspectives. | | | | | |
| ii) Identifying authority of different sources (traditional sources & emerging sources). | | | | | |
| iii) Applying a critical eye to information before usage. | | | | | |

**6. Information creation as a process**

| Statements | Level of competence | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| i) Matching an information need with an appropriate product. | | | | | |
| ii) Understanding that creation of information can take different modes and formats (e.g. peer review articles, technical reports, blogs, etc.) | | | | | |
| iii) Understanding different methods of information dissemination. | | | | | |
| iv) Accepting the ambiguity surrounding the potential value of information creation expressed in emerging formats or modes. | | | | | |

**7. Information has value**

| Statements | Level of competence | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| i) Respecting the original ideas of others (e.g., referencing properly). | | | | | |
| ii) Contributing to the information marketplace rather than consuming only (e.g., publications, writing in communications or GEOCOM). | | | | | |
| iii) Inclined to examine one's information privilege. | | | | | |

**8. Research as inquiry**

| Statements | Level of competence | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| i) Considering research as an open-ended exploration and engagement with information. | | | | | |
| ii) Value intellectual curiosity in developing questions and learning new investigative methods. | | | | | |
| iii) Maintaining an open mind and a critical stance. | | | | | |
| iv) Value persistence, adaptability, and flexibility. | | | | | |
| v) Seeking multiple perspectives during information gathering and assessment. | | | | | |
| vi) Seeking appropriate help when needed. | | | | | |
| vii) Follow ethical and legal guidelines in gathering and using information. | | | | | |
| vii) Demonstrate intellectual humility (i.e., recognize one's intellectual or experiential limitations). | | | | | |

## 9. Scholarship as conversation

| Statements | Level of competence | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| i) Recognising ongoing scholarly conversation (e.g. Further research, surveys and possible areas of improvements in scholarly communications) | | | | | |
| ii) Seeking out conversations taking place in my research area. | | | | | |
| iii) Recognising that scholarly conversations take place in various venues. | | | | | |
| iv) Suspending judgement on the value of a single piece of information until the larger context for the scholarly conversation is better understood. | | | | | |
| v) Understanding the responsibility that comes with entering the conversation through participatory channels. | | | | | |
| vi) Value user-generated content and evaluate contributions made by others. | | | | | |
| vii) Recognising that systems privilege authorities and that not having a fluency in the language and process of a discipline disempowers my ability to participate and engage. | | | | | |

**10. Searching as strategic exploration**

| Statements | Level of competence | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| i) Exhibiting mental flexibility and creativity. | | | | | |
| ii) Understanding that first attempts at searching do not always produce adequate results. | | | | | |
| iii) Realising that information sources vary greatly in content and format and have varying relevance and value, depending on the needs and nature of the search. | | | | | |
| iv) Seeking guidance from experts, such as librarians at NESEIC Library, fellow researchers, and other professionals in the field. | | | | | |
| v) Recognising the value of browsing and other serendipitous methods of information gathering | | | | | |

**SECTION C: Services offered by NESEIC Library**

11. Do you make use of library services?

| | | | |
|---|---|---|---|
| a) Yes | | b) No | |

12. How do you access NESEIC Library?

| Method | Tick |
|---|---|
| a) Online via online library platforms (e.g. Elsevier, EBSCO, EDN, etc.) | |
| b) Physically | |
| c) Both online and physically | |

13. In your experience of using the library, does it offer services that may enhance your digital information literacy skills?

| | | | | | |
|---|---|---|---|---|---|
| a) Yes | | b) Not sure | | c) No | |

14. What services does NESEIC Library offer that may enhance your digital information literacy skills?

| **Services** | **Tick (all applicable)** |
|---|---|
| a) Digital Information and Literacy Skills Instruction (Trainings) | |
| b) Dialogic Spaces (e.g. Geomarker spaces, seminars, webinars, etc.) | |
| c) Reference Services (One on one instruction with Librarians) | |
| d) Digital Library Services (EDN, E-resources) | |
| e) Library publication services | |
| f) Research support services | |

**Section D: Digital information literacy skills challenges or gaps**

15. What do you think are the challenges or gaps that geoscientist face with regards to acquisition of digital information literacy skills?

