

INFLUENCE OF DIGITAL LEARNING FACILITIES IN PROMOTION OF CRITICAL THINKING AND PROBLEM SOLVING SKILLS AMONG PRINCIPALS IN ENUGU STATE

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Abstract

This study investigated the extent to which digital learning facilities promoted critical thinking and problem-solving skills among principals in Enugu State. Two research questions guided the study. The study adopted a descriptive survey research design and was carried out in Enugu State, Nigeria. The population comprised 295 principals in public secondary schools, consisting of 145 male and 150 female principals. Owing to the manageable size of the population, the census technique was adopted and the entire population was studied. Data were collected using a structured questionnaire titled *Digital Learning Facilities, Critical Thinking and Problem-Solving Skills Questionnaire (DLFCTPSSQ)*. The instrument was face-validated by three experts, comprising two experts in Educational Management and one expert in Measurement and Evaluation. The reliability of the instrument was established using the Cronbach Alpha method, which yielded an overall reliability coefficient of 0.81. The questionnaire was administered by the researcher with the assistance of six trained research assistants, and all the copies distributed were successfully retrieved. Data were analyzed using mean and standard deviation, while the decision rule was based on the real limits of numbers as follows: 3.50–4.00 = Very High Extent, 2.50–3.49 = High Extent, 1.50–2.49 = Low Extent, and 1.00–1.49 = Very Low Extent. The findings revealed that computer systems promoted critical thinking and problem-solving skills among principals to a high extent, while smartphones promoted these skills to a low extent. Based on the findings, it was recommended that the Post Primary Schools Management Board should organize regular capacity-building programmes to enhance principals' competence in utilizing digital learning facilities for effective school administration.

Keywords: digital learning facilities, computer systems, smartphones, critical thinking

Introduction

The increasing integration of digital technologies into education has transformed the administration and management of schools across the world. Educational institutions are increasingly adopting digital learning facilities to enhance instructional delivery, improve communication, facilitate collaboration, and support evidence-based decision-making. Beyond classroom instruction, these technologies have become essential tools for school administrators, particularly principals, whose responsibilities require effective planning, supervision, monitoring, evaluation, and leadership. The ability of principals to utilize digital learning facilities effectively has become critical for promoting innovative leadership practices and improving educational outcomes. Sari, Priatna, and Juandi (2022) observed that the integration of digital technologies has significantly reshaped educational practices by providing opportunities for more effective teaching, learning, and school management. Similarly, Rafiq (2024) maintained that digital learning environments facilitate the development of higher-order thinking skills that enable educational leaders to respond effectively to the demands of contemporary education.

Digital learning facilities refer to technological resources that support the acquisition, management, storage, dissemination, and utilization of information for educational purposes. These facilities include computers, laptops, tablets, smartphones, internet services, interactive whiteboards, multimedia projectors, learning management systems, digital libraries, cloud-based applications, virtual meeting platforms, and other information and communication technologies that facilitate teaching, learning, and educational administration. Kumar (2024) explained that digital technologies provide efficient mechanisms for processing and transmitting information, thereby improving productivity and institutional effectiveness. Zhang (2024) further asserted that recent technological innovations enable educational administrators to access real-time information, evaluate institutional performance, simulate different administrative scenarios, and make informed decisions capable of improving school effectiveness.

The responsibilities of school principals have become increasingly complex due to continuous educational reforms, technological innovations, globalization, and the changing expectations of society. Principals are expected to provide instructional leadership, manage human and material resources, resolve conflicts, supervise teachers, improve students' learning outcomes, and ensure the effective implementation of educational policies. Accomplishing these responsibilities requires the ability to think critically and solve problems efficiently. Chang (2023) noted that educational leaders require advanced cognitive competencies to navigate the complexities associated with rapidly changing educational environments. Likewise, Kim and Lee (2022) emphasized that educational institutions increasingly value educational leaders who demonstrate analytical thinking, creativity, adaptability, and effective problem-solving abilities necessary for institutional growth and sustainability.

