Digital Competencies of LIS Educators in Nigeria for Virtual Teaching and Learning in the Fourth Industrial Revolution (4IR)

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Abstract
The study investigated the digital competencies of Library and Information Science (LIS) Educators in Nigeria for virtual teaching and learning based on two objectives. Two constructs from the Educators Pedagogic Competencies of the European Commission DigCompEdu framework were used to identify the digital competency progression level of LIS educators in Nigeria. This study adopted a quantitative research methodology. Data was collected using an online questionnaire shared on the WhatsApp group of the National Association of Library and Information Science Educators (NALISE), and 97 responses were received. The data collected was presented and descriptively analysed using frequency counts. The study found that LIS educators were at different digital competency levels in using digital technologies, from the Explorer to the Pioneer levels, but more so at the Explorer and Newcomer levels for assessing the teaching and learning process. The study recommended structured digital skills training for LIS educators, especially for evaluating teaching and learning. The study also recommended pedagogical support in the context of virtual teaching and learning.
Keywords: Digital competencies, LIS Educators, Virtual teaching and learning, 4IR

Introduction

Globally, higher education institutions operate in a fast-changing new environment characterised by rapid technological advancement, information explosion, and competition. (Shonhe, Jain, & Akakandelwa, 2023), driven by the Fourth Industrial Revolution (4IR). The 4IR refers to the era of technological advancement, which combines digital and physical through emerging technologies. It is hinged on new technologies such as artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing and blockchain technology (Elayyan, 2021). A distinguishing feature of the 4IR is the speed, scale, and impact of these technologies incorporated into the daily lives and activities of the populace. The 4IR has blurred the lines between digital and physical resources for teaching, learning and research while also creating semi-autonomous and innovative workplaces, which raises the demand for an intelligent workforce with digital knowledge and skills (Oosthuizen, 2022). Furthermore, the 4IR has brought about new opportunities for delivering education and new challenges that require educators to possess a set of digital competencies.

The European Framework for the Digital Competence of Educators (DigCompEdu) refers to digital competencies as the skills, understanding, and outlooks required to proficiently utilise digital tools for communication, problem-solving, information management, and, in the context of this study, virtual teaching and learning, which is one of the outcomes of the 4IR.

Virtual teaching and learning involve using digital technologies to impart knowledge and help students learn. There is little or no physical contact between the teacher and the student in this environment. Integrating 4IR technologies in online learning has numerous benefits, including personalised learning, increased student engagement, and improved access to educational resources (Suvin, 2020).

The COVID-19 pandemic exacerbated the need for virtual teaching and learning as many higher learning institutions worldwide adopted digital innovations, including 4IR technologies, to support remote learning (Shonne et al., 2023). Globally, educators now have a new understanding of the potential and benefits of using technology to achieve learning outcomes for students; the challenge is having the right skills to thrive. In order to reap the advantages of digital technologies in the 4IR, educators must be skilled and able to use them. For instance, to enhance students' flexibility in developing skills and pursuing passions, educators must develop teaching strategies to maximise their potential and equip students with the knowledge and abilities necessary to shape the future through technological innovation. (https://www.intel.com/content/www/us/en/education/teaching-strategy/teaching-4thindustrial-revolution.html).

It is worth mentioning that the process of developing teachers' digital competencies for virtual teaching and learning presupposes the following stages: detection of the digital technologies' potential in teaching, learning how to use digital tools, knowledge of where and when to use these tools, and training on the usage of these tools, depending on the characteristics of the subjects they teach (Adegbore, Adeniji and Adeshina (2015), Kožuh, Maksimović, & Osmanović Zajić, 2021). A digitally competent and literate teacher can communicate with colleagues, students, and parents using various digital tools and applications, such as mobile phones and the Internet, to mention just a few (Ferrari, 2012).

Library and Information Science educators in the 21st century are expected to train information professionals who can thrive in the 4IR. A crucial aspect of the evolving role of library professionals is the increasing emphasis on digital resources and information management; with the rise of online databases, e-books, and digital archives, librarians must possess strong digital literacy skills (Ankad, 2024). Thus, to fully reap these advantages in the Nigerian educational system and offer genuine learning opportunities in the 4IR, Library and Information Science (LIS), educators in Nigeria must use these technologies and understand how, where and when digital tools and technologies can help them in their work. Due to the speed at which technology is developing, it is more crucial than ever for library and information science educators to have a strong foundation in digital competencies to successfully communicate and teach in a virtual environment. A study by Danner (2018) stated that many teaching staff and university faculty are not trained in ICT integration in teaching and have never designed or delivered lectures through online means.

