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Professionals' Digital Information Literacy Skills: A Case of Geoscientists in Namibia

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Abstract
Digital information literacy plays a critical role in transforming how professionals navigate and interact with the ever-changing and evolving information technology landscape. The digital information landscape has significantly influenced and changed how individuals work and collaborate therefore necessitating professionals to continuously upskill and reskill to effectively function in their professions. This paper reports the findings from a study undertaken at the Geological Survey of Namibia. The objective of the study was to explore the digital information literacy skills of geoscientists. The Association of College and Research Libraries Framework of Information Literacy for Higher Education (2016) was used as a theoretical support for the study which used mixed methods. The study employed a questionnaire designed for this purpose. Fifty -three geoscientists were given copies of the questionnaire and 32 responded (60%). A semi-structured interview was used to collect information from seven managers and three librarians. The study findings reveal that geoscientists have basic information processing skills but have limited skills to appropriately evaluate and use digital information technology tools. Findings also highlight that there is a need to prioritise digital information literary training, collaborative spaces, professional support, funding and continuous training to ensure that professionals like geoscientists' have adequate digital information literacy skills to effectively function in their roles. Therefore, the study recommends that key role players should collaborate to develop programmes to enhance digital information literacy skills of professionals like geoscientists, so they are equipped to navigate this rapidly changing digital era.

Keywords: Digital Information Literacy, Skills, Geoscientists, Geological Survey of Namibia.

Introduction

The digital information landscape has dramatically influenced and changed the way people live and work, calling for a 'new' set of skills to fully participate in and benefit from a digital information-based economy (Bartolomé et al., 2021; Shin and Jeon, 2023; Smith-Aldrich, 2024; Sparks et al., 2016). Many professional jobs are going through fundamental transformation, so are the skill sets required to do them (Bartolomé et al., 2021) and geoscience as a profession is not exempt from these fundamental changes. With the digital transformation, professionals are continuously having to keep abreast with the relevant skills to effectively function in this evolving digital information landscape. The integration of advanced technologies like connectivity, artificial intelligence, robotics and machine learning in the workplace not only requires staff to know how to navigate these disruptive innovations but requires employees to have

dynamic skills and need to continuously develop their capacity. The Fourth Industrial Revolution (4IR) and other disruptive innovations have increased the need for a well skilled workforce (Kivunja, 2014). The job market calls for employees who are self-aware of their digital information literacy (DIL) abilities and able to seek out professional development as needed. This is crucial for employees to stay informed about the rapidly changing workplace landscape and take advantage of technological advancements (Falloon, 2020). While information literacy has been around for decades, the shape and form of information and access to information needed continue to evolve and have become more complex (Mardani and Silalahi, 2021). As a result of this evolution and complexity, information literacy and digital literacy are intertwined. Digital information literate (DIL) individuals can utilise information and communication technologies to locate, comprehend, assess, produce and share digital information (Becker, 2018). Sparks et al. (2016) consider DIL as the skills that enable 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.

The fast-evolving work environment and the dynamic information technology landscape require 'new' and different skills (Aharony et al., 2017). Institutions such as libraries are regarded as the information hubs of many governments, private and non-governmental organisations. These play a critical role in improving outcomes linked to the UN 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). DIL skills are critical in this digital workplace environment because they enable interaction between peers and technologies for information and knowledge management (Mohammadi, 2024). Furthermore, DIL skills can enable the workforce to manage explicit knowledge by generating, transforming and applying it in real-life situations such as the workplace. Individuals with digital information literacy can effectively evaluate and use resources mediated through the organisational network to solve problems, which is the organisation's social capital (Widén et al., 2021). DIL is increasingly becoming a prerequisite for employment in today's job market because many industries require proficiency in digital tools and technologies. Despite the impact that these skills have in the workplace, there are still areas that have not yet been explored, necessitating the exploration of DIL skills within different professional settings, hence this study.

