Data literacy and higher education in the 21st century

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Abstract

This abstract discusses the significance of data in the era of big data, emphasizing its role as a fundamental building block of truths. The concept of datafication, the transformation of various aspects of life into digital data, is explored, focusing on the emergence of data literacy as a crucial subset of information literacy necessary for navigating the virtual landscape. The write-up underscores the skills essential for data literacy, highlighting the role of data science, authentic context, and quantitative reasoning. It emphasizes the importance of data literacy programs covering data analysis techniques, real-world applications, critical thinking in data, and data ethics. The mention of meta-skills as higher-order abilities crucial for navigating the dynamic twenty-first-century environment adds depth to the discussion—the abstract delves into the distinction between data literacy and information literacy, emphasizing their complementary nature. Integrating data literacy into educational programs, particularly in libraries, is stressed for relevance in meaningful information resource utilization. The context extends to higher education in Nigeria, where the role of institutions in developing a knowledge economy and human capital is explored. The abstract underlines the global importance of higher education for sustainable development and emphasizes the critical role of data literacy in this context. Challenges faced by Nigeria, including research productivity and data literacy, are discussed, highlighting the need for skills like critical thinking and data comprehension in the twenty-first century. The abstract concludes by advocating for incorporating data literacy education at all levels in Nigeria's educational system to foster growth, development, and informed decision-making.

Keywords

Data, higher education, 21st century

Introduction

Data has long been a driving force in science, and it is now doing the same in vocational education, where success is frequently determined by the ability to comprehend information. Nigeria's data literacy is gradually gaining importance as the country embraces digital transformation; there is a growing awareness of the need for individuals and organizations to understand, interpret, and use data effectively (Deja, Rak, & Bell, 2021). Data literacy is a foundational skill that empowers individuals in higher education to navigate the evolving landscape, make informed decisions, foster innovation, and prepare students for the challenges of the 21st century. Furthermore, in an era of increasing interdisciplinary research and technological advancement, data literacy is essential for researchers in order to be able to collect, analyze, and interpret data to conduct meaningful research and contribute

innovatively. The role of data in academic institutions is undergoing a profound evolution driven by technological advancements changing educational paradigms, therefore making any institutions that prioritize data literacy better positioned to adapt to change, improve educational outcomes, and contribute to the overall advancement of society.

However, challenges such as limited access to quality education and technology infrastructure still impact the widespread development of data literacy (Raffaghelli, Manca, Stewart, Prinsloo, & Sangrà, 2020). Data literacy is the ability of an individual to identify, work with, analyze, and communicate data effectively. In the rapidly evolving landscape of higher education in the 21st century, a critical gap exists among students and educators in data literacy skills. This deficiency needs to improve the ability of academic institutions to harness the full potential of data-driven decision-making, improve students' learning outcomes and promote institutional advancements.

The data literacy landscape in higher education could be characterized by a proactive approach to integrating data skills into academic programs, a growing recognition of its importance, efforts to integrate data literacy into curricula, and increased demand for data skills among students. In the age of big data, the sheer volume of digital resources is overwhelming. Data are perceived as the fundamental building blocks of truths. Data collection, processing analysis and use for decision-making form the foundation of self-efficacy, which gives people control over their lives and careers (Carlson, Johnston, Westra & Nichols, 2013).

Collecting, deploying and analyzing data for decision-making is referred to as datafication. Datafication transforms various aspects of life, activities, and information into digital data. In the modern digital age, many activities and phenomena are being quantified, recorded, and analyzed as data. This process involves converting analog information into a digital format that computer systems can store, process, and analyze. Data, the smallest quantitative unit of knowledge, are now used to interpret reality objectively. Data literacy is regarded as a subset of information literacy (information). People may require skills such as data literacy and specialized knowledge to be at ease and competent in virtual information. This may also apply to academics and postgraduate students, where data literacy skills may benefit professional advancement (Mandinach & Gummer, 2016).

Overview of data literacy

Data literacy is defined as the ability to use critical thinking to draw valuable conclusions from data, make sense of abstractions, and apply analysis results (Shreiner & Dykes, 2021). Comprehending abstractions becomes critical in becoming data literate because data is meaningless unless linked to indicate a relationship between concepts; this is because the ability to make sense of multiple independent concepts and infer the specific link between them is similar to computational thinking. This results from careful thought and critical analysis, improving the individual's skills and producing more insightful interpretations of the data (Davenport & Patil, 2012; Elder & Paul, 2020).