Critical thinking has become one of the most valued competencies required of educational leaders in the twenty-first century. It enables individuals to examine situations objectively, evaluate evidence, analyze alternative perspectives, make logical judgments, and arrive at informed decisions. Tang, Vezzani, and Eriksson (2020) described critical thinking as a reasoned and reflective cognitive process involving analysis, evaluation, interpretation, and informed decision-making. Hidayati (2019) explained that critical thinking enables individuals to question assumptions, evaluate the credibility of available information, and formulate logical explanations for complex situations. Monteiro (2020) further argued that critical thinking involves both cognitive abilities and positive dispositions such as curiosity, open-mindedness, flexibility, and intellectual responsibility. Similarly, Reynders (2020) maintained that critical thinking empowers professionals to synthesize available evidence, evaluate competing alternatives, and justify decisions based on logical reasoning and empirical evidence.

Closely related to critical thinking is problem-solving, which remains an indispensable competency for effective educational leadership. Problem-solving involves identifying challenges, analyzing available information, generating alternative solutions, selecting the most appropriate course of action, implementing decisions, and evaluating outcomes. Educational administrators encounter numerous challenges relating to curriculum implementation, staff management, learners' welfare, financial administration, infrastructural development, and policy implementation, all of which require sound problem-solving abilities. Fissore (2021) described problem-solving as the ability to understand situations, identify challenges, analyze relevant information, and implement effective solutions capable of achieving desired objectives. Horn and Veermans (2019) argued that successful problem-solving depends largely on an individual's ability to apply

contextual knowledge, analytical reasoning, and reflective thinking to practical situations. Consequently, principals who possess strong problem-solving skills are more likely to make informed decisions that enhance school effectiveness and organizational performance.

The increasing availability of digital learning facilities has created significant opportunities for strengthening critical thinking and problem-solving skills among educational professionals. Digital technologies provide access to vast information resources, virtual learning environments, online professional development programmes, collaborative platforms, data visualization tools, and artificial intelligence applications that encourage analytical reasoning, creativity, reflective practice, and evidence-based decision-making. Changwong (2018) observed that digital learning environments promote higher-order cognitive engagement by encouraging learners and educational professionals to analyze, evaluate, and synthesize information from multiple sources before making decisions. Dumitru and Halpern (2023) similarly maintained that technology-supported learning environments enhance reasoning abilities, creativity, innovation, and collaborative problem-solving through authentic learning experiences. Consequently, principals who effectively utilize digital learning facilities are more likely to demonstrate improved leadership competence, better decision-making, and enhanced institutional performance.

Globally, empirical studies have consistently demonstrated the positive influence of digital learning facilities on critical thinking, problem-solving, instructional leadership, and organizational effectiveness. Studies conducted across Europe, Asia, and North America indicate that the integration of educational technologies improves reflective leadership, collaborative decision-making, professional competence, and institutional innovation. Sari, Priatna, and Juandi (2022) reported that digital learning environments significantly enhanced critical thinking, reflective practice, and collaborative learning among educational professionals. Likewise, Rafiq (2024) found that technology-supported learning environments promote active engagement, collaborative inquiry, and innovative problem-solving among educators and school administrators. These findings suggest that digital learning facilities have become indispensable resources for improving educational leadership across different educational systems.

Across Africa, the adoption of digital learning facilities has gained increasing attention as governments and educational institutions seek to improve educational quality and administrative efficiency. Several African countries have implemented policies aimed at expanding digital infrastructure, improving internet connectivity, strengthening digital literacy, and promoting technology-supported educational management. Despite these efforts, many educational institutions continue to experience challenges associated with inadequate technological infrastructure, unstable electricity supply, poor internet connectivity, insufficient funding, and limited opportunities for continuous professional development. These constraints reduce the ability of school principals to maximize the benefits of digital learning facilities for effective leadership and informed decision-making. Consequently, there remains a need to strengthen institutional support for technology integration and capacity building among educational leaders across the continent.

In Nigeria, educational reforms have increasingly emphasized the integration of information and communication technologies into teaching, learning, and school administration. Federal and state governments have introduced various initiatives aimed at improving digital infrastructure, expanding internet access, promoting digital literacy, and

enhancing technology utilization among educators and school administrators. Nevertheless, many public secondary schools continue to face challenges such as inadequate digital facilities, poor maintenance of available technologies, irregular electricity supply, limited internet access, and insufficient professional training in the effective use of digital resources. These limitations may hinder principals from utilizing digital learning facilities effectively to promote critical thinking and problem-solving skills required for efficient school administration.

