

**ROLE OF DIGITAL INFRASTRUCTURE AND DIGITAL SKILLS DEVELOPMENT
IN THE IMPLEMENTATION OF BUSINESS EDUCATION CCMAS IN PUBLIC
UNIVERSITIES, SOUTH EAST NIGERIA**

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Abstract

In a rapidly digitalizing world, integrating digital competencies into education is pertinent for maintaining global standards. This study examines the impact of digital infrastructure and digital skills development on the implementation of the Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education across public universities in South East Nigeria. Utilizing a descriptive survey design, a population of 311 was used, comprising a stratified random sample of 150 Business Education lecturers and administrators. Data were collected using a structured questionnaire through Google Forms, which five experts validated. The overall reliability coefficient value of 0.81 was obtained using the Cronbach's Alpha statistical tool. Data were analysed using mean and standard deviation and multiple regression analysis. Findings, among others, revealed that robust digital infrastructure is a significant positive predictor of CCMAS implementation—explaining approximately 16.2% of the variance—while digital skills development showed a marginally nonsignificant negative trend. These findings suggest that, although high-quality digital infrastructure enhances curriculum delivery, current digital skills training may not be fully aligned with the practical needs of CCMAS, potentially limiting its effectiveness. The study recommended that policymakers should develop comprehensive digital infrastructure plans and implement targeted digital skills training programs directly linked to the pedagogical and operational requirements of Business Education, to foster a more digitally inclusive and competitive education system.

Keywords: Digital Infrastructure, Digital Skills Development, CCMAS, Business Education and Public Universities

Introduction

In a rapidly digitalising world, education systems are being reimagined to meet the demands of emerging technological landscapes. Business education, as a critical field for fostering entrepreneurial and managerial competencies, must align with national efforts for digital transformation. The implementation of the Core Curriculum Minimum Academic Standards (CCMAS) in Nigeria serves as a strategic framework for standardizing education while incorporating digital competencies to meet global educational benchmarks. The acronym, CCMAS, is a newly approved content of study by the National Universities commission (NUC) for every field of study in public universities in Nigeria. This paper investigates the impact of digital infrastructure and digital skills development on the implementation of CCMAS in Business Education, highlighting their interconnected roles in shaping educational outcomes.

Digital infrastructure refers to the technological foundation that supports digital activities and services. It includes high-speed internet access, data centers, cloud computing, and the availability of smart devices (Adeleke & Ogunleye, 2021). In the context of Business Education, digital infrastructure is critical for facilitating online learning platforms, digital course content, and virtual collaborative spaces (Ali, 2020). The presence and quality of digital infrastructure can be measured by internet penetration rates, broadband access, and the availability of digital learning facilities in educational institutions.

Digital skills development, on the other hand, involves equipping educators and students with the competencies necessary to effectively navigate and leverage digital technologies (Eze et al., 2022). These skills encompass a wide range of abilities, including digital literacy, data analysis, and the use of digital tools for teaching and learning. In the context of CCMAS implementation, digital skills development can be measured by the number of digital training programs, the level of digital literacy among educators and students, and the integration of digital tools in curriculum delivery.

The relationship between digital infrastructure, digital skills development, and the implementation of CCMAS is both complementary and dynamic. Adequate digital infrastructure provides the necessary platform for digital skills acquisition, while the

development of digital competencies enhances the ability to effectively utilise technological resources in educational settings (Umeh & Onwughalu, 2023). Together, these factors contribute to the successful implementation of CCMAS by fostering an environment that supports innovative teaching and learning practices.

Theoretically, this study draws on the Technology Acceptance Model (TAM), which posits that perceived usefulness and perceived ease of use influence the adoption of technology (Davis, 1989). In the context of CCMAS implementation, the availability of digital infrastructure and the development of digital skills are likely to enhance the perceived usefulness and ease of adopting digital educational tools. This theoretical framework underscores the importance of addressing both technological and human factors to ensure the successful integration of digital innovations in education.

Globally, several countries have demonstrated the transformative potential of digitalisation in education. This is not unconnected with the fact that Estonia's digital education strategy has positioned it as a leader in e-learning and digital competency development (Kitsing, 2020). Similarly, Finland's education system has successfully integrated digital skills training into its national curriculum, fostering a culture of innovation and adaptability (Sahlberg, 2019). These cases underscore the importance of strategic investments in digital infrastructure and skills development to enhance educational outcomes.