Data science, including data collection, calculation, analysis and interpretation, and communication, are examples of primary data literacy skills. For students entering the labor market, these skills could be measured with a test at the end of the course. Authentic context and quantitative reasoning are essential skills related to intermediate and advanced data literacy. Data collection, calculation, analysis and interpretation, and communication skills are critical for teaching students, academics,

and other tertiary institution staff members how to critically evaluate the utility of data models as part of teaching basic data literacy skills (McKendrick, 2015).

Understanding data enables the use of data insights to make predictions. As a result, data literacy programs should assist people in improving their understanding of patterns and their ability to overcome obstacles as they arise (Klidas & Hanegan, 2022). Data literacy programs involve content such as Data Analysis techniques, real-world Applications, Critical Thinking in Data and Data Ethics and Privacy, among others. When properly designed and implemented, programs like these will reinforce data literacy in society while promoting the development of other abilities known as meta-skills (Liquete, 2012). Meta-skills refers to higher-order abilities that enable individuals to acquire, adapt, and apply various specific skills. Examples are critical thinking, problem-solving, communication, and learning how to learn. A Meta-skilled individual can navigate a dynamic and evolving work environment. (Kumar, Kumar, & Lochab,2022). Meta-skills are critical for increased participation in the rapidly changing twenty-first century. However, they are not fundamental but build on the foundation of data literacy and pre-existing abilities. Carlson and Johnston (2015) provided the foundational skills for data information literacy based on a literature review written in their book after evaluating students' performance that "the high level of interest in these competencies are divided into twelve (12) major themes: introduction to databases and data formats, data discovery and acquisition, data management and organization, data conversion and interoperability, quality assurance, metadata, data curation and reuse, cultures of practice, data preservation, data analysis, data visualization, and Ethics, including data citation. Sub-themes and specific lessons must be learned to gain mastery and competence in data information literacy. Furthermore, after evaluating students' performance in their book, "the high level of interest in fundamental topics, such as data formats and an introduction to databases, indicate the relative need for preparation in the core technological skills required to work in an e-research environment. Students lack the fundamental technological skills required to function in a data-driven society, implying that this tendency exists in other societies Carlson & Johnston, 2015).

It is widely agreed that a data-literate person—someone who can comprehend and evaluate knowledge derived from accurate data or facts—should be able to apply mathematical ideas to a real-world problem related to his or her area of expertise and demands. IT skills, the third component of data literacy, are intended to simplify data analysis and synthesis by displaying facts in a virtual form. As a result, a person with basic data literacy skills should be able to find and use appropriate IT resources for his or her needs first and foremost (Gebre, 2018). However, teaching IT skills is complicated because users typically do not investigate database technologies until they genuinely need to collect and use data (Maybee & Zilinski,2015). As a result, demanding that people learn these abilities in an entirely simulated educational environment, in the abstract, is difficult.

More often than not, scholars distinguish between data literacy and information literacy (Palsdottir, 2021). Data literacy is related to information literacy (Shields, 2005; Koltay, 2016). The quality of information is critical in the data literacy-information literacy relationship. The level of trust placed in the source, that is, the level of transparency, is determined by how quickly one can recognize the veracity of facts, how quickly one can grasp their logic, how valuable the data are, and how closely they adhere to the standards (Koltay, 2016). To evaluate source material in data literacy, knowledge of primarily (but not exclusively) quantitative approaches to data model construction, as a structure

describing a set of intentionally gathered facts, is required. In this sense, information literacy is a broader concept, with qualitative analytical methods much more frequently used to confirm the reliability of information (Shrestha, 2018). To enable data literacy in practice, it is paramount to emphasize the importance of information literacy-like critical thinking about information resources.

Nowadays, data literacy is just as important as information literacy. They complement each other well and unmistakably contribute to libraries' educational mission of encouraging the meaningful use of information resources to create knowledge and invent new things. As a result, it is well justified for inclusion in library educational programs. Academics and librarians can use data literacy skills to design learning programs that integrate with the faculty and demonstrate the fruit of their labor to avoid a situation where the results of their academic work are indiscernible (Augood, 2019).