Recent developments in educational technology demonstrate that attention has shifted from merely providing digital facilities to ensuring that these technologies are effectively utilized to strengthen leadership capacity, evidence-based decision-making, collaborative learning, innovation, and sustainable school improvement. Emerging technologies such as artificial intelligence, cloud computing, learning analytics, virtual collaboration platforms, digital databases, and online professional learning communities are increasingly being integrated into educational administration to enhance leadership effectiveness. Chang (2023), Zhang (2024), and Kumar (2024) emphasized that these technological innovations enable educational leaders to analyze information critically, generate innovative solutions, monitor institutional performance, and respond proactively to emerging educational challenges. These developments suggest that the effectiveness of educational leadership depends not only on the availability of digital facilities but also on principals' ability to utilize them in promoting higher-order thinking and effective problem-solving.

Although previous empirical studies have examined digital learning facilities in relation to students' academic achievement, teachers' instructional effectiveness, digital literacy, online learning, and classroom engagement, relatively few studies have specifically investigated their influence on the promotion of critical thinking and problem-solving skills among secondary school principals. Existing studies have largely focused on classroom instructional processes, leaving limited empirical evidence regarding the role of digital learning facilities in strengthening principals' cognitive competencies required for effective educational leadership. Furthermore, there is limited empirical evidence within the context of public secondary schools in Enugu State, thereby creating a contextual and knowledge gap that warrants further investigation. Hence, it is against this background that this study investigates the influence of digital learning facilities in promoting critical thinking and problem-solving skills among principals in Enugu State. The findings of the study are expected to provide useful empirical evidence for educational policymakers, school administrators, teacher education institutions, and other stakeholders on strategies for improving the utilization of digital learning facilities to strengthen educational leadership, enhance evidence-based decision-making, promote effective problem-solving, and facilitate sustainable school improvement.

Statement of the Problem

The integration of digital learning facilities has become increasingly important in promoting effective educational leadership and enhancing critical thinking and problem-solving skills among school principals. Ideally, principals are expected to effectively utilize available digital learning facilities to access relevant information, analyze complex administrative issues, make informed decisions, solve emerging school-related problems, and improve the overall management of their schools. They are also expected to demonstrate the capacity to leverage digital technologies for continuous professional development, collaborative decision-making, strategic planning, and evidence-based

leadership, thereby fostering effective teaching, learning, and sustainable school improvement. However, the reality in many public secondary schools in Enugu State appears to differ from this expectation. Despite the growing emphasis on digital transformation in education, many principals seem to experience challenges in effectively utilizing digital learning facilities for administrative and instructional leadership. Inadequate access to modern digital technologies, poor internet connectivity, irregular electricity supply, insufficient digital competence, limited professional training, and inadequate technological infrastructure may have constrained the effective use of digital learning facilities. Consequently, these limitations may affect principals' ability to think critically, analyze administrative situations objectively, generate innovative solutions, make timely decisions, and respond effectively to the complex challenges associated with school administration.

Although efforts have been made to promote the integration of digital technologies in Nigerian schools, there is limited empirical evidence on the extent to which digital learning facilities influence the promotion of critical thinking and problem-solving skills among principals, particularly in public secondary schools in Enugu State. Most existing studies have focused primarily on students' academic achievement, teachers' instructional practices, digital literacy, and technology integration in classroom teaching, with relatively little attention given to principals' higher-order cognitive competencies required for effective educational leadership. Therefore, it is this apparent gap that constitutes the problem of this study. Therefore, the study seeks to investigate the influence of digital learning facilities in promoting critical thinking and problem-solving skills among principals in Enugu State with a view to providing empirical evidence that will inform policies and strategies for strengthening technology-driven educational leadership and improving school effectiveness.

Purpose of the Study

The main purpose of this study was to examine the extent to which digital learning facilities promote critical thinking and problem-solving skills among principals in Enugu State. Specifically, the study sought to determine the:

1. extent to which computer systems promote critical thinking and problem-solving skills among principals in Enugu State.
2. extent to which smartphones promote critical thinking and problem-solving skills among principals in Enugu State.