However, it is pertinent to note that educators' digital competencies cannot be analysed as an isolated collection of knowledge and skills but rather as a constituent part of a group of various competencies essential in a digital era (Voogt, Erstad, Dede & Mishra, 2013). For LIS educators, the virtual teaching and learning change has created new opportunities and obstacles in Nigeria and other nations. These professionals must have a variety of skills and talents linked to the use of technology in education to satisfy the current world's expectations. Thus, the European Framework for the Digital Competence of Educators (DigCompEdu) constructs that holistically assess educators'

competencies in six areas, including teaching and learning, was adapted for this study. The DigCompEdu framework provides a general reference frame to support the development of educator-specific digital competencies in Europe and is intended for educators at all educational levels (Redecker & Punie, 2017).

The objectives of the study are to:

1. Identify the digital competency progression level of LIS educators in Nigeria with regards to virtual teaching and learning using constructs from the European Commission DigCompEdu framework.
2. Identify the digital competency progression level of LIS educators in Nigeria with regards to evaluation and feedback using constructs from the European Commission DigCompEdu framework.

Literature Review

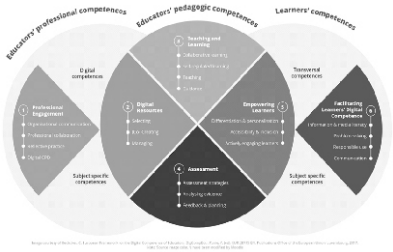
The 4IR revolutionised all aspects of human existence, including how we transfer knowledge and learn new things. These technological advancements transform workplaces into semi-autonomous, innovative environments, increasing the need for a digitally skilled and knowledgeable workforce (Oosthuizen, 2022). Digital literacy (DL) is essential for educators to navigate the complexities of modern teaching environments. DL encompasses functional skills such as using digital tools for communication, information retrieval and critical skills that enable educators to evaluate and utilise digital resources effectively (David-West, 2022; Ogunbodede et al., 2023). In Nigeria, there is a growing concern that numerous librarians lack the digital skills and knowledge to effectively use computers and other technology-related devices (Osinulu, 2021). Thus, there is a call for LIS schools to integrate these required skills and competencies into the course curriculum to prepare professionals in the digital age (Yadav, 2021). According to Ogunbodede et al. (2023), some of the research on the assessment of digital proficiency of educators has contradictory findings; a number of the studies concluded that university educators have a high digital competency, while the other set of studies indicated that university educators have low, medium-low, or intermediate levels of digital proficiency. David-West's (2022) study investigated the digital literacy skills among 26 library and information science (LIS) lecturers in universities in Rivers State, Nigeria. The study showed that LIS educators lacked the knowledge and abilities to use online platforms for instruction without help.

Conversely, the study by Atchrimi and Ogunbodede (2024) found that librarians have a high level of basic digital competence skills and employ various methods to acquire digital skills. Basic digital skills may not be sufficient for virtual teaching and learning. Corroborating this assertion, Ahaiuzu, Nyemezu, and Onyema (2020) revealed that although LIS educators could use basic computer interfaces and mobile and new media technologies for blended learning, they were not adopting it. The researchers attributed this to a lack of skills despite stating that educators could use computer interfaces and new media technologies.

From the literature, none of these studies assessed the digital competencies of LIS educators for virtual teaching and learning. Additionally, these studies did not hinge their findings on any theory to understand the digital competency level. Thus, a knowledge gap for the present study.

Theoretical Framework

The study adapted constructs of the European Framework for the Digital Competence of Educators (DigCompEdu Framework) developed by the European Commission's Joint Research Centre. It consists of 22 competencies organised in six areas.



For the purpose of this study, the researchers focused on the Educators' pedagogic competencies and adapted the *Teaching and Learning* and the *Assessment* constructs to understand the progression level of LIS educators. The *Teaching and Learning* constructs involve activities around planning and implementing digital devices and resources in the teaching process, so as to enhance the effectiveness of teaching interventions. For the *Assessment* construct, it is expected that when digital technology is incorporated into teaching and learning, the improvement of the current assessment systems must be taken into consideration (Redecker, 2017).

There are six progression levels for the DigCompEdu Framework, they are:

Newcomer: Newcomers recognise the potential of digital technologies to improve their professional and educational practices. However, their experience with these technologies is somewhat restricted, primarily focusing on internal communication, lesson planning, and managing operations.

Explorer: Explorers are aware of the potential of digital technologies and are interested in exploring them to enhance pedagogical and professional practice. They have begun utilising digital technology in a few domains of digital competency, but without adopting a thorough or consistent strategy.

