



DIGITAL LITERACY AND STUDENTS' RESEARCH COMPETENCE: EMPIRICAL EVIDENCE FROM A NIGERIAN POLYTECHNIC

#IRO-IDORO, Charlotte Bose & *JIMOH, Tajudeen Adisa

& *Department of Office Technology and Management, The Federal Polytechnic Ilaro, Ogun State, Nigeria

#Orcid ID: 0000-0002-1379-6250 & *0000-0002-6931-3369

[#charlotte.iroidoro@federalpolyilaro.edu.ng](mailto:charlotte.iroidoro@federalpolyilaro.edu.ng)

[*tajudeen.jimoh@federalpolyilaro.edu.ng](mailto:tajudeen.jimoh@federalpolyilaro.edu.ng)

Abstract

Contemporary higher education demands remarkable digital skills for credible academic and research engagement among the students, yet empirical evidence points to increasing utilization of digital tools, but limited skills for credible research outputs among students especially in sub-Saharan Africa. This study examines the extent to which the level of digital literacy among students of the Federal Polytechnic, Ilaro, Ogun State predicts their proficiency in research, particularly in three domains of higher education students' research activities - literature and information search, data processing and analysis, and research report documentation. Grounded in the Transfer of Learning Theory, the study conceptualized digital literacy as a foundational competence that is often transferred into the different activities embedded in research endeavour, evaluating their interaction in determining students' proficiency for desirable research outcomes. Using a cross-sectional online survey, data were collected from 467 Higher National Diploma students selected through purposive and snowball sampling, with data collection spanning a period of 3 weeks. The Digital Literacy and Research Competence Questionnaire (DLRCQ), designed on a 4-point Likert rating scale, was adapted from validated scales and analyzed using linear regression to test three hypotheses. Results show a strong, significant relationship between digital literacy and literature/information search competence ($R = 0.730$, $R^2 = 0.533$, $p < 0.001$), indicating that over half of the variance in students' search abilities is explained by digital skills. Digital literacy also significantly predicted research documentation competence ($R = 0.628$, $R^2 = 0.394$, $p < 0.001$), demonstrating its importance for structuring reports, applying citation styles, and using digital writing tools. Conversely, digital literacy exhibited only a weak but significant effect on data processing and analysis competence ($R = 0.264$, $R^2 = 0.070$, $p = 0.008$), revealing a critical skills gap in students' data analysis proficiency and readiness, despite their general digital literacy. Digital literacy generally has significant positive contributions to research capability among students of the Federal Polytechnic, Ilaro, with a weakness in data analysis skills among

the students, indicating a mismatch between general digital abilities and specialized research competence for data analysis. Strengthening institutional support for advanced digital skills, particularly statistical software use, data interpretation, and problem-solving is recommended to enhance students' data analysis proficiency and overall research capability.

Keywords: *Data analysis, Digital literacy, Information search, Research competence, Research documentation*

Introduction

Higher Educational Institutions (HEIs) in developed and developing nations have the responsibility of equipping and developing students with abilities for remarkable academic engagement and fitness in addition to fostering students' productive functionality in known and emerging areas. In Polytechnics particularly, the goal transcends the ability for academic engagement, it encompasses mastery of skills and the application of technical knowledge to solve problems using appropriate approaches, tools and machines.

The evolving nature of technology use in almost all domains of human endeavours is altering traditional models of education, thus requiring skillful use and application of digital tools by faculty members and particularly, the students. Thus, digital literacy, encompassing the ability to effectively and critically navigate, evaluate, and create information using digital technologies (UNESCO, 2018), has become an indispensable skill in the academic environment. Central to the mandate of higher educational institutions are the core activities of teaching, learning and research in which educators and learners are frequently engaged. These necessitate increased attention to the digital competence of both faculty members and students as they are expected to possess and utilize such competence in the pursuit of these core components of tertiary institutions' activities.