Higher education in Nigeria

Bernett (2017) sees higher educational institutions as distinct from others in terms of research, defining higher education in terms of the levels and functions of the educational experience offered. Higher education has been widely acknowledged as a critical tool for developing a knowledge economy and human capital worldwide (Adepoju & Okotoni 2018). According to Peretomode (2018), higher education is the facilitator, bedrock, powerhouse, and driving force for a nation's socioeconomic solid, political, cultural, healthier, and industrial development, as higher education institutions are increasingly recognized as wealth and human capital-producing industries.
Higher education is essential for all developing countries if they are to prosper in a global economy where knowledge has become a critical competitive advantage. The quality of knowledge generated in higher education institutions is critical to national competitiveness. Countries can achieve sustainable development by improving the skills of their human capital through higher-level training. Higher-level human resources training has been recognized as a primary tool for national development on a global scale. Such high-level educational provision enables citizens to acquire skills and techniques that can be applied to increase human productivity (Thom-otuya & Inko-Mariah, 2016).

According to the Federal Ministry of Education (2004) section 8 (59), the goals of higher education in Nigeria are as follows: Contribution to national development through high-level workforce training development and instillation of appropriate values for individual and societal survival, Individuals' intellectual capabilities to understand and appreciate their local and external environments are being developed, acquisition of physical and intellectual skills that will allow the individual to be a self-sufficient and valuable member of society. Scholarship and community service for national unity and national and international understanding and interaction are promoted and encouraged. Nigeria has a population of approximately 154 million people. A growing population necessitates expanding higher education to meet the quality challenges in Higher Education in Nigeria in the Twenty-First Century.

Data literacy and the 21st century in Nigeria

The world is changing, and to remain relevant, one must change as well. The rate of change in the world is accelerating, and inventions are appearing at an unprecedented rate. Nigeria, a developing country with an active and prosperous population, cannot catch up in this race. The country's ability to advance as it should has been hampered by low research productivity and data literacy levels. Combing through the literature, countries with higher data literacy rates develop faster. (Pingali, Aiyar,

Abraham, & Rahman, 2019). Nigeria has one of the largest populations of young people, with a better chance of providing a unique opportunity to build a productive society. This has not been the case, as several hindrances have slowed the country's growth and development. Being on the cutting edge of technological and informational advancement is critical. In the twenty-first century, some talents are in demand and will provide a better future with appropriate applications. As a result, citizens of the twenty-first century must be capable of dealing with issues such as critical thinking, data comprehension, and making data-driven decisions (Chinien & Boutin, 2011; Wanner, 2015).
Data literacy education in post-primary (secondary) education in Europe is gaining increased recognition as societies become more data-driven. The emphasis on data literacy reflects the growing importance of understanding, interpreting, and critically evaluating information in various forms. (Fontichiaro, & Johnston, 2020). This, however, is different with Nigeria. Nigerian scholars need to be exposed early enough to the rudiments of data literacy.

Data literacy is one of the skills every Nigerian in the twenty-first century must have. Aside from the individual, having these abilities will allow Nigeria to enjoy advancements and consistent growth and development. Data literacy education has been shown to improve students' study habits and learning skills because these skills are fundamental to developing other literacies (information, statistical, digital, media, computational, and visual), known as meta or trans-literacy.

Furthermore, studies have shown that higher-education students can better manage higher-order thinking and provide more practical answers (Mackey and Jacobson, 2011; Vahey et al.,2012). This will affect the research output of these societies, allowing their students to more effectively validate and generate research with a high impact factor and broad applicability (Frau-Meigs, 2012; Hattwig, Bussert, Medaille, & Burgess, 2013). Consequently, to achieve this result, these abilities must be introduced into society and the educational system when they can pique individuals' interest and lead to their success.

Conclusion

Scholarly work focusing on conceptualizing information literacy to improve learning in higher education may shed light on the emergence of data literacy in Nigeria. For higher education institutions to reach their lofty goals, in the 21st century, students, academics, and other staff must be able to analyze and manipulate data to make informed decisions. Data Literacy skills must be taught at all levels of education in Nigeria, particularly at higher learning institutions.

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