| **Challenges** | **Tick (all applicable)** |
|---|---|
| a) Digital information literacy skills training | |
| b) Limited integration of digital information literacy skills in the workplace environment | |
| c) Lack of motivation/professional support from superiors | |
| d) Lack of collaborative spaces (community of practice) | |
| e) Lack of support from the library | |
| f) Inability to utilise ‘new’ technologies (such as softwares, e-resources, etc.) | |

| | |
|---|---|
| g) Other (please specify) | |

Others (Please specify) ……

**Section E: General comments**

16. Are there any other issues relevant to the research topic of this study that you would like to bring to the attention of the researcher?
    ……
    ……
    ……
    ……

**Thank you for your participation and contribution to the study!**

Martin V.S. Hipangwa
Email address: HPNMAR004@myuct.ac.za or Contact number: +264817497874

## Appendix 2: Semi-structured interview schedule for GSN Management

## Analysis of digital information literacy skills of geoscientist at the Geological Survey of Namibia

### Description of the research and participation

My name is Martin V.S. Hipangwa and I am a Master of Library and Information Studies (MLIS) student in the Department of Knowledge and Information Stewardship at the University of Cape Town. I am currently carrying out an analysis of the digital information literacy skills of geoscientists at the Geological Survey of Namibia (GSN). The study is being supervised by Dr Andiswa Mfengu. The objective of this study is to critically analyse the level of digital information literacy skills of the geoscientists within the Geological Survey of Namibia. The study is underpinned by the Academic and Research Libraries (ACRL) Information Literacy Framework (Academic and Research Libraries, 2016). As part of this study, I need to interview geoscientists who are managers on a supervisory level (GNS management), to get an in-depth understanding of the digital information literacy skills of geoscientists working at GSN. The interview will take approximately 45 minutes and you have consented to the interview being **recorded or not recorded**.

### Section A: Background information

1. Which division are you currently serving in?
2. How long have you been a geoscientist?
3. How many geoscientists are you currently supervising?
4. Are you aware of digital information literacy skills?
5. What do you consider as digital information literacy skills (e.g., writing skills, computer literacy, research skills, etc.)

### Section B: Digital information literacy skills of geoscientists

6. From your experience with supervising geoscientists, do you think geoscientists possess the relevant digital information literacy skills? (**Researcher to probe further** i.e. Why do you think so?)

7. What do you think are the most critical digital information literacy skills that geoscientists need the most for their daily work at the Division?
8. How do geoscientists integrate digital information literacy skills in their workplace environment?

**Section C: Services provided to enhance digital information literacy skills of the geoscientists**

9. Does your division support geoscientists in acquiring digital information literacy skills? (Researcher to probe further: **If yes, how? And if no, why**)
10. As an experienced geoscientist, do you think NESEIC Library provides services that enhance geoscientists' digital information literacy skills?

**Section D: Digital information literacy skills challenges**

11. What barriers or challenges are geoscientists currently encountering at the workplace in relation to digital information literacy?
12. How are these challenges being addressed at the Divisional level or organisational level?
13. What other key role players do you think could be involved in curbing these challenges?

**Section E: Strategies in support of the acquisition and enhancement of digital information literacy skills of geoscientists**

14. As a supervisor, what strategies do you think should be put in place to enhance geoscientist digital information literacy skills?
15. How are these strategies aligned to the GSN priorities?

**Section F: General comments**

16. Are there any other issues relevant to the research topic of this study that you would like to bring to the attention of the researcher?

**Thank you for your time and contribution to the study!**

**[Time: __ ]** **[Date: __ ]**

## Appendix 3: Semi-structured interview schedule for NESEIC Librarians

## Analysis of digital information literacy skills of geoscientist at the Geological Survey of Namibia

### Description of research and participation

My name is Martin V.S. Hipangwa and I am a Master of Library and Information Studies (MLIS) student in the Department of Knowledge and Information Stewardship at the University of Cape Town. I am currently carrying out an analysis of the digital information literacy skills of geoscientists at the Geological Survey of Namibia (GSN). The study is being supervised by Dr Andiswa Mfengu. The objective of this study is to critically analyse the level of digital information literacy skills of the geoscientists within the Geological Survey of Namibia. The study is underpinned by the Academic and Research Libraries (ACRL) Information Literacy Framework (Academic and Research Libraries, 2016). As part of this study, I need to interview National Earth Science and Energy Information Center (NESEIC) Librarians, to get in-depth understanding of the digital information literacy skills of geoscientists working at GSN. The interview will take approximately 45 minutes and you have consented to the interview being **recorded or not recorded.**

### Section A: Background information

1. What position are you serving in?
2. How long have you been serving in this position?
3. What academic qualifications do you hold?
4. How often do you interact with geoscientists?
5. What platforms do you use to engage with geoscientists?