Research is a critical component of the productivity index of faculty members, and a key requirement and success factor for the award of degrees and diplomas to students (Jalal, 2020). The teaching of research procedure and methodology is aimed at equipping the students' requisite competence for independent and collaborative research, they are expected to have mastery of the techniques, design and implementation of the different stages of research, and to manifest these skills and knowledge in the conduct of research that is applicable in their respective fields (Munna & Kalam, 2021; Lin et al., 2023). However, in tertiary institutions, especially in Nigeria and other developing African nations, where applied research and project-based learning form critical components of academic requirements, evidence from several studies (Parsazadeh, et al., 2015; Agina-Obu & Okwu, 2023; Zhai et al., 2024; Aremu & Udofia, 2025) suggests that many students in tertiary institutions still exhibit limited research skills, poor information validation practices, and overreliance on unverified online content, all of which weaken the quality and credibility of their research outputs. Also, as students are increasingly adopting the use of digital tools for academic and research activities, they manifest varying levels of competencies in their research endeavours and encounter a series of challenges in the conduct and completion of research exercises. Such variation raises concerns about how effectively students utilize digital resources in conducting sound academic research, and little is known about the extent to which students' digital literacy translates into tangible research competence and academic productivity.

The evolving nature of higher educational institutions is characterized by glaring and tremendous shifts to the use of technology-enabled platforms and tools for information search, processing, storage and transmission, and particularly, information and knowledge management, thus stimulating the adoption of digital tools, platforms and models.

Research is a careful and curiosity-driven effort that is systematically tailored towards the discovery of facts, the testing of existing theory, or the development of new ideas on a known subject (Nwakpa, 2015). Research activities are expected to be tailored towards deeper understanding what is being examined through observation,

experimentation and analysis with a view to contributing to the existing knowledge on the subject and making a definite conclusion on the variables of interest (Adebola, 2009; Delumn (2016), Research is aimed at utilizing specific empirical or other forms of data to formulate, expand or evaluate a theory or the discovery of knowledge. In carrying out research, carefully planned methods and approaches are deployed by students not only to complete the research but to fulfil the requirements for the award of diplomas or degrees (Alexander, 2015).

The success of students' research is dependent on a number of factors, such as supervisory guidance, institutional support, access to research resources, and students' motivation, but the quality and credibility of students' research outputs are a reflection of their research competence (Christidis et al., 2024, Nwigwe et al., 2024). Competence denotes a set of skills, know-how, attitude, mastery and knowledge that can be applied for the completion of a particular task, understanding and taking the right perspectives on issues, concepts, phenomena, etc. for personal satisfaction, social integration and professional demands (Enache et al., 2021).

Different perspectives, viewed from varying lenses, have been advanced by writers and researchers to describe what research competence entails (Castillo-Martínez & Ramírez-Montoya, 2021). Research competence is described as a composite of a researcher's ability to perceived and identify specific problems worthy of investigation, acquisition of knowledge on the problem, developing a ground understanding of relevant concepts and theories, synthesizing existing argument, designing appropriate approach and utilizing relevant data and tools for the implementation and dissemination of the research results (Belyanina, 2018; Mogonea & Remus, 2019). Similarly, Gess et al. (2017) posit that meaning research engagement and outcomes depend on the capability to define and square a research problem, designing appropriate methodology and implementing every phase diligently and in a way to solve the identified problem and contribute to the existing body of knowledge.

According to Castillo-Martínez and Ramírez-Montoya (2021), "competence in a research context covers dexterity in literature search towards understanding and integrating concepts and theories, methodological domain, data gathering, and the management of document-writing norms, and use of technological tools in steering the research". Such competence embodies complex, stable, multi-functional skills of an individual, which are acquired through a specially crafted learning process, developed and mastered over time through consistent and independent practical activities that deliver high-quality research (Alexander, 2015; Olawale, 2016). Key competence required for conducting research includes "understanding of the fundamental theories and literature in the subject of interest, knowledge of related terminology, skills in data analysis and interpretation and research reporting and writing abilities required for publishing and communicating research findings" (Shivni, et al., 2021; Adebisi, 2022). In the context of the present study, the focus is directed at those domains that are primarily related to the successful engagement of higher education students in research and the reporting of their research findings. Thus, information and literature search, data vetting, analysis and interpretation, and report documentation competencies are considered.