Research Context

This study was conducted at the Geological Survey of Namibia (GSN), which is a directorate within the Namibian Ministry of Mines and Energy, established in the early 1900s. It oversees geological research and mining activities in Namibia. The GSN is divided into six divisions: Regional Geoscience, Economic Geology, Geophysics, Geochemistry, Engineering, and Environmental Geology (Schreiber and Nguno, 2008). Today GSN is a modern research institute, and the core tasks are mapping, mineral exploration, research in geophysics, geochemistry and geoengineering. Some departments also deal with regulatory functions, geohazards, education, environment, water resources and land use planning (Schneider, 2016). The Geological Survey of Namibia is responsible for disseminating geological research data which are accessible through databases such as Earth Data Namibia (EDN) (Schreiber and Nguno, 2008). The directorate hosts both the National Earth Science Museum and the National Energy and Earth Science Information Centre (NESEIC) library. In the context of this study, geoscientists refer to employees in the field of earth sciences to characterise its materials, understand the processes that shape it, and unravel its history (Shar, 2013), and they make up the employees' populace at GSN. Geological survey libraries are classified as research libraries with unique features because they are subject-specific. NESEIC library has unique collections that cover areas spanning earth sciences, energy, sustainable development, and other interdisciplinary fields that cut across these areas. Staff members, who are mostly made up of geoscientists and support staff members such as librarians, are the primary users of the NESEIC library. Post-COVID-19, geoscientists have highly sought digital services, which necessitated this study to critically analyse the staff members' digital information literacy skills for better service provision, access and utilisation of these resources.

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, limit their activities or seek safe spaces, years later this challenge identified by IFLA still persists. In addition to the problems posed by digital spaces, there is an increase in misinformation, disinformation, fake news and information overload which may deter individuals from engaging with digital information. A digital information literate individual can leverage the benefits of the digital era and digital information while being critical of available information, technology and tools. A study in Namibia by Robert (2015), focused on information retrieval knowledge of users using National Earth Science and Energy Information Centre (NESEIC) databases and identified a gap in information literacy skills of the users, including geoscientists, a decade later, this is still the case specifically with DIL skills gap. In Namibian and other African countries context, limited studies have explored the relationship between DIL skills and the professionals in research-intensive institutions.

Creswell and Creswell (2018) dispute that a research problem "might spring from an experience researchers have had in their personal lives or workplaces". In the researchers' experience as a librarian at NESEIC, geoscientist DIL skills tend to be limited as they find it difficult to effectively navigate, evaluate and use information available on digital platforms. Similarly, from the literature, little has been written on the digital information skills possessed by scientists and how these skills serve as an enabler in their professional work from the African context. The researcher also observed, especially during the COVID-19 pandemic as researchers needed to work virtually and collaborate, a skills gap related to DIL as the library received an increased number of requests to assist with navigating and accessing digital databases. While previous studies have explored digital information literacy skills in sub-Saharan Africa, many of these studies have focused on students and higher education institutions therefore there is a research gap concerning the digital information literacy skills of professionals, especially in research-intensive institutions.

Hence, the main objective of the study was to critically analyse the DIL skills of the geoscientists within the Geological Survey of Namibia (GSN). The following research questions were used to address this objective:

1. What DIL skills do the geoscientist possess?
2. What challenges or gaps do geoscientists have in relation to DIL skills?
3. What strategies can be employed to support the acquisition and enhancement of DIL skills of geoscientists?

Literature Review

Literacy is generally regarded as the ability to read and write. The concept of information literacy (IL) was first put forth by Zurkowski (1974), and defined by the Association of Research and College Libraries [ACRL] (2016) as the 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. IL is an umbrella term for different literacies such as critical information literacy, workplace information literacy, digital information literacy, etc. These terms can be used interchangeably with IL, but they are different depending on the lens and context they are used in. This study focuses on digital information literacy (DIL), which 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 synthesise information through digital technology and having a fundamental understanding of the ethical/legal issues surrounding the use of such information (Sparks et al., 2016). Digital Information Literacy, a 21st-century literacy, encompasses various life and soft skills required to navigate the rapidly evolving digital information environments (Chigisheva et al., 2021). Reddy et al. (2020) comprehensive view of DIL captures the essence of DIL; which is the ability to use digital technology to search for, locate, analyse, and synthesise information resources, evaluate their credibility, apply appropriate citation methods and ability to adhere to legal and ethical considerations. Although much has been written about DIL skills, less has been written about professionals' DIL skills in the African context. Tokarz and Bucy (2019) carried out a content analysis of articles published in *Communications in Information Literacy* and concluded that information literacy is a global concept; however, United States of America (USA) authors

and journals dominate the global landscape and they recommended that the USA should make more space for others to join the conversation. In Africa and the global south, although the concept is not new, literature on DIL is still limited compared to that on information literacy. Furthermore, Audrin and Audrin (2022) state that, in the past two decades, the number of publications related to DIL 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 many studies, it becomes difficult to comprehend the field of research and to gain a comprehensive understanding of the unique aspects and areas of focus. Thus, more focused in-depth, and empirical studies on DIL need to be carried out in the global south to address this disparity.