Integrator: Integrators test out digital technologies in various settings and for various goals, including them into many of their operations; while still trying to figure out which tools are most effective in certain circumstances and how to adapt digital technology to pedagogical tactics and procedures.

Expert: Experts use a range of digital technologies confidently, creatively and critically to enhance their professional activities. They intentionally choose specific digital technologies for particular situations and seek to understand the advantages and limitations of various digital strategies.

Leader: Leaders have a consistent and comprehensive approach to using digital technologies to enhance pedagogic and professional practices. They rely on a broad repertoire of digital strategies from which they know how to choose the most appropriate for any given situation.

Pioneer: Pioneers question the adequacy of contemporary digital and pedagogical practices, of which they themselves are leaders. They are concerned about the constraints or drawbacks of these practices and driven by the impulse to innovate education even further (Redecker, 2017).

3.0 Methodology

This study adopted a quantitative research methodology and collected data on the digital competencies of LIS educators in Nigeria using an online questionnaire designed with Google forms. The questionnaire was distributed on the WhatsApp group of the National Association of Library and Information Science Educators (NALISE). A total of 97 responses were received from 266 educators on the group. A breakdown of the responses per cadre is indicated on Table 1 in the presentation of findings below. The data collected was presented and descriptively analysed using frequency counts. The constructs from the European Commission DigCompEdu framework were used to find out and understand the digital competency progression level of LIS educators in Nigeria. However, given the specific challenges of the use of technologies in sub-Saharan Africa and the gradational nature of digital competencies, the proficiency questions were contextually adapted. The data collected were based on two constructs *Teaching & Learning* and *Evaluation & Assessment* of the DigCompEdu framework.

Furthermore, an online questionnaire was used to collect data from the different cadre of LIS educators. This was done to drive home the point of the study which is the use of digital technologies for teaching and learning. However, it is pertinent to note that from observation, the higher cadre of educators were not too comfortable responding to online questionnaires. This may have skewed the sampled population in favour of the educators in the lower cadre. More so, the sampled population is small, thus, this should be taken into consideration when generalising the findings and discussions from the study. In addition, it is pertinent to note that the aim of this study is to understand the progression level of LIS educators with regards to digital competencies for virtual teaching and learning; it is not for performance assessment.

4.0 Presentation of findings

Table 1 Response Rate

S/N	Cadre	Number
1	Professorial	12
2	Senior Lecturer	03
3	Lecturer I	42
4	Lower Cadre	40
	Total	97

Objective 1: Identify the digital competency progression level of LIS educators in Nigeria with regards to virtual teaching and learning using constructs from the European Commission DigCompEdu framework.

Teaching & Learning:

Table 2: Teaching: Assessment of the use of digital technologies in the classroom with students to ensure that they add value

Progression Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
Newcomer	I do not use any type of digital technology or tool when teaching	0	0	0	0	0
Explorer	I make basic use of available equipment for teaching (e.g., digital whiteboards, projectors)	12	3	36	35	86
Integrator	I use a wide variety of digital resources and tools in my classes.	4	0	30	20	54
Expert	I try out di□erent teaching methods according to the digital technologies I choose	4	0	18	25	47
Leader	I develop my own portfolio of activities, technologies and teaching methods.	4	0	18	25	47
Pioneer	I use digital tools to implement innovative teaching methodologies and share them with my networks, so that they can also benefit.	4	0	18	25	47

The data visualised in Table 2 above indicates that none of the sampled LIS educators were in the *Newcomer* progression level for Teaching. (Multiple answers are possible, that's why the total responses can be more than the response rate of 97).

Table 3: Guidance: Monitoring students' activities and interactions in online collaborative environments used for teaching and learning.

Progressiou Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
Newcomer	I cannot communicate with learners through digital means, e.g., e-mail	0	0	0	0	0
Explorer	I can monitor student activities in the online environments (e.g., WhatsApp Groups) we use.	8	0	36	30	71
Integrator	I can analyse my students' online activities using the most appropriate methods and tools	4	3	30	25	62
Expert	I can analyse and intervene in my learners' online activities (e.g., discussions) with motivating or corrective comments	8	3	30	30	71
Leader	I encourage students to participate in online activities by asking questions.	4	3	24	25	56
Pioneer	I can redirect students' online activities when I foresee problems	4	0	30	25	59

Similarly, the data visualised in Table 3 above indicates that none of the sampled LIS educators were in the *Newcomer* progression level for Guidance. Majority of the LIS educators were in the Explorer followed closely by Expert progression level for

Table 4: Collaborative Learning: The use of digital technologies to enable students work in groups to acquire and reflect knowledge.