The need for students in higher education to be skilled and ready for innovative solutions, problem solving, idea formation, new processes development, among others, is a pointer to the peculiarity of students' proficiency in the use of digital tools and applications (Udokwo, 2016). A range of tools are constantly being utilized to aid in carrying out research and digital technology-powered platforms and outlets are available to researchers to communicate and share their research findings (Institute for Academic Development, 2021), while every stage of research is often implemented with the aid of digital tools (Argentin, et. al., 2014; Jiao et al. 2025). Digital literacy has evolved over time as a concept covering compelling knowledge and skill demands on schools and students in the digital age. Digital literacy thus becomes an important competence domain that is given attention in a bit to promote learning and research in ways that facilitate knowledge and information management, data

sourcing and analysis and implementation of high-quality research among students and faculty members (Touron, et. al., 2018).

According to Bashar and Naaz (2024), digital literacy refers to “the capacity to understand information and use it on computers and the internet in a variety of ways, technologies to communicate knowledge on digital platforms”. European Commission (2015) describes digital literacy as “the confident and critical use of information technology for work, leisure and communication, and it underpins the basic skills in information and communication technology to search, retrieve, assess, store, produce, present and exchange information, to communicate and participate in collaborative networks via the internet and other IT applications”. Digital literacy primarily focuses on digital technology usage and people can productively engage in the digital era confidently, safely, ethically and wisely (Pangrazio et al., 2020). As posited by Cornell (2019), “digital literacy is an individual’s ability to find, evaluate, utilize, share and create content using information technologies and the internet”, and it encompasses a wide range of skills necessary to function and succeed in the constantly evolving digital societies.

This study builds on the Transfer of Learning Theory of Thorndike and Woodworth (1901) in which performance in a particular task is believed to be hinged on the expertise skills acquired from other domains of knowledge or skill. The theory explains how individual competence in a particular task could predict competence in another area as a result of similar cognitive, structural or skill requirements, thus explaining how previously acquired skills by an individual could be applied across other different but related domains (Perkins & Salomon, 1992; AlSagheer, 2011).

As digital literacy in the context of this study covers competences in the confident use of digital tools and platforms (Eshet-Alkalai, 2004; Ng, 2012), and research competence denotes students’ abilities for information sourcing/literature search, data processing and analysis, and documentation and reporting of research findings. The two focuses of the study require distinct underlying cognitive processes for which makes transfer of learning from one to another possible. The Transfer of Learning Theory therefore provides a theoretical foundation for predicting that students who possess remarkable digital literacy and more likely to effectively engage in research activities and see the same through to a desirable end. An obvious gap in empirical literature stems from previous research approaches to digital literacy and research competence as distinct and unrelated constructs of treat digital literacy and research competence as unrelated constructs, regardless of the fact that students are increasingly depending on digital tools and resources for planning and conducting research, analyzing data and reporting research findings. Thus, with the application of the Transfer of Learning Theory digital literacy is framed as a vital competence that students apply in the conduct of their research.

Research Hypotheses

In line with the objectives of this study, the following null hypotheses were raised:

H_{01} : Digital Literacy does significantly predict literature and information search competencies of the students.

H_{02} : Students with high digital literacy do not exhibit significant data processing and analysis skills than those with low digital literacy.

H_{03} : Possession of high digital literacy does not imply high competence for research report documentation among the students.