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 growth. Bartolomé et al. (2021) argue that knowing how to use some computer programs or applications is not enough, but skills such as problem-solving and digital literacy skills are required in a technology-rich environment. The 4IR which focuses on digital technologies has dramatically transformed our lives as well as the knowledge and skills required to navigate this digital era. Kivunja (2014) asserts that, with the plethora of information formats in the 21st century, employees will be required to manage digital information daily and, thus, need to be prepared. This is still true almost a decade later, and the need has been further highlighted. This shift to digital, as observed specifically during the COVID-19 pandemic period, has created a need for individuals to have a more advanced set of knowledge and skills to participate in ongoing discourse and knowledge creation (Sparks et al., 2016). This highlights the need for individuals to not only be information literate but also digital information literate. Without these skills, individuals may struggle to navigate the digital information landscape, putting them in a disadvantaged position in the digital economy (IFLA, 2017).

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). This has resulted in the increasing importance of DIL. 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 (Mishra, 2018; Nikou and Aavakare, 2021). Wellings and Casselden (2017) employed a mixed methods approach in an exploratory study to investigate the information-seeking behaviour of scientists and engineers in the United Kingdom. While the study did not investigate the DIL skills of these engineers or scientists, it did conclude that both groups use Google to find information. The study further revealed that engineers seek help from librarians, while scientists conduct independent searches of subject-specific information sources.

The development of DIL in the global south is not well conceptualised compared to the countries in the global north (Flywel and Jorosi, 2018; Noll, 2017). Despite information literacy having a positive impact on lifelong learning, a lack of relevant skills to use the information may be detrimental to the organisation in the case of professionals. Dabengwa (2018) concluded that the absence of a formal learning curriculum and training resources in academic libraries in Africa 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 falls short of its mandate of ensuring that users are well-equipped with relevant skills. Moreover, inadequate efforts to train civil servants by the government, digital divide, and inexperienced librarians are some of the challenges that hinder the DIL among working professionals (Dabengwa, 2018; Mbatha, 2015; Noll, 2017). To overcome these challenges, Rybin Koob et al. (2022) advocate for digital accessibility and information literacy training in research libraries, which requires collaboration and ongoing capacity building.

As evident in the literature, DIL and lifelong learning provide individuals with the knowledge and skills to effectively navigate, evaluate, and use digital tools and information, to enable them to grow and adapt in a constantly evolving digital environment (Solmaz, 2017). This ultimately enhances users' information-seeking behaviour and increases their interest in using library services through online or mobile platforms (Hashim et al., 2022). Technological advancements have 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 use information has necessitated that libraries

adapt their services, and be proactive to align with changing user needs and expectations, especially in relation to 'new' technological innovations and relevant skills.

Supporting Theoretical Framework

The study is supported by the 2015 Association of College and Research Libraries (ACRL) Framework for Information Literacy, which encourages cooperation between librarians and users, recognising that information literacy is not solely the responsibility of the library but a collective effort = (Berman and Kuden, 2017). While the framework has been applied mainly in the higher education context, in the absence of relevant frameworks, researchers tend to borrow theories or frameworks. The framework is made of six frames that present the big ideas through which to view information literacy (DIL, in the case of this study) with the hope of drawing emphasis on how these ideas are internalised by the information users (Sparks et al., 2016). The six frames reflect a more integrative organisation of the skills because they have taken a less fragmented and more comprehensive approach to information literacy and, by extension, DIL. 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 geoscientists are considered as researchers. DIL at a professional level is experienced at a broader level (Sayyad Abdi, 2017). The broader context enables professionals to encounter and recognise a wider range of information experiences that occur in the wider workplace environment and these experiences can be unique due to organisational culture of that specific workplace. Therefore, utilising the ACRL framework was deemed suitable for analysing the DIL of geoscientists within the GSN. The framework is widely adopted in IL research globally because it 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 to develop genuine expertise within a discipline or profession. Some critics regarded the ACRL framework as very narrowly focused on library-centered activities and skills (Beilin, 2015), however, this study used multiple voices from librarians, managers, and geoscientists to get a balanced view of DIL skills.