Progression Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
Newcomer	I am not proficient in integrating digital technologies into collaborative learning activities	0	0	6	15	21
Explorer	I can identify opportunities and implement assignments for learners to work collaboratively by searching for information online or presenting their results in digital formats	8	3	36	25	72
Integrator	I structure course activities that require my students to work collaboratively in groups, using the Internet to find information and presenting their results in digital formats	8	3	24	20	55
Expert	I design course assignments that require students to use online collaborative environments to exchange knowledge and discuss.	4	0	24	15	43
Leader	I design course assignments that require students to use online collaborative environments to create and share knowledge.	4	0	18	20	42
Pioneer	I design curricular activities that require the use of digital technologies to design new formats that enhances collaborative learning and the co-creation and sharing of knowledge.	8	0	24	25	57

The data visualised in Table 4 above indicates that the majority of the LIS educators were in the Explorer, Pioneer and Integrator progression levels for Enhancing Collaborative Learning.

Table 5: Self-regulated Learning: The use of digital technologies to enable students to plan, document and monitor their own learning process

Progression Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
	It is not possible in my work environment.	4	0	0	5	9
New Comer	I do not or only very rarely consider how students could use digital technologies in self-regulated activities or assignments.	4	0	0	15	19
	I encourage my students to use digital technologies to support their individual learning activities and assignments, e.g., for information retrieval or presenting results.	8	3	24	30	65
Explorer	I encourage my students to use digital technologies to collect evidence and record progress, e.g. to produce audio or video recordings, photos, texts.	4	0	24	30	58
	I use digital technologies (e.g., ePortfolios, learners' blogs) to allow learners to record and showcase their work.	0	0	12	20	32
	I use digital technologies for learner self-assessment.	4	3	24	20	51
Integrator	I use digital technologies or environments to allow learners to manage and document all stages of their learning,	0	0	12	15	27
Expert	I help my students in developing, applying and revising suitable criteria for self-assessment, with the support of digital technologies.	4	0	12	15	31
Leader	I reflect on the appropriateness of my digital strategies in fostering self-regulated learning and continuously enhance my strategies.	0	3	12	15	30

The data visualised in Table 5 above indicates that the majority of the LIS educators were in the Explorer progression level for Enhancing Self-Regulatory Learning.

Objective 2: Identify the digital competency progression level of LIS educators in Nigeria with regards to evaluation and feedback using constructs from the European Commission DigCompEdu framework.

Evaluation & Assessment

Table 6: Assessment strategies: The use of digital technologies for formative and summative assessment

Progression Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
Newcomer	I monitor students' progress regularly, but not by digital means.	6	6	12	24	48
Explorer	I use some digital tools, e.g., Questionnaire/blog/activity submission logs, to check students' progress.	6	0	24	24	54
Integrator	I use several digital tools to monitor my students' progress.	6	0	18	18	42
Expert	I integrate the use of various digital tools to monitor my students' progress.	0	0	18	18	36
Leader	I selectively choose the best digital tools and try them out for use with my students to assess and check progress.	0	0	24	24	48
Pioneer	I develop my own apps and digital tools to track progress and/or conduct assessments.	0	0	24	12	36

The data visualised in Table 6 above indicates that there was a close even distribution of the educators across the progression levels from the Explorer to Newcomer and Integrator levels for Enhancing Assessment Strategies.

Table 7: Analysing Evidence: To generate, select, critically analyse and interpret digital evidence on students' activities, performance and progress, in order to inform teaching and learning.

Progression Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
Newcomer	I do not or only very rarely refer to digitally recorded data to understand where my students stand.	0	0	18	20	38
	Information about this type of students is not available to me and/or someone else in my institution analyses it.	0	0	18	10	28
Explorer	I analyse academically relevant data, e.g. student performance for individual feedback and targeted interventions	13	0	18	8	38
	I am aware that digital assessment tools (e.g. quizzes) can be used within the teaching process to provide me with timely feedback on learners' progress.	6	3	24	10	43
Integrator	I evaluate the data resulting from digital assessments to inform learning and teaching.	12	3	12	10	37
	I am aware that the data on my learners' activity, as it is recorded in the digital environments which I use with them, can help me monitor their progress and provide them with timely feedback and assistance.	0	0	18	6	24
Expert	I use digital technologies (e.g., online questionnaire/assessment forms) within the teaching process to provide me with timely feedback on learners' progress.	0	0	24	6	30
Leader	I continuously monitor digital activity and regularly reflect on digitally recorded learner data to timely identify and react upon critical behaviour and individual challenges.	0	0	18	5	23
Pioneer	I implement advanced data generation and visualisation methods into the digital activities I employ, e.g., based on learning analytics.	0	0	18	5	23

The data visualised in Table 7 above indicates that the majority of the LIS educators were in the Explorer progression level for Analysing Evidence.