### Section B: Digital information literacy skills of geoscientist

6. From your experience as you interact and provide services to geoscientists, do you think geoscientists possess the relevant digital information literacy skills?

7. By virtue of being a librarian, what do you think are the most critical digital information literacy skills that geoscientists need the most for their daily work at the Directorate?

**Section C: Services provided by National Earth Science and Energy Information Centre**

8. Geoscientists are the primary users of the NESEIC Library, what are the current library services provided by the NESEIC Library? (**Researchers to probe:** How often does the library provide these services? Do geoscientists utilise these services? How often do they use these services?)
9. How do these services enhance digital information literacy skills of the geoscientists?

**Section D: Digital information literacy skills challenges**

10. What barriers or challenges do you think geoscientists are currently encountering at the workplace in relation to digital information literacy?
11. How are these challenges being addressed at organisational level, specifically by NESEIC Library?
12. What other key role players do you think should be involved in curbing these challenges?
13. What challenges, if any, do you think NESEIC Library face in assisting geoscientists with enhancing their digital information literacy skills?

**Section E: Strategies in support of the acquisition and enhancement of digital information literacy skills of geoscientists**

14. What are some of the strategies that you think can be put in place to enhance geoscientist digital information literacy skills by NESEIC Library?
15. How are these strategies aligned with the GSN priorities?

**Section F: General comments**

16. Are there any other issues relevant to the research topic of this study that you would like to bring to the attention of the researcher?

**Thank you for your time and contribution to the study!**

**[Time: __ ]  [Date: __**

## Appendix 4: Information sheet for interviews

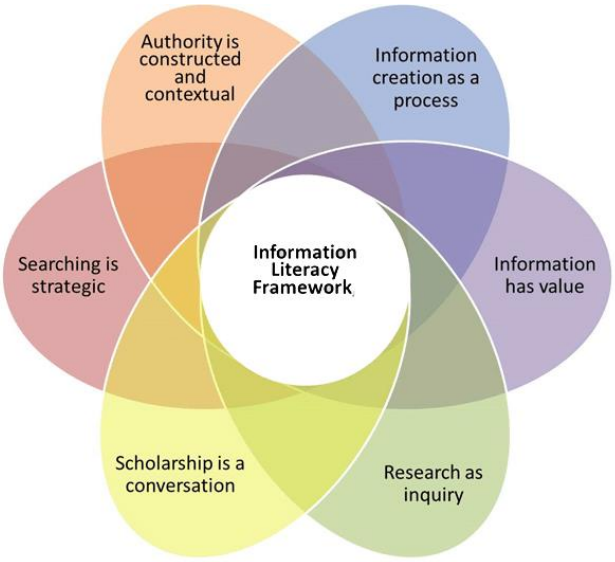
## Analysis of digital information literacy skills of geoscientist at the Geological Survey of Namibia

### Purpose:

To get the grasp of digital information literacy skills, participants are encouraged to go through this information sheet before the interview**.**

**Digital information literacy** is the ability to function in a knowledge society through the appropriate use of information and communication technology to solve information problems, including the ability to research, organise, and synthesize information through digital technology (Sparks, Katz & Beile, 2016:3-4).

The study is using the Association of Research and Academic Libraries Framework for Information Literacy for High Education to analyse digital information literacy skills of geoscientists.




The framework is organised into six frames, each consisting of a concept central to information literacy.

1. **Authority is constructed and contextual:** Experts know how to seek authoritative voices but also recognize that unlikely voices can be authoritative, depending on need. Novice learners may need to rely on basic indicators of authority, such as type of publication or author credentials, where experts recognize schools of thought or discipline-specific paradigms.

2. **Information creation as process:** Recognising the nature of information creation, experts look to the underlying processes of creation as well as the final product to critically evaluate the usefulness of the information. Novice learners begin to recognise the significance of the creation process, leading them to increasingly sophisticated choices when matching information products with their information needs.