Methodology

The study employed a convergent parallel mixed methods approach to explore the DIL skills of geoscientists at the Geological Survey of Namibia (GSN). A case study research design was adopted to provide an in-depth analysis of the DIL skills of geoscientists at GSN. The study respondents included 32 (60%) geoscientists (out of 53 in total), seven (out of 13) managers, and three (out of four) librarians working at GSN. The study collected quantitative data from geoscientists through an online questionnaire survey, with a response rate of 60% (n=32). Qualitative data was collected using semi-structured interviews with seven purposively sampled managers and three librarians within GSN (see Table 1). Analysis of quantitative and qualitative results were merged to complement each other to provide insights into the problem at hand (Creswell and Clark, 2018). Quantitative findings are presented using tables displaying the frequencies (*f*), percentages (%), mean (M), and standard deviation (SD). Thematic content analysis was used to analyse qualitative data from interviews, and triangulation was used to merge both qualitative and quantitative data.

Table 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 and Technical Assistants		
Directorate Executives	2	-	-	-	-	-
Economic Geology	1	1	4	3	-	1
Regional and Mapping Geology	1	3	10	-	-	2
Geo-Information	1	1	2	-	4	5
Geophysics	1	2	4	4	-	1
Geochemistry and Laboratory	1	2	4	4	-	1
Engineering and Environment Geology	1	-	3	1	-	-
Total population	8	9	27	12	4	
Total sample per group of participants	7	3	17	12	3	
Total sample	32 (Questionnaire respondents)				10 (Purposive sampled managers and librarians)	

Results and Discussions

The study was supported by the ACRL Framework of Information Literacy Skills, which is mainly used in academic settings and was adopted for the professional setting to explore DIL in a research-intensive institution. Respondents in the questionnaire were required to indicate their job titles, 60% of the 53 geoscientists responded to the survey and the majority 53% (17) of respondents were senior geoscientists, 28% (9) geoscientists followed by three 9% (3) chief geoscientists and 9% (3) technical assistants who responded to the questionnaire (see Figure 1). None of the Deputy Directors, Directors, and Deputy Executive Director completed the questionnaire, however, this group was interviewed as part of GSN management. The majority 40% (13) of the respondents, have been employed at GSN for 6-10 years, giving the impression that their experiences were 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% (see Figure 1).

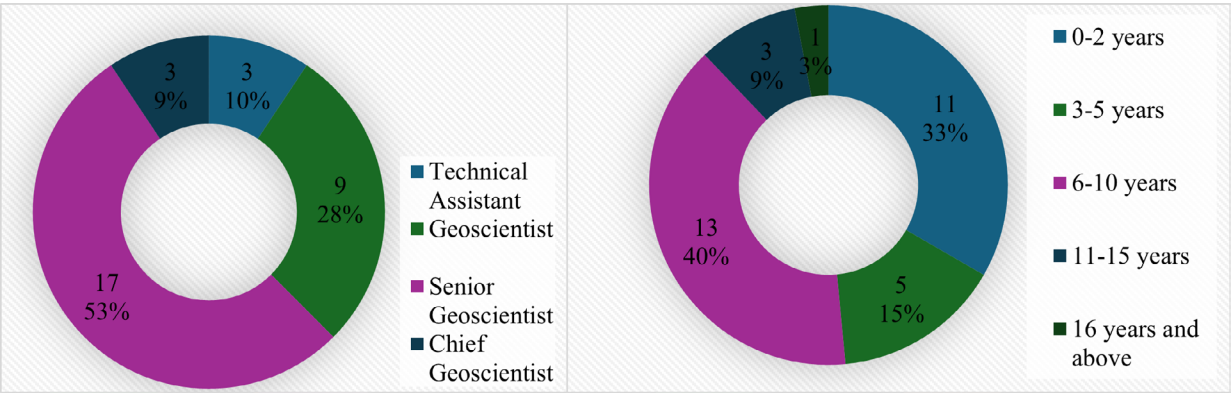

Figure 1: Geoscientists' Job Titles and Geoscientists' Number of Years Working at GSN (N=32).