Table 8: Feedback and Planning: The use of digital technologies to provide targeted and timely feedback to students.

Progression Level	Proficiency Statements	Professorial cadre	Senior Lecturer	Lecturer I	Lower cadre Lecturers	Total
	I provide constructive feedback to learners, but not in digital format.	0	3	6	15	24
Newcomer	I am not aware how digital technologies can help me in providing feedback to learners or adapting my teaching strategies.	4	0	18	10	32
Explorer	I evaluate the advantages of using digital methods to provide constructive feedback	8	0	18	20	46
Integrator	I use di_erent digital methods to provide feedback and improve my practices regarding non-digital feedback.	4	0	12	25	41
Expert	I combine di¯erent digital approaches to provide feedback.	4	0	18	20	42
Leader	I choose the best digital tools for feedback after testing them with dil'erent groups of learners.	0	0	12	25	37
Pioneer	I develop my own apps or digital tools to provide feedback to students	0	0	12	15	27

The data visualised in Table 8 above indicates that the majority of the LIS educators were in the Explorer, Integrator and Expert progression levels for Analysing Evidence.

5.0 Discussion of the Findings

The findings from the data collected indicate that for the teaching & learning constructs, the sampled LIS educators in Nigeria were not in the *Newcomer progression* stages according to the European Commission DigCompEdu framework. They were at different levels from the *Explorer* to the *Pioneer* levels. It's not surprising also that the data showed that the lower cadre of educators in Lecturer I cadre were in the higher progression levels from *Integrator* to *Pioneer* when compared to the higher cadre of educators (Professors & Senior Lecturers). This cannot be unconnected with the tech savvy nature of the lower cadre of educators. This is a good development for the LIS students as digital technologies can enhance and improve teaching and learning strategies in many different ways (Redecker, 2017). Interestingly, for the Evaluation & Assessment construct, quite a number of the educators were at the *Newcomer* stage except for a sub construct-*feedback and planning.* As much as the use of digital technologies is good for teaching and learning, the learning process will be complete and enhanced when digital technologies are used for the assessment activities. This finding aligns with the findings of the study of Basilotta-Gómez-Pablos et al (2022) where they found that teachers recognised that they have a low or medium–low digital competence, as well as the absence of certain competencies, especially those related to the evaluation of educational practice.

According to the Digital Competency Framework used for this study, the progression of proficiency levels is cumulative with the exception of the first proficiency level. This means that for an educator to be on a higher proficiency level, she/he must be proficient in the competency level below. For instance, *Explorers* (must have overcome the concerns or doubts present at the *Newcomer* level). It is pertinent to note that in the case of LIS educators in Nigeria, an educator can be at the *Explorer* stage (Explorers are aware of the potential of digital technologies and are interested in exploring them to enhance pedagogical and professional practice) and be at the *Leader* level (Leaders have a consistent and comprehensive approach to using digital technologies to enhance pedagogic and professional practices) at the same time based on their level of awareness and interest. A number of educators are actually aware of the digital technologies and are leading the use of these technologies for their teaching, even though they are not highly proficient with the technologies.

5.0 Conclusion and Recommendations

The study identified the progression levels of LIS educators in Nigeria for teaching and learning. The educators were at different digital competency levels in the use of digital technologies from the *Explorer* to the *Pioneer* levels and *Newcomer* level for teaching and learning and assessment of the teaching and learning process respectively. Disaggregating the findings by cadre revealed that the LIS educators at the senior and professorial cadre have not shown significant or sufficient development level of their digital competencies compared to the LIS educators in the lower cadre.

Digital skills and competencies are important for teaching and learning in the 4IR. The ubiquity of digital devices and applications, in particular, requires educators to develop their digital competence and LIS educators are no exception. As role models to their students, it is important that they model the competencies they expect their students to have. This is even more important with the paradigm shift in jobs in the 4IR. The study recommends the following:

1. The first step to understanding the digital training needs of educators is to identify their present competency level which is what this study has identified. There are also other variables like the cadre, which the determines the competency development of each educator. Thus, there is a need to structure the digital skills training plans for the different cadres of educators.

2. Educators also need to continuously invest in their professional development. This is important especially with the ever-changing digital needs of learners. According to Basilotta-Gómez-Pablos et al (2022), the greatest challenge for university teachers in the twenty-first century is not become comfortable, to continue learning and to continue researching.

3. There is also the need for pedagogical support in the context of virtual teaching and learning.

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