Despite these advancements, Nigeria faces significant challenges in digitalising its education sector. Inadequate digital infrastructure, limited access to high-speed internet, and insufficient digital literacy among educators and students hinder the effective implementation of CCMAS (Okeke et al., 2023). Addressing these challenges requires a multi-stakeholder approach involving government, educational institutions, and private sector partners to invest in digital infrastructure and provide comprehensive digital skills training.

This study contributes to the state of the art by providing empirical insights into the role of digital infrastructure and digital skills development in the implementation of CCMAS in Business Education. By identifying the critical factors that influence successful implementation, this research aims to inform policy and practice, fostering a more digitally inclusive and competitive education system in Nigeria. Through a comprehensive analysis

supported by relevant literature and empirical data, the paper underscores the need for a strategic and integrated approach to national digitalisation efforts in education.

Statement of the Problem

The digital transformation of education has become imperative for aligning educational systems with global technological standards. In Nigeria, the implementation of the Core Curriculum and Minimum Academic Standards (CCMAS) seeks to standardize education while integrating digital competencies. However, it is observed that the successful implementation of CCMAS in Business Education faces significant hurdles, though not limited to inadequate digital infrastructure and limited digital skills development among educators and students. The absence of robust technological infrastructure hampers the delivery of digital content and virtual learning, while the lack of digital literacy limits educators' ability to adopt and deploy modern teaching methods effectively.

Existing literature highlights the critical role of digitalization in enhancing educational delivery and curriculum implementation (Adeleke & Ogunleye, 2021; Eze et al., 2022). However, there remains a significant research gap in understanding how digital infrastructure and digital skills development specifically influence the implementation of CCMAS in Business Education within the Nigerian context. While studies have focused on general digital adoption in education, few have examined the combined and context-specific impacts of these factors on CCMAS implementation.

This gap underscores the need for empirical research to explore these dynamics and provide actionable insights for policymakers and educational stakeholders. Understanding the extent to which digital infrastructure and digital skills development influence CCMAS implementation is crucial for developing strategic solutions that ensure educational relevance and competitiveness. This study addresses this gap by investigating the interplay between these factors, thereby contributing to the literature on digital education transformation in Nigeria.

Research Objectives

1. To examine the perceived influence of digital infrastructure on the implementation of Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education.
2. To assess the impact of digital skills development on the implementation of Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education.

Research Questions

1. What is the perceived influence of digital infrastructure on the implementation of Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education?
2. What is the impact of digital skills development on the implementation of Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education?

Hypotheses

H₀₁: Digital infrastructure does not have a significant influence on the implementation of Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education.

H₀₂: Digital skills development does not have a significant impact on the implementation of Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education.

Literature Review

Digital Infrastructure in Education

Digital infrastructure serves as the essential foundation for any educational digitalization initiative. It comprises elements such as high-speed broadband internet, network infrastructure, data centres, cloud computing, and the availability of digital devices. Effective digital infrastructure enables seamless access to online learning platforms, multimedia content delivery, and virtual collaborative environments. (Dwivedi et al., 2022). Scholars like Adeleke and Ogunleye (2021) emphasize its critical role in improving educational access and fostering digital literacy in educational institutions. Measurement indicators for digital

infrastructure in education include internet penetration rates, access to educational technology tools, data storage capacities, and the stability of network services (Okeke et al., 2023).

However, despite these recognized benefits, educational institutions in Nigeria face substantial challenges due to the inadequacy of digital infrastructure. The absence of stable internet connections, limited access to smart devices, and inconsistent power supply undermine efforts to implement digital learning initiatives, including the Core Curriculum Minimum Academic Standards (CCMAS) (Kamuriwo et al., 2024). Addressing these infrastructural deficits requires strategic investments from both the government and private sectors to create a conducive environment for digital learning. Studies by Ejiro and Onwukwe (2021) suggest that schools with access to robust digital infrastructure report higher engagement and improved learning outcomes, further underscoring its importance in modern educational systems.