Lastly, in terms of the biographical information of geoscientists, they were asked to indicate their highest educational qualification, as this was vital to aid in effectively analysing their digital information literacy skills. Most geoscientists, 63% (20) of the geoscientists hold an Honours degree whilst 28% (9) hold a Master's degree as the highest qualification (see Figure 2). In addition, interviewed GSN managers indicated that they have been in service for 15 years or more and each supervises at least three or more subordinates under their Subdivisions. On the other hand, interviewed librarians are all holders of Honours degree in Library and Information Sciences (LIS), and have been in service for over 3 years. Thus, various data collected from the various groups of participants and respondents yielded much-needed information given a rich background biographical information.

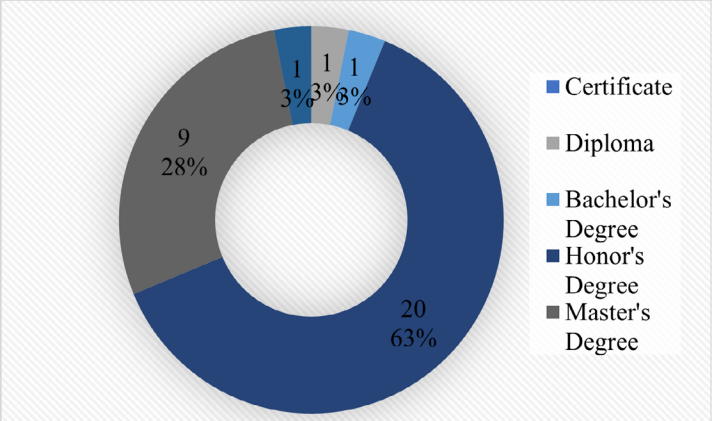

Figure 2: Geoscientists Highest Level of Qualification (N=32).

The study explored the DIL skills of geoscientists, and the majority of geoscientists generally had a moderately high level of competency in DIL skills. In the first frame, '*authority is constructed and contextual'*, the findings show that the majority of the surveyed geoscientists (59% and 62% respectively, for the first two dispositions in this frame) have a moderately high level of competency and very few (16%) have high competence in this frame (see Table 2). This might be attributed to the fact that geoscientists are still trying to keep up with the exponential growth of digital transformation, hence the average to moderately high level of competence in this frame. In a similar study by Mahmood et al. (2021), their results revealed that the participants had a good to a moderate level in relation to DIL skills, however, they were not confident in applying advanced search options. This study found that 50% (M=3.3 and SD=0.71) of the questionnaire survey respondents are highly skilled in '*applying a critical eye to information before usage'* (see Table 2). As reported by other scholars (Mishra, 2018; Nikou and Aavakare, 2021), the need to properly evaluate information is not new to the digital age. Similarly, as stated earlier by Solmaz (2017), hinting at the exponential growth of digital information and the need for users to critically evaluate digital information. Cronbach's alpha coefficient (0.81) for this frame indicated a good internal consistency.

Table 2: Authority is Constructed and Contextual (N=32).

Statements	Level of Competence										Cronbach's Alpha= 0.86	
	0(None)		1(Low)		2(Average)		3(Moderate high)		4(High)			
	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**	**0.72**
Identifying authority of different sources	0	0%	0	0%	7	22%	20	62%	5	16%	**2.9**	**0.67**
Applying a critical eye to information before usage	0	0%	0	0%	5	16%	11	34%	16	50%	**3.3**	**0.71**

In the '*information creation as a process*' frame, specifically '*understanding different modes and formats of information'*, the study found that geoscientists have moderate-high to high levels of competence (82% in total, M=3 and SD=0.84 (average)) in this frame (see Table 3). Similarly, findings from interviewed geoscientists revealed that geoscientists can search and access information using digital platforms such as Earth Data Namibia and NESEIC e-resources databases at GSN. A few geoscientists (18% in total) indicated that they have a low level of competency in this frame's dispositions (see Table 3). Robert's (2015) study focused on information retrieval knowledge of users using National Earth Science and Energy Information Centre (NESEIC) databases and found that there were limited information literacy skills among participants.