Methodology

The study employed a cross-sectional survey research design to assess the influence of students' digital literacy on their research competence at one point in time. The population comprised all 2751 Higher National Diploma students of The Federal Polytechnic, Ilaro at the time of the study. Through an online survey, purposive sampling was used to cover only the HND classes as they were deemed to have remarkable knowledge of research work. In doing this, snowballing method was used, class representatives and WhatsApp group of all Higher National Diploma classes were identified. A structured questionnaire tagged Digital Literacy and Research Competence Questionnaire was designed on Google Form, and the link was sent to the class groups through the class representatives. In the design of the questionnaire, input items for digital literacy were drawn from Digital Literacy Scale of Abas, et al., (2019) and Digital and information literacy framework of the Open University (2012). The online survey was conducted within 21 days during which 467 Higher National Diploma students participated.

Results

In testing the hypothesis, linear regression analysis was employed in order to verify the relationship and the magnitude of influence of the independent variables on the dependent variables.

H₀₁: Digital Literacy does significantly predict literature and information search competencies of the students.

Table 1: Regression Analysis of Digital Literacy and Literature/Information Search Competence among the students

Model	B	Std. Error	Beta	R	R ²	Adj. R ²	F	t	Sig.	Std. Error of Estimate
(Constant)	44.008	0.806	—	0.730	0.533	0.528	110.840	54.603	.000	1.282
Digital Literacy	0.480	0.192	0.730	—	—	—	—	10.528	.000	—

a. Dependent Variable: Literature/Information Search Competence

The result indicates a strong positive relationship between digital literacy and literature and information gathering skills, as reflected by a correlation coefficient of 0.730. The result suggests that the students who exhibit higher levels of digital literacy and can effectively handle digital tools and applications are likely to manifest higher skills in effectively and efficiently sourcing and evaluating information for research purposes. The relationship between the variables denotes that skillful use of digital tools as a result of improved digital literacy has a significant positive contribution to the students' competence in literature search and retrieval in the research activities.

From the results, approximately 53.3% of the variation in literature and information search competence of the surveyed students could be linked to their level of digital literacy. This positions digital skills as a critical success factor for literature and information gathering in the research process. This means that staff or students who possess advanced digital literacy, such as proficiency in using online databases, search engines, digital libraries, and citation tools, are more likely to perform better in identifying credible sources, synthesizing scholarly information, and integrating findings into their work. At p-value $0.00 < 0.05$ and a coefficient of 0.48 pointing to the magnitude of change in the students' abilities in literature and information search as a result of digital literacy, we concluded that digital literacy significantly predicts literature and information search competencies of the students, thus rejecting the null hypothesis.

This result corroborates the arguments of Adewuyi and Olayinka (2021) and Kumar (2020), who emphasized that digital literacy is an essential enabler of research productivity and evidence-based decision-making in academic institutions. It also aligns with the Transfer of learning theory that there is a connection between previously acquired knowledge and performance in another content and processes (Steiner, 2001). With the general perspective of the theory, the transfer phenomenon occurs as mastery and competent of digital tools and platforms facilitate the information search in the research process by students.

The findings revealed a remarkable digital competence level among the students which is applied in their search for relevant and literature in chosen research subjects. Competence in the use of digital resources, platforms and media helps in identifying reliable and scholarly sources for conceptual, empirical and theoretical frameworks in a research endeavour. Such a level of digital literacy is instrumental in managing and synthesizing sources and citations for reference purposes. The findings align with Ngozi (2012) and Cornell (2019) that researchers' use of digital information search resources is key in sourcing, accessing and synthesizing literature into high-quality academic publications.