Research Questions

The following research questions guided the study:

1. To what extent do computer systems promote critical thinking and problem-solving skills among principals in Enugu State?
2. To what extent do smartphones promote critical thinking and problem-solving skills among principals in Enugu State?

Methods

The study adopted a descriptive survey research design. The design was considered appropriate because it enabled the researcher to collect data from principals on the extent to which digital learning facilities promote critical thinking and problem-solving skills in public secondary schools. The study was conducted in Enugu State, South-East Nigeria. Enugu State comprises six Education Zones, namely Agbani, Awgu, Enugu, Nsukka, Obollo-Afor, and Udi. The State has a large number of public secondary schools managed by the Post Primary Schools Management Board (PPSMB), making it suitable for

investigating the promotion of critical thinking and problem-solving skills among principals through the use of digital learning facilities. The population of the study comprised 295 principals in all the public secondary schools in Enugu State, consisting of 145 male and 150 female principals (Post Primary Schools Management Board [PPSMB], Enugu, 2024). Owing to the manageable size of the population, no sampling was carried out. Consequently, the entire population of 295 principals was studied using the census technique.

The instrument for data collection was a structured questionnaire developed by the researcher titled Digital Learning Facilities, Critical Thinking and Problem-Solving Skills Questionnaire (DLFCTPSSQ). The questionnaire consisted of two sections. Section A elicited information on the respondents' demographic characteristics, while Section B contained 20 items organized into two clusters. Cluster One comprised 10 items on computer systems, while Cluster Two comprised 10 items on smartphones. The instrument was structured on a 4-point rating scale of Very High Extent (VHE) = 4, High Extent (HE) = 3, Low Extent (LE) = 2, and Very Low Extent (VLE) = 1. The instrument was subjected to face validation by three experts. Two were from the Department of Educational Management, while one was from the Department of Mathematics and Computer Education (Measurement and Evaluation Unit), all in the Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu. Their observations and suggestions regarding the clarity, relevance, adequacy, and appropriateness of the items in relation to the purpose of the study and research questions were incorporated in producing the final version of the instrument. To establish the reliability of the instrument, a trial test was conducted using 40 principals drawn from public secondary schools in Ebonyi State, comprising 20 male and 20 female principals, who were not part of the study population. The data obtained were analyzed using Cronbach Alpha, which yielded an overall reliability coefficient of 0.81, indicating that the instrument was sufficiently reliable for the study.

The researcher, with the assistance of six trained research assistants, administered 295 copies of the questionnaire directly to the respondents. The research assistants were briefed on the objectives of the study and the procedures for administering and retrieving the instrument. All 295 copies of the questionnaire administered were successfully retrieved, representing a 100% return rate. Data collected were analyzed using mean and standard deviation to answer the research questions. The decision rule was based on the real limits of numbers as follows: 3.50–4.00 = Very High Extent; 2.50–3.49 = High Extent; 1.50–2.49 = Low Extent; and 1.00–1.49 = Very Low Extent.

Results

Research Question 1: To what extent do computer systems promote critical thinking and problem-solving skills among principals in Enugu State?

Table 1: Mean ratings of male and female principals on the extent to which computer systems promote critical thinking and problem-solving skills among principals in Enugu State.

S/N	Item Statement	Male Principal		Female Principal		Overall (n = 295)		Decision
			SD		SD		SD	
1	Computer systems enable users to experiment with, analyze, and evaluate	2.62	.96	2.58	.89	2.60	.93	High Extent