Table 3: Information Creation as a Process (N=32).

Statements	Level of Competence										Cronbach's Alpha= 0.81	
	(None)		1(Low)		2(Average)		3(Moderate high)		4(High)			
	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**	**0.91**
Understanding different modes and formats of information	0	0%	2	6%	4	12%	14	44%	12	38%	**3.2**	**0.86**
Understanding different methods of information dissemination	0	0%	1	3%	3	9%	15	47%	13	41%	**3.3**	**0.74**
Accepting the ambiguity expressed in emerging formats or modes	0	0%	1	3%	11	34%	11	34%	9	28%	**2.9**	**0.86**

Findings from librarians through interviews revealed that geoscientists are 'fairly skilled' as the majority only have basic information literacy skills. Librarian 3 opined that "*geoscientists tend to be heavily reliant on librarians as their search engines rather than for guidance*". However, GSN manager 3 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".* This is contrary to someone who is digitally information literate as they need to be able to function in a knowledge society through the appropriate use of ICTs. A study by Polizzi (2020) also agreed that functional and critical digital skills and knowledge of navigating the Internet and the digital environment need to complement basic information literacy skills. The findings from interviewed librarians and GSN managers differ from those from geoscientists in the '*information creation as a process*' frame, librarians and GSN managers regarded geoscientists as being less skilled in this

frame. The librarians' views are likely because they interact with geoscientists when they require assistance with accessing and using library resources, while GSN managers are geoscientists themselves and work directly with geoscientists in their professional roles. While the contexts in which librarians and GSN managers interact with geoscientists are different, the views are similar.

In the third frame, '*information has value'*, most of the respondents (17, 53%) rated themselves as having a high level of competency, whilst only 5 (16% in total) geoscientists regarded themselves as having a low level of competency or none in 'respecting others original ideas' (see Table 4). In a similar study with librarians, Khan (2020) noted that the DIL skills of librarians in Pakistan were found to be low and recommended that due to the high demand for these skills, librarians need to acquire these skills to better support users, which is no different in the case of geoscientists. Findings also revealed that the majority (56% in total) of geoscientists are moderately high and highly skilled in 'respecting the original idea of others'. This is because most of the surveyed geoscientists hold higher degrees such as bachelor's and master's degrees and thus should have been exposed to referencing training and praxis in research.

Table 4: Information has Value (N=32).

Statements	Level of Competence										Cronbach's Alpha= 0.67	
	0(None)		1(Low)		2(Average)		3(Moderate high)		4(High)			
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
Respecting the original ideas of others	0	0%	1	3%	4	13%	10	31%	17	53%	**3.4**	**0.81**
Contributing to the information marketplace rather than consuming only	1	3%	4	13%	9	28%	10	31%	8	25%	**2.7**	**1.11**
Inclined to examine one's information privilege	0	0%	2	6%	8	25%	13	41%	9	28%	**2.9**	**0.87**

In the fourth frame '*research as inquiry'*, the majority (27, 84% in total) of geoscientists indicated having a moderately high and high level of competence viewing research as an open-ended exploration, with only one 1 (3%) acknowledging that they have a low level of competency (see Table 5). Many geoscientists are either average or moderately high in this frame which further reflects that geoscientists are proficient in engaging in research as expected, as this is a key performance indicator for them. Librarian 2 explained that "*geoscientists who are currently studying are better positioned with digital information literacy skills because this was evident in their research work, day-to-day work, and interaction with librarians".* A study by Sparks et al. (2016) 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 developing countries, like Namibia, are often viewed as struggling to publish research, and most of their articles are turned down by international journals due to plagiarism claims and lack of English proficiency (Amarante et al., 2021). But in this case, geoscientists are engaged in various research activities and publish in regional journals, hence the average to moderately high rating. In addition, geoscientists rated themselves as mostly having a moderately high competency and at times, high competency (78% in total) for 'follow ethical and legal guidelines'. In addition, GSN manager 5 indicated that "*we deal with research every day and I can say geoscientists are good at it*". This was expected as most geoscientists are involved in various research activities in the organisation and are aware of research integrity principles. These findings were supported by interviewed librarians who noted that geoscientists who are currently studying are better positioned with DIL skills, an observation noted earlier. Similarly, one interviewed manager also revealed that due to the geoscientist's exposure to research, they are highly skilled in this frame. A contrary finding by Amarante et al. (2021) revealed that the under-representation of global south researchers in research on development in the south might plausibly be attributed to deficiencies in research skills. This study found that geoscientists are skilled in research as inquiry against the background of DIL skills, however, this was a small sample and, in a research-focused institution, the case might be different for other institutions in the global south.