H₀₂: Students with high digital literacy do not exhibit significant data processing and analysis skills than those with low digital literacy

Table 2: Regression Analysis of Digital Literacy and Data Processing and Analysis skills among the students

Model	B	Std. Error	Beta	R	R ²	Adj. R ²	F	t	Sig.	Std. Error of Est
(Constant)	44.863	2.799	—	0.096*	0.007*	0.003*	7.251	16.030	.000	1.811*
Digital Literacy	0.141	0.052	0.264	—	—	—	—	2.693	.008	—

a. Dependent Variable: Data Processing and Analysis skills

The results as presented above indicate that there is a weak positive relationship between digital literacy and data processing skill and about 6% variation in data processing and analysis skills could be attributed to digital literacy. A weak positive relationship between digital literacy and data processing and analytic skills was found with a correlation coefficient (R) of 0.264 and a coefficient of determination (R²) of 0.070. This implies that only 7% of the variance in students' data processing and analysis skills can be explained by their level of digital literacy, while the remaining 93% of the variation is influenced by other factors not captured in this model. The adjusted R² value of 0.060 further confirms the limited explanatory power of digital literacy on these skills. The F-value of 7.251 and p-value less than 5% threshold of significance, indicate that the model is adequate and sufficient in relating the variables.

It was revealed from the findings that digital literacy contributes only 14% increase in data processing and analysis competence among the students. However, with a p-value 0.008, we conclude that digital literacy has a significant impact on the data processing and analysis competence of the students. This finding suggests that although digital literacy contributes marginally to students' ability to process and analyze data, it is not a strong determinant in this context. The weak association indicates that possessing general digital skills, such as information retrieval, use of digital tools, or basic computer literacy, does not necessarily translate into advanced competencies in data manipulation, statistical analysis, or use of analytical software (e.g., SPSS, Excel). This implies that the students' digital skills in these areas are relatively low to adequately utilize data analysis tools.

The result contradicts some earlier studies, e.g., Kayyali (2024) that that higher digital literacy enhances analytical proficiency among tertiary students. In contrast, the current finding aligns with the position of Hussain et al. (2022), who reported a relatively strong ability of students in the use of computers but an extremely limited ability in the use of data analysis software. The result also supports Martin & Grudziecki

(2006) that the inability of students to analyse information critically is another consequence of insufficient digital literacy.

Olayemi and Abubakar (2022) state that digital literacy alone is insufficient for data competence unless supported by targeted training in data analytics, critical thinking, and problem-solving. For implication, this outcome reflects the need to strengthen curriculum integration of data analysis tools and applied digital skills beyond basic literacy. It can be deduced from the results that students in HEIs may possess the general digital skills, but lack the technical analytical skills and disposition that are required for research data analysis and evaluation. This is a clear indication that students’ abilities and skills for data processing and analysis require the combination of general digital literacy with specialized training and guidance in statistical data analysis. The weak relationship observed points out the specific skill deficiency that could undermine effective independent research among the students.

H₀₃: Possession of high digital literacy does not imply high competence for research report documentation among the students

Table 3: Regression Analysis of Digital Literacy and Report Documentation Skills among the students

Model	B	Std. Error	Beta	R	R ²	Adj. R ²	F	t	Sig.	Std. Error of Est.
(Constant)	41.919	1.325	—	0.628	0.394	0.388	63.136	31.631	.000	1.460
Digital Literacy	0.376	0.299	0.628	—	—	—	—	7.946	.000	—

a. Dependent Variable: Report Documentation Skills

As depicted in the results, a strong positive relationship was revealed between digital literacy and abilities for research reporting and documentation skills, R being 0.63. The result shows that a unit change in digital literacy will result in about 37.6 unit change in the research report documentation skills of the students. The p-value 0.000 suggests the acceptance of the alternative hypothesis, thus we concluded that Possession of high digital literacy does not imply high competence for research report documentation among the students. The results clearly revealed digital literacy as a critical factor that impinges on the students’ quality of research documentation - their ability to arrange research reports appropriately, applying the approved referencing style and project writing format, among others.