	different scenarios, thereby promoting critical thinking.							
2	Computer systems enable users to collect, analyze, and visualize large datasets, thereby promoting critical thinking.	2.62	.89	2.55	.94	2.59	.92	High Extent
3	Computer systems provide access to vast information, enabling users to research, evaluate sources, and synthesize knowledge.	2.55	.92	2.59	.89	2.57	.91	High Extent
4	Computer systems facilitate collaboration and feedback through online platforms, discussion forums, and peer review, thereby promoting critical thinking.	2.65	.82	2.63	.80	2.64	.81	High Extent
5	Computer systems utilize artificial intelligence and machine learning algorithms to analyze complex data, identify patterns, and support critical thinking.	2.54	.84	2.57	.82	2.56	.83	High Extent
	Mean	2.59	0.88	2.58	0.86	2.59	0.88	High Extent
	Computer Systems and Problem-Solving Skills							
6	Computer systems provide data analysis tools such as spreadsheets, statistical software, and visualization tools to support problem-solving.	2.59	.82	2.60	.82	2.60	.82	High Extent
7	Computer systems provide decision-support systems that assist principals in analyzing problems and making informed decisions.	2.63	.80	2.54	.82	2.59	.81	High Extent
8	Computer systems enable users to create simulations of complex situations for experimentation and analysis.	2.56	.89	2.60	.90	2.58	.90	High Extent
9	Computer systems provide modelling tools that support problem analysis and solution development.	2.60	.94	2.64	.88	2.62	.91	High Extent
10	Computer systems provide communication tools such as e-mail, video conferencing, and instant messaging to facilitate collaborative problem-solving.	2.67	.87	2.68	.93	2.68	.90	High Extent
	Mean	2.61	0.86	2.60	0.87	2.60	0.86	High Extent
	Cluster Mean/SD	2.60	0.87	2.59	0.86	2.59	0.87	HE

The results presented in Table 1 show that the male principals had mean ratings ranging from 2.54 to 2.67, while the female principals had mean ratings ranging from 2.54 to 2.68. The cluster mean ratings for the male and female principals were 2.60 and 2.59, with corresponding standard deviations of 0.87 and 0.86, respectively. The overall mean ratings ranged from 2.56 to 2.68, with a cluster mean of 2.59 and a standard deviation of 0.87. Based on the established decision rule, the cluster mean of 2.59 indicates that computer systems promote critical thinking and problem-solving skills among principals in Enugu State to a high extent. The relatively low standard deviation values further indicate that the responses of the respondents were homogeneous, suggesting consistency in their opinions.

Research Question 2: To what extent do smartphones promote critical thinking and problem-solving skills among principals in Enugu State?

Table 2: Mean ratings of male and female principals on the extent to which smartphones promote critical thinking and problem-solving skills among principals in Enugu State.

S/N	Item Statement	Male Principal	SD	Female Principal	SD	Overall (n = 295)	SD	Decision
11	Smartphones provide instant access to vast amounts of information, enabling users to research and gather information on various topics.	2.54	.91	2.50	.95	2.53	.93	High Extent
12	Educational applications such as Duolingo, Coursera, and Khan Academy provide interactive learning experiences that promote critical thinking.	2.52	.93	2.54	.94	2.53	.94	High Extent
13	Applications such as chess and brain teaser games challenge users to think critically and solve problems.	2.51	.90	2.53	.90	2.52	.90	High Extent
14	Games such as Logic Grid Puzzles and The Talos Principle require users to think logically and make connections between different pieces of information.	2.53	.86	2.53	.88	2.53	.87	High Extent
15	Smartphones enable users to participate in online forums and discussions, thereby promoting critical thinking through the exchange of ideas.	2.54	.96	2.58	.93	2.56	.95	High Extent
	Mean	2.52	0.91	2.53	0.92	2.53	0.91	High Extent
	Smartphones in the Promotion of Problem-Solving Skills							
16	Smartphones enable users to participate in online forums and discussions that facilitate collaborative problem-solving.	2.50	.91	2.52	.90	2.51	.91	High Extent
17	Social media platforms, when used responsibly, facilitate problem-solving through collaboration and information sharing.	2.45	.95	2.48	.90	2.47	.93	Low Extent
18	Smartphones encourage open communication that supports problem-solving.	2.38	.90	2.43	.88	2.41	.90	Low Extent
19	Smartphones encourage interpersonal motivation that enhances problem-solving.	1.50	.96	1.58	.97	1.54	.97	Low Extent
20	Smartphones increase personal efficacy and self-determination in solving problems.	2.55	.80	2.54	.82	2.54	.82	High Extent
	Mean	2.27	0.94	2.31	0.89	2.29	0.91	Low Extent
	Cluster Mean/SD	2.40	0.93	2.42	0.91	2.41	0.92	LE

The results presented in Table 2 show that the male principals had mean ratings ranging from 1.50 to 2.55, while the female principals had mean ratings ranging from 1.58 to 2.58. The cluster mean ratings for the male and female principals were 2.40 and 2.42,

with corresponding standard deviations of 0.93 and 0.91, respectively. The overall mean ratings ranged from 1.54 to 2.56, with a cluster mean of 2.41 and a standard deviation of 0.92. Based on the established decision rule, the cluster mean of 2.41 indicates that smartphones promote critical thinking and problem-solving skills among principals in Enugu State to a low extent. The relatively low standard deviation values indicate that the respondents' opinions were homogeneous, suggesting consistency in their responses.