In the fifth frame '*scholarship as conversation,'* the majority of the geoscientists in the questionnaire rated themselves moderately high to a high level of competency for dispositions such as 'recognising ongoing scholarly conversation' (71% in total) and 'scholarly conversations take place in various venues' (81% in total) (see Table 6). Some studies highlighted a lack of scientific networks (Amarante et al., 2021) exposure to the outside world (Malanga and Chigona,

2018), and a lack of opportunities that hinder scholars from engaging with other professionals beyond their reach. Hence, these may be a hindrance in acquiring relevant skills in this frame. Other studies have shown that the workplace environment 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 and Kaur, 2014). Conversating with other professionals on current trends and discoveries or research results provides an opportunity for peer feedback, which improves scholarship; hence it is deemed important in this frame and in acquiring and enhancing DIL skills. Numerous studies have assessed the DIL skills of different population groups and argued that such skills empower individuals with independent learning and critical thinking (Dabengwa, 2018; Malanga and Chigona, 2018; Naveed and Rafique, 2018).

Table 5: Research As Inquiry (N=32).

Statements	Level of Competence										Cronbach's Alpha= 0.89	
	0(None)		1(Low)		2(Average)		3 (Moderate high)		4(High)			
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
Research as an open-ended exploration	0	0%	1	3%	4	13%	15	47%	12	38%	**3.2**	**0.76**
Value intellectual curiosity	0	0%	1	3%	10	31%	11	34%	10	31%	**2.9**	**0.87**
Maintaining an open mind and a critical stance	0	0%	1	3%	6	19%	14	44%	11	24%	**3.1**	**0.80**
Value persistence, adaptability, and flexibility	0	0%	2	6%	6	19%	16	50%	8	25%	**3.0**	**0.82**
Seeking multiple perspectives.	0	0%	1	3%	7	22%	10	31%	14	44%	**3.2**	**0.86**
Seeking appropriate help when needed	0	0%	2	6%	6	19%	10	31%	14	44%	**3.1**	**0.93**
Follow ethical and legal guidelines	0	0%	0	0%	7	22%	9	28%	16	50%	**3.8**	**0.79**
Demonstrate intellectual humility	0	0%	1	3%	9	28%	11	24%	11	24%	**3.0**	**0.86**

Table 6: Scholarship as Conversation (N=32).

Statements	Level of Competence										Cronbach's Alpha= 0.90	
	0(None)		1(Low)		2(Average)		3(Moderate high)		4(High)			
	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	0	0%	4	13%	7	22%	11	34%	10	31%	**2.8**	**1.07**
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%	**2.7**	**0.87**
Value user-generated content and evaluate contributions made by others	0	0%	2	87%	7	22%	15	47%	7	22%	**2.9**	**0.83**
Recognising that systems privilege authorities, disempowers my ability to participate and engage	0	0%	4	12%	3	9%	16	50%	8	25%	**2.9**	**0.90**

Lastly, findings in the sixth frame '*searching as a strategic exploration'* revealed that the majority of the geoscientists rated themselves as having a moderately high to a high level of competency in all four dispositions apart from 'exhibiting mental flexibility and creativity', where the majority rated themselves as having average to a moderately high level of competency (78% in total) (see Table 7). The findings of this study further highlighted, through the interviewed librarians, that geoscientists are 'fairly skilled' in this frame. This was because librarians carried out most of the geoscientists' searches, hence the assumption that they are 'fairly skilled' in this area rather than highly skilled. The study also showed that senior geoscientists and chief geoscientists integrated DIL skills to some extent, however, at the Deputy director level and higher, there is a sense that DIL skills are not prioritised at this level because of their job requirements, as these roles are mostly administrative rather than research focused. GSN managers indicated that only some geoscientists possess the necessary DIL skills. For instance, GSN Manager 2 indicated, "*most of the geoscientists that we have are young and have senior degrees such as master's and PhD, thus I can say they have the key skills as they recently completed their formal studies*". This comment refers to age and academic exposure, which infers that because of their exposure, this group of geoscientists might have the core DIL skills, but they still need to be able to apply these skills in a somewhat different context.