Conclusion

The study investigated the influence of digital literacy on research competence of students with a focus on literature and information search, data processing and analysis, and research report documentation skills. The findings revealed that digital literacy significantly impacts students’ literature and information search competence and research report documentation skills, with strong positive correlations and substantial portions of variance. Students with higher skills in handling and utilizing digital tools, resources and platforms are likely to have greater proficiency in searching, evaluating, and appropriately incorporating literature for conceptual, empirical and theoretical frameworks of their research and other academic writings. Such students will also demonstrate competence in following the approved project reporting format and documentation of their research findings. However, the general digital competence alone is not sufficient to ensure an advanced data analysis capability which requires domain-specific learning and instruction. This reveals a significant skill gap in the areas of utilizing statistical tools and applications for data processing and analysis tasks, implying that students require targeted instruction and structured training to translate basic digital literacy into higher-order analytical competence.

In line with the Transfer of Learning Theory, the findings support that students' digital literacy is a significant enabler of their competence in information and literature search, research documentation and reporting. Despite the low contribution to digital skills in data processing and analysis, student can easily transfer their digital literacy into the learning of the specialized statistical packages for data analysis.

Recommendations

With the research concluded, the following recommendations are proffered:

1. The findings point to the need for the Federal Polytechnic, Ilaro and other similar tertiary institutions to prioritize structured training in data analysis to develop students' competence in using statistical packages for data management and analysis. Academic departments should embed digital research tools, such as citation managers, data analytics software, and online repositories, into coursework and research supervision.
2. Management of higher educational institutions should strengthen the conduciveness of their learning environment to further stimulate academic and research engagement among the students.
3. There is a need, on the part of students, for deliberate personal efforts channeled into digital technology use for research and other learning goals. These measures will not only improve research quality and productivity among the students but also advance institutional performance in innovation and knowledge dissemination.

References

- Abas, M. K., Yahaya, R. A. & Feedin, M. S. (2019). Digital literacy and its relationship with employee performance in the 4ir. *Journal of International Business, Economics and Entrepreneurship*, 4(2), e-ISSN :2550-1429
- Abas, M. K., Yahaya, R. A. & Feedin, M. S. (2019). Digital literacy and its relationship with employee performance in the 4ir. *Journal of International Business, Economics and Entrepreneurship*, 4(2), e-ISSN :2550-1429
- Adebisi, Y. A. (2022). Undergraduate students' involvement in research: Values, benefits, barriers and recommendations. *Annals of Medicine and Surgery*, 81, ISSN 2049-0801. <https://doi.org/10.1016/j.amsu.2022.104384>.
- Adebola, B. E. (2009). A logical approach to research *proposal* Development. In A. O. Ajayi (ed). Institutionalization of research and development. Oduprints.
- Adenekan, T. E. & Jimoh, T. A. (2021). Technological innovation, digital competence and job performance of secretaries in public tertiary institutions in Ogun State, Nigeria. *International Journal of Innovative Science and Research Technology*, 6(12), 5-12. ISSN 2456-2165, www.ijisrt.com.
- Agina-Obu, R., & Okwu, E. (2023). Impact of digital literacy on university students' use of digital resources in Nigeria. *Asian Journal of Information Science and Technology*, 13(2), 60-65. <https://doi.org/10.51983/ajist-2023.13.2.3587>.
- Alexander, M. P. (2015). Added value of video compared to audio lectures for distance learning. *International Journal of Medical Informatics*, 73(2), 189-193.