The successful implementation of the Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education is heavily reliant on robust digital infrastructure (Awa, 2023), which includes essential technological resources such as hardware, software, and reliable internet connectivity (Nayyar & Tripathi, 2024). Inadequate digital infrastructure poses significant challenges to the effective deployment of standardised curricula like CCMAS. For instance, Adamu and Abdullahi (2024) highlighted that insufficient Information and Communication Technology (ICT) facilities in Nigerian universities impede the adoption of innovative teaching practices integral to CCMAS. The National Universities Commission (NUC) has also recognized the critical role of digital infrastructure in curriculum implementation, emphasizing that without adequate technological support, universities may struggle to meet the standards set by CCMAS, thereby affecting the quality of Business Education. Consequently, the null hypothesis (H01), which posits that digital infrastructure does not have a significant influence on the implementation of CCMAS in Business Education, is challenged by empirical evidence. This indicates that robust digital infrastructure is essential for the successful implementation of CCMAS.

Digital Skills Development

Digital skills development encompasses the acquisition of competencies necessary to effectively utilise digital technologies. These skills span a wide spectrum, including digital

literacy, proficiency in collaborative tools, data analysis, cybersecurity awareness, virtual classroom management, multimedia content creation, adaptive learning technology utilization, and the ability to navigate and adopt new digital platforms (Eze et al., 2022). In educational contexts, particularly within South East Nigeria, these skills are essential for both educators and students to harness the full potential of technology-driven teaching and learning models.

Empirical studies consistently demonstrate the positive impact of digital skills development on educational outcomes. For instance, a study by Emeasoba et al. (2022) examined digital strategies for teaching Business Education in universities in South East Nigeria and found that digital skills strategies significantly enhance teaching effectiveness, especially in the new normal era. The study highlighted the importance of online and ICT skills strategies in improving the delivery of Business Education, enabling educators to function effectively in a digital world.

Despite its importance, research indicates that many educators in South East Nigeria lack adequate digital competencies, thereby limiting the effectiveness of curriculum implementation. A study by Njuku and Anunobi (2024) investigating the relationship between the digital skills of academic librarians and the provision of virtual access services in federal university libraries in South East Nigeria revealed a low positive relationship between librarians' digital skills. The relationship also included the provision of access services. The study emphasized the need for continuous development programs to equip educators with the necessary digital skills.

Addressing these gaps requires strategic investments in training programs that cover core digital competencies. Initiatives such as the Science, Technology, Engineering, and Mathematics (STEM) Educators Training by STEMi Makers of Africa have made strides in this direction by training educators with advanced STEM instructional pedagogy and hands-on lab training (Delen & Yüksel, 2023). These programs aim to build educators with exemplary practices who can serve as STEM ambassadors, promoting STEM education in their respective schools and training their colleagues.

Furthermore, the Federal Government has shown commitment to revitalising digital capacity building in the region. For example, plans to revitalise the Digital Bridge Institute (DBI) Enugu campus aim to empower Southeastern youths with digital skills, thereby enhancing job creation and economic growth in the region.

Thus, the effective implementation of the Core Curriculum and Minimum Academic Standards (CCMAS) in Business Education necessitates that educators possess advanced digital competencies to deliver curriculum content as intended. However, research indicates a significant deficiency in these competencies among Nigerian educators, extending beyond basic computer literacy to a lack of proficiency with essential digital tools, thereby hindering effective curriculum delivery (Obadiah et al., 2024). This underscores the critical need for continuous professional development programs focused on enhancing digital skills among educators. National policies, such as the National Digital Economy Policy and Strategy (NDEPS), advocate for embedding digital skills at all educational levels to cultivate a workforce proficient in modern technologies, aligning with CCMAS objectives to produce graduates equipped with relevant digital competencies (Kattington, 2010). Therefore, the null hypothesis (H02), which posits that digital skills development does not significantly impact CCMAS implementation in Business Education, is contradicted by evidence demonstrating that enhancing educators' digital competencies is essential to fulfilling curriculum objectives and preparing students for the contemporary workforce.

The Relationship Between Digital Infrastructure and Digital Skills Development

The interplay between digital infrastructure and digital skills development is essential for the successful implementation of digital curricula. Adequate digital infrastructure provides the platform for acquiring and applying digital skills, while digital skills enable educators and students to maximize the benefits of technological investments. Adeleke and Ogunleye (2021) highlight that the absence of either factor can significantly undermine educational outcomes.

It is not unlikely that a well-equipped educational institution with poor digital skills among educators may fail to utilize available resources fully. Conversely, a digitally skilled workforce without access to adequate digital infrastructure faces limitations in effectively delivering educational content. Umeh and Onwughalu (2023) emphasize that a synchronized

approach that simultaneously addresses both digital infrastructure and skills development is necessary for achieving optimal educational outcomes in Business Education.