Furthermore, findings from interviewed participants indicated that geoscientist roles require specialised skills compared to other professions which

are not in research-intensive institutions. One GSN Manager 4 indicated that "*geoscientists create and store data digitally and derive reports; thus, I can say they possess DIL skills*". Interviewed librarians were further asked to discuss some of the DIL skills that they think are vital for geoscientists. They indicated that the most critical DIL skills are research and communication skills, as they enable them to effectively navigate through emerging digital platforms. Librarian 1 indicated, "*I expect geoscientists to be highly skilled in strategic searching and research skills, but this is not always the case*". Geoscientists still need guidance in searching for information strategically when they are conducting research.

Table 7: Searching as Strategic Exploration (N=32).

Statements	Level of Competence										Cronbach's Alpha= 0.83	
	0(None)		1(Low)		2(Average)		3(Moderate high)		4(High)			
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	M	SD
Exhibiting mental flexibility and creativity	0	0%	1	3%	7	22%	18	56%	6	19%	**2.9**	**0.73**
First attempts at searching do not always produce adequate results	0	0%	0	0%	5	16%	11	34%	16	50%	**3.4**	**0.73**
Realising that information sources vary in content and format	0	0%	0	0%	6	19%	12	38%	14	43%	**3.3**	**0.74**
Seeking guidance from experts in the field	0	0%	3	3%	3	9%	6	18%	11	34%	**3.1**	**0.98**
Recognising the value of browsing and other serendipity	0	0%	1	3%	4	12%	14	43%	13	40%	**3.2**	**0.77**

The study also probed strategies that can be employed to strengthen the DIL skills of geoscientists. The ability to monitor and evaluate DIL progress was found to be important by GSN managers. Integration of DIL skills in the workplace at all levels needs to be considered as this will enable all geoscientists to engage in their work effectively as work and research are 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 DIL skill training strategic plan. Study participants also indicated that GSN management needs to increase the funding and investment in relevant technologies and software to aid the advancement of geoscientists' DIL skills. The study findings highlighted that there is a need to forge collaborations that mutually benefit geoscientists. 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' DIL skills. The study further recommended that DIL skills training needs to be developed, establishing a geoscientist community of practice, intentionally and better funding for capacity development, and improving relevant infrastructure and technology.

Conclusions and Recommendations

In summation, the study found that the majority of geoscientists are generally skilled in DIL skills across the six frames of the ACRL Framework of Information Literacy, which was used to explore the DIL skills of geoscientists. In exploring what DIL skills geoscientists possess, the study found out that they possess the following skills: basic searching skills, research processing skills, communication skills, and evaluative skills. Research and communication skills were found to be the key dominant DIL skills that geoscientists require to navigate through digital platforms. The study found several challenges and gaps in relation to geoscientist DIL skills. The first challenge relates to limited flexibility and creativity in carrying out deep searching, which reflects the broader struggle with rapid digital transformation and voluminous information online. The other challenge is the lack of continuous professional development exposure. Limited understanding of information creation processes leads to the heavy reliance on librarians to meet their geoscientific information needs. The acquisition and enhancement of DIL skills are critical in this digital age. The study found that it is crucial to integrate DIL skills in the workplace as well as develop a contextualised strategic DIL framework. Moreover, the study found that strengthening collaborations and building a community of practice for peer-to-peer learning and networking in the workplace. Based on the findings of this study, stakeholders, such as librarians and managers, should work collaboratively to develop programs to enhance professional's DIL skills, putting into consideration the contextual realities that define 21st-century workplaces. The study further recommends professional support, funding and continuous training to ensure that professionals have adequate DIL skills to effectively function in their roles. Additionally, the

study suggests the need to prioritise digital literacy training in the workplace. Despite focusing on a single institution, the insights gained in the study are valuable for understanding the DIL skills of professionals in research-intensive settings and, thus, are relevant to professionals in Namibia, Africa and beyond. Future research on a larger scale is necessary to further explore this phenomenon.

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