- AlSagheer, A. (2011). The Transfer of learning: Exploration of benefits and perspectives in the state of Kuwait. *International Journal of Management & Information Systems*, 15(2),39-48.
- Aremu, V. I., & Udofia, I. G. (2025). *Impact of digital literacy skills on undergraduate performance in Nigeria. African Journal of Applied Research*, 11(2), 210-219. <https://doi.org/10.26437/ajar.v11i2.1031>
- Argentine, R. (2014). Leadership metaphors: Developing innovative teaching strategies. *American Journal of Management*, 13(1), 79.
- Bashar, U. & Naaz I. (2024). *Digital literacy: The importance, initiatives and challenges. International Research Journal of Modernization in Engineering Technology and Science*, 6(5), 6218-6223)
- Belianina O. & Ushakova, E. (2018). Critical review about aquaponics: Non-boring sciences as a base of competence. *Handbook of Research on Students' Research Competence in Modern Educational Contexts*. DOI: 10.4018/978-1-5225-3485-3.ch009
- Belyanina, L. A. (2018). Formation of an effective multi-functional model of the research competence of students. In V. Mkrttchian & L. Belyanina (Eds.), *Handbook of Research on Students' Research Competence in Modern Educational Contexts* (pp. 17-39). IGI Global. <http://doi.org/10.4018/978-1-5225-3485-3.ch002>
- Castillo-Martínez, I. M. & Ramírez-Montoya, M. S. (2021). Research Competencies to Develop Academic Reading and Writing: A Systematic Literature Review. *Frontline Education*.
- Castillo-Martínez, I. M. & Ramírez-Montoya, M. S. (2021). Research competencies to develop academic reading and writing: A systematic literature review. *Frontline Education*.
- Christidis M, Waters P, Ärlegård L, Säflund Z, Christidis N. (2024). Factors influencing the quality of undergraduate students' degree projects: From student and supervisor perspectives. *Eur J Dent Educ.*, 29(1):162-174. doi: 10.1111/eje.13060.
- Cornell, Z. E., Palermo, Claire. (2019). Developing research competence in undergraduate students through hands on learning. *Journal of Biomedical Education*, 2019, 1-9. <https://doi.org/10.1155/2015/306380>.
- Delumn, J. (2016). Telling the truth about damned lies and statistics. *The Chronicle Review*, 47(34).
- Enache, R. C., Gorghiu, G., Gorghiu, L. M., Petrescu, A. M. A., & Stăiculescu, C. (2021). How do the Romanian students consider the research competencies appropriate for their future career? *Revista Romaneasca pentru Educatie Multidimensionala*, 13(4), 162-179. <https://doi.org/10.18662/rrem/13.4/476>
- Eshet-Alkalai, Y. (2004), Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, 13(1), 93–106.
- Gess C., Wessels I. & Blömeke S. (2017). Domain-specificity of research competencies in the social sciences: Evidence from differential item functioning. *Journal for Educational Research* 9(2), 11–36.
- Gess C., Wessels I. & Blömeke S. (2017). Domain-specificity of research competencies in the social sciences: Evidence from differential item functioning. *Journal for Educational Research* 9(2), 11–36.
- Homaki, C. H. (2016). Vulnerability as a regulatory category in human subject research. *Journal of Law, Medicine and Ethics*, 37(1), 12-18.
- Hussain, B. A., Li, S., & Alsanad, A. (2022). Assessment of information literacy abilities: A case study of