3. **Information has value:** Information possesses several dimensions of value, including as a commodity, as a means of education, as a means to influence, and as a means of negotiating and understanding the world. Legal and socioeconomic interests influence information production and dissemination.

4. **Research as inquiry:** Research as Inquiry Research is iterative and depends upon asking increasingly complex or new questions whose answers in turn develop additional questions or lines of inquiry in any field.

5. **Scholarship as a conversation:** Communities of scholars, researchers, or professionals engage in sustained discourse with new insights and discoveries occurring over time as a result of varied perspectives and interpretations.

6. **Searching as strategic exploration:** The act of searching often begins with a question that directs the act of finding needed information. Encompassing inquiry, discovery, and serendipity, searching identifies both possible relevant sources as well as the means to access those sources.

**Adopted from ACRL Framework of Information Literacy Framework (2016)**

**END**

## Appendix 5: Auto-ethnography guide

## Analysis of digital information literacy skills of geoscientist at the Geological Survey of Namibia

### Preamble

My name is Martin V.S. Hipangwa and I am a Master of Library and Information Studies (MLIS) student in the Department of Knowledge and Information Stewardship at the University of Cape Town. I am currently carrying out an analysis of the digital information literacy skills of geoscientists at the Geological Survey of Namibia (GSN). The study is being supervised by Dr Andiswa Mfengu. The objective of this study is to critically analyse the level of digital information literacy skills of the geoscientists within the Geological Survey of Namibia. The study is underpinned by the Academic and Research Libraries (ACRL) Information Literacy Framework (Academic and Research Libraries, 2016). As part of this study, I am conducting an auto-ethnography to get an in-depth understanding of the digital information literacy skills of geoscientists working at GSN. The auto-ethnography is informed by the study's four critical questions.

Auto-ethnography is regarded as a personal approach to qualitative research, involving introspection, writing, reflection and connection to the wider social, political, and cultural understandings of the meanings made of personal experience (Fourie, 2021:198). This guide will therefore guide the narrative auto-ethnography where the researcher will journal and incorporate the auto-ethnographer's experiences to analyse the geoscientist digital information literacy skills. This instrument is used as a secondary qualitative data collection method for the study.

[Note: The researcher will be guided by the following questions in conducting autoethnography]

### Section A: Background information

1. How long have you been supporting geoscientists in your capacity as a librarian?
2. In your day-to-day encounter with geoscientists, librarians and managers at GSN, do you think they understand what digital information literacy is?

**Section B: Digital information literacy skills of geoscientist**

3. In your experience and working at the GSN, do geoscientist possess relevant digital information literacy skills?

4. What do you think are the most critical digital information literacy skills that geoscientists need the most for their daily work at the Directorate?

5. In your experience with geoscientists, how do they integrate digital information literacy skills in their workplace environment?

**Section C: Services provided by National Earth Science and Energy Information Centre**

6. Geoscientists are the primary users of the NESEIC Library, what are the current library services provided by the NESEIC Library?
7. In your experience supporting geoscientist, how do you think these services enhance digital information literacy skills of the geoscientists?

**Section D: Digital information literacy skills challenges**

8. What barriers or challenges that geoscientists are currently encountering at the workplace in relation to digital information literacy?
9. How are these challenges being addressed at GSN?
10. What other key role players may be involved in curbing these challenges?
11. What challenges, if any, does NESEIC Library face in assisting geoscientists with enhancing their digital information literacy skills?

**Section E: Strategies in support of the acquisition and enhancement of digital information literacy skills of geoscientists**

12. What are some of the strategies that you think can be put in place to enhance geoscientist digital information literacy skills by NESEIC Library?
13. How are these strategies aligned with the GSN priorities?

**Section F: General comments or reflections**

14. Any general comments, experiences or personal reflections related to the study?

**END**

## Appendix 6: Informed consent for interviews

## Analysis of digital information literacy skills of geoscientist at the Geological Survey of Namibia

### Description of the research and participation

My name is Martin V.S. Hipangwa and I am a Master of Library and Information Studies (MLIS) student in the Department of Knowledge and Information Stewardship at the University of Cape Town. I am currently carrying out an analysis of digital information literacy skills of geoscientists at the Geological Survey of Namibia (GSN). The study is being supervised by Dr Andiswa Mfengu. The objective of this study is to critically analyse the level of digital information literacy skills of the geoscientists within the Geological Survey of Namibia. The study is underpinned by the Academic and Research Libraries (ACRL) Information Literacy Framework (Academic and Research Libraries, 2016). As part of this study, I need to interview geoscientists who are managers on a supervisory level (GNS Management) and Librarians to get an in-depth understanding of digital information literacy skills of geoscientists working at GSN. The interview will take approximately 45 minutes.