Discussion

The findings of the study revealed that computer systems promote critical thinking and problem-solving skills among principals in Enugu State to a high extent. Specifically, the respondents indicated that computer systems enable users to collect, analyze, and visualize large datasets; provide access to vast amounts of information for research, evaluation, and knowledge synthesis; facilitate collaboration through online platforms, discussion forums, and peer review systems; and utilize artificial intelligence and machine learning technologies to support critical thinking. The findings further showed that computer systems provide data analysis tools, decision-support systems, simulation platforms, modelling tools, and communication applications such as e-mail, video conferencing, and instant messaging that enhance problem-solving and informed decision-making among principals. These findings suggest that computer systems have become indispensable digital learning facilities that support educational leadership by enabling principals to analyze information critically, solve administrative problems, and make evidence-based decisions. The findings are in agreement with those of Changwong (2018) and Dumitru and Halpern (2023), who reported that technology-supported learning environments enhance critical thinking, reasoning, and problem-solving by providing authentic learning experiences and encouraging analytical engagement with real-life situations.

The findings also revealed that smartphones promote critical thinking and problem-solving skills among principals in Enugu State to a low extent. Although respondents acknowledged that smartphones provide immediate access to information, support the use of educational applications, facilitate participation in online discussions, and encourage collaboration and the sharing of ideas, their overall ratings indicated that smartphones are not being utilized sufficiently to enhance problem-solving skills. In particular, the respondents rated the use of social media platforms for problem-solving, open communication, and interpersonal motivation at a low extent, thereby reducing the overall contribution of smartphones to the promotion of critical thinking and problem-solving skills. This finding implies that despite the availability and portability of smartphones, their educational and administrative potential has not been fully harnessed by principals. The finding corroborates the submission of Song and Cai (2024), who maintained that educational applications available on smartphones provide interactive learning experiences capable of enhancing critical thinking when effectively utilized. The finding also supports Rennie (2017), who emphasized that human behaviour, attitudes, and values influence how technological resources are utilized in achieving educational and professional goals. Consequently, there is a need to strengthen principals' digital competence and encourage the purposeful utilization of smartphones as tools for educational leadership, collaboration, and effective decision-making.

Conclusion

This study examined the extent to which digital learning facilities promote critical thinking and problem-solving skills among principals in Enugu State. The findings

revealed that computer systems promote critical thinking and problem-solving skills to a high extent by providing opportunities for information access, data analysis, collaboration, communication, simulation, and evidence-based decision-making. Conversely, smartphones were found to promote critical thinking and problem-solving skills to a low extent, indicating that although they possess significant educational and administrative potential, they are not being optimally utilized by principals. The study therefore concludes that the effective utilization of digital learning facilities, particularly computer systems, can strengthen principals' cognitive competencies, enhance decision-making, improve problem-solving abilities, and contribute to effective school administration. Consequently, greater attention should be given to improving digital infrastructure, strengthening digital competencies, and encouraging the purposeful use of digital learning facilities among principals in public secondary schools.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. The Post Primary Schools Management Board (PPSMB) should organize regular capacity-building programmes, workshops, and in-service training for principals to enhance their competence in the effective utilization of computer systems and smartphones for promoting critical thinking, problem-solving, and evidence-based school management.
2. Government and the Post Primary Schools Management Board (PPSMB) should provide adequate digital learning facilities, reliable internet connectivity, and alternative power supply in public secondary schools to enable principals to maximize the use of digital technologies for effective educational leadership and decision-making.

Educational Implications of the Study

The findings of this study imply that effective utilization of digital learning facilities, particularly computer systems, can enhance principals' critical thinking and problem-solving skills, leading to improved decision-making and school administration. The study also highlights the need for government and educational stakeholders to provide adequate digital infrastructure and continuous capacity-building programmes to strengthen principals' digital competencies for effective educational leadership.

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