- Institute for Academic Development (2021). Digital Skills. <https://www.ed.ac.uk/institute-academic-development/study-hub/learning-resources/digital>
- Jalal, A. (2020). Research productivity in higher education environment. *Journal of Higher Education Service Science and Management*, 3(1), 1-14. <https://www.joherd.co/journals/index.php>.
- Jiao, H., Wang, T., Libaers, D., Yang, J. & Hu, L. (2025). The relationship between digital technologies and innovation: A review, critique, and research agenda. *Journal of Innovation & Knowledge*, 10(1). <https://doi.org/10.1016/j.jik.2024.100638>.
- Lin, M. Liu, L. Y. J. & Pham, T. N. (2023). Towards developing a critical learning skills framework for master's students: Evidence from a UK university. *Thinking Skills and Creativity*, 48. <https://doi.org/10.1016/j.tsc.2023.101267>.
- Mogonea, F., and Remus Mogonea, F. (2019). The pedagogical research project - an essential tool for the development of research competencies in the field of education. *Educatia* 21 17, 49–59. doi: 10.24193/ed21.2019.17.05
- Mogonea, F., and Remus Mogonea, F. (2019). The pedagogical research project - an essential tool for the development of research competencies in the field of education. *Education* 21(17), 49–59.
- Montoya, P. (2021) *A framework for integrating ICT in Teaching and learning process in Secondary Schools in Kenya*. Master of Science thesis submitted at University of Nigeria school of Computing and informatics.
- Munna, A. S. & Kalam, M. A. (2021). Teaching and learning process to enhance teaching effectiveness: A literature review. *International Journal of Humanities and Innovation*, 4(1), 1-4.
- Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, 59(3), 1065–1078. <https://doi.org/10.1016/j.compedu.2012.04.016>
- Ngozi, A. G. (2012) *Research methods: Quantitative and qualitative approaches*. Nigeria Acts Press.
- Nwakpa, P. (2015). Research in tertiary institutions in Nigeria: Issues, challenges and prospects: Implication for educational managers. *IOSR Journal of Humanities and Social Science*, 20(6), 45-49. www.iosrjournals.org.
- Nwigwe, O. E., Shaoan, M. M., Igweani, C. C., Ouattara, C. A. T. & Okagbue, E. F. (2024). University Students' Intentions to Develop Competences and its Influencing Factors: A Nigerian Context. *Academic Journal of Interdisciplinary Studies* 13(4). Doi: 10.36941/ajis-2024-0147.
- Olawale, G. (2016). Assessing the impact of educational video on student engagement, critical thinking and learning: *The current state of play*. White paper, Sage Publishing.
- Pangrazio, L. Godhe, A. A., & Ledesma, A. G. L. (2020). What is digital literacy? A comparative review of publications across three language contexts. *E-Learning and Digital Media*, 17(6), 442–459.
- Parsazadeh, N, Ali, R. & Saeed, I. I. R (2015). Digital information evaluation skills among students in higher education. *Jurnal Teknologi (Sciences & Engineering)* 75(11), 91–99. www.jurnalteknologi.utm.my.
- Perkins, D. N., & Salomon, G. (1992). Transfer of learning. *International Encyclopedia of Education* (2nd ed.).

Pergamon Press.

- Shivni, R., Cline, C., Newport, M., Yuan, S., & Bergan-Roller, H. E. (2021). Establishing a baseline of science communication skills in an undergraduate environmental science course. *Int. J. STEM Educ.*, 8(1), [10.1186/s40594-021-00304-0](https://doi.org/10.1186/s40594-021-00304-0).
- Steiner, G. (2001). Transfer of Learning, Cognitive Psychology in Neil J. S., Paul B. B. Ed. International Encyclopedia of the Social & Behavioral Sciences, Pergamon, 15845-15851. <https://doi.org/10.1016/B0-08-043076-7/01481-9>.
- The Open University (2012). Digital and information literacy framework. <http://www.open.ac.uk/libraryservices/subsites/dilframework>.
- Thorndike, E. L., & Woodworth, R. S. (1901). The influence of improvement in one mental function upon the efficiency of other functions. *Psychological Review*, 8(6), 553–564. <https://doi.org/10.1037/h0074898>.
- Trist, E. L., & Bamforth, K. W. (1951). Some social and psychological consequences of the longwall method of coal-getting: An examination of the psychological situation and defences of a work group in relation to the social structure and technological content of the work system. *Human Relations*, 4(1), 3-38. <https://doi.org/10.1177/001872675100400101>.
- Yuan, X., Rehman, S., Altalbe, A. Rehman, E. & Shahiman M. A. (2024). Digital literacy as a catalyst for academic confidence: exploring the interplay between academic self-efficacy and academic procrastination among medical students. *BMC Med Educ* 24, 1317. <https://doi.org/10.1186/s12909-024-06329-7>
- Zhai, C., Wibowo, S. & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learn. Environ.* 11(28). <https://doi.org/10.1186/s40561-024-00316-7>.
- Zoe, E. D. & Claire, P. (2015). Developing research competence in undergraduate students through hands on learning. *Journal of Biomedical Education*, [pageshttp://dx.doi.org/10.1155/2015/306380](http://dx.doi.org/10.1155/2015/306380).