### Anonymity and confidentiality

Please be assured that your participation in this study is confidential and no personal information will be identifiable. You will not be identified in any specific way and all responses in this study will be treated with utmost confidentiality. Your responses will only be used for research purposes.

### Voluntary participation

Your participation in this study is voluntary, and you have the right to withdraw from the interview at any time. Please be aware that you are not under any obligation to answer the questions that I will be asking. The interview will only be recorded as per your agreement. Your participation will be greatly appreciated.

**Benefits**

There are no direct personal benefits for participating in this study. However, the study will contribute to enhancing the understanding of the geoscientists' digital information literacy skills, which may also be beneficial to the GSN.

**Contact information**

If you have any questions or concerns about this study, please contact:

Martin Hipangwa (Researcher)
hpnmar004@myuct.ac.za

Dr Andiswa Mfengu (Supervisor)
andiswa.mfengu@uct.ac.za

+264817497874

**Consent**

I freely consent to take part in this study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop participating at any point should I not wish to continue. I also confirm that the purpose of the study has been fully explained to me. I understand that this is a research project whose purpose is not necessarily to benefit me personally in the immediate or short term. I also understand that my participation will be treated with confidentially.

I **agree/disagree** (*circle your preference*) to the interview being recorded.

**Signature of participant:** ……  **Date:** ……

**Signature of researcher:** ……  **Date:** ……

## Appendix 7: UCT Ethics approval letter

**Department of Knowledge and Information Stewardship**
University of Cape Town
Upper Campus

Private Bag X1, RONDEBOSCH, 7701 South Africa
Level 5 Hlanganani, Chancellor Oppenheimer Library
Tel: +27 (0) 21 650 4546 Fax: +27 (0) 21 650 2529
E-mail: dkis@uct.ac.za
Web: www.dkis.uct.ac.za

Ref. no.: UCTDKIS2022-10-10 01 November 2022

Dear Mr Hipangwa

The Ethics Review Committee of the Department of Knowledge and Information Stewardship has granted ethical clearance on behalf of the Humanities Faculty of the University of Cape Town for your Master's study entitled: *Analysis of the digital information literacy skills of geoscientists at the Geological Survey of Namibia.*

You are reminded to seek further permissions from the Ministry of Mines and Energy, Namibia, before commencing with your data collection at the Geological Survey of Namibia.

I wish you well with your study.

Yours sincerely,

Michelle Kahn

Chair, Department (DKIS) Research Ethics Committee

## Appendix 8: Ministry of Mines and Energy ethics approval letter

REPUBLIC OF NAMIBIA

MINISTRY OF MINES AND ENERGY

Tel.: +264 61 284-8111
Fax: +264 61 238643 / 220386
E-mail: info@mme.gov.na
Website: www.mme.gov.na

6 Aviation Road
Private Bag 13297
WINDHOEK

02 November 2022

Mr. Martin Hipangwa
PO Box 833
Ohangwena
Email: Martin.Hipangwa@mme.gov.na
Telephone: +264 61 284-8200

**RE: REQUEST TO CONDUCT A RESEARCH STUDY AT THE MINISTRY OF MINES AND ENERGY, GEOLOGICAL SURVEY OF NAMIBIA DIRECTORATE**

This is to acknowledge receipt of your letter seeking permission to collect data through questionnaires and interviews. This letter serves to grant Mr. Hipangwa a student at UCT who is pursuing a master's degree in library and information studies to collect data for his research study on Analysis of digital information literacy skills of geoscientist at the Geological Survey of Namibia. The Ministry of Mines and Energy has no objection to the proposed study of Mr. Hipangwa, furthermore, we will support him wherever possible.

It is envisaged that the outcome of the study will provide areas of improvement of the service to the library users and the staff members

Sincerely

MINISTRY OF MINES AND ENERGY
OFFICE OF THE EXECUTIVE DIRECTOR
2022 -11- 02
Private Bag 13297
Windhoek

Simeon N. Negumbo
**Executive Director**

All official correspondence must be addressed to the Executive Director