Theoretical Framework: Technology Acceptance Model (TAM) (1989)

This study is anchored on the Technology Acceptance Model (TAM), developed by Davis (1989), which posits that perceived usefulness and perceived ease of use are critical determinants of technology adoption. The model underscores the importance of both technological and human factors in the adoption of educational technologies. In this context, digital infrastructure and digital skills development are expected to influence the perceived usefulness and ease of implementing CCMAS in Business Education.

The TAM framework provides a theoretical lens through which the relationships between digital infrastructure, digital skills development, and CCMAS implementation can be examined. By considering the dual influence of technological and human factors, TAM offers a comprehensive understanding of the dynamics involved in adopting digital innovations in education.

Empirical Studies and Research Gap

Several empirical studies have explored the role of digital infrastructure and digital skills development in educational contexts. Kitsing (2020) highlighted how Estonia's digital education strategy has led to significant improvements in educational outcomes by prioritizing investments in digital infrastructure and skills development. Similarly, Sahlberg (2019) documented Finland's success in integrating digital skills training into its national curriculum, fostering a culture of innovation and adaptability.

While these studies provide valuable insights, they are predominantly focused on developed economies with advanced digital ecosystems. In contrast, the Nigerian context presents unique challenges, including limited digital infrastructure, inadequate digital skills development programs, and the evolving nature of educational policies such as CCMAS. Existing studies often focus on general digital adoption without examining the specific interplay between digital infrastructure, digital skills development, and curriculum implementation.

This research gap underscores the need for context-specific studies that address the unique challenges and opportunities presented by CCMAS in Business Education. By exploring the combined effects of digital infrastructure and digital skills development on CCMAS implementation, this study aims to provide empirical insights that inform policy and practice.

Methodology

The study adopted a descriptive survey research design to explore the influence of digital infrastructure and digital skills development on the implementation of CCMAS in Business Education in Nigeria. This design was suitable for obtaining detailed and accurate information about the state of digital adoption in educational institutions. The target population of 311 comprises Business Education lecturers and administrators from public universities in North East, Nigeria. A stratified random sampling technique was employed to ensure representative coverage across different geopolitical zones, selecting a sample size of 150 respondents. Data were collected using a structured questionnaire administered through Google Forms to facilitate efficient and widespread participation. The questionnaire was divided into sections that captured demographic information, the availability and quality of digital infrastructure, digital skills development levels, and CCMAS implementation outcomes. To ensure content validity, the instrument underwent expert review and pilot testing. The collected data were analysed using descriptive and inferential statistics, including mean, standard deviation, and multiple regression analysis to test the formulated hypotheses. Findings were presented in tables and charts to enhance clarity and provide actionable insights for educational stakeholders.

Result and Discussion

Multiple Regression Analysis Predicting the Implementation of CCMAS in Business Education

Predictor	B	Std. Error	Beta	T	p
Intercept	2.449	0.165	—	14.835	.000 ***
DF	0.42	0.087	0.516	4.804	.000 ***
DS	-0.153	0.082	-0.2	-1.865	.064 †

Model Summary

R	0.403
R ²	0.162

Adjusted R² 0.15
 Std. Error of Estimate 0.583

ANOVA

Regression SS	9.295	df = 2	F(2,141)=13.667 .000 ***
Residual SS	47.945	df = 141	
Total SS	57.24	df = 143	

Sample Size (n) 144

Note:

† p < .10; * p < .05; ** p < .01; *** p < .001.

A multiple regression analysis was conducted to examine the extent to which digital infrastructure (DF) and digital skill development (DS) predicted scores on the implementation of CCMAS in Business Education (CCMAS). The overall model was statistically significant, $F(2, 141) = 13.667$, $p < .001$, and accounted for approximately 16.2% of the variance in implementation of CCMAS in Business Education (CCMAS) ($R = .403$, $R^2 = .162$, adjusted $R^2 = .150$). The standard error of the estimate was 0.583.

Concerning the individual predictors, digital infrastructure (DF) emerged as a robust positive predictor. Specifically, the unstandardized coefficient for digital infrastructure (DF) was 0.420 (SE = 0.087), indicating that, holding digital skill development (DS) constant, each one-unit increase in digital infrastructure (DF) was associated with an expected increase of 0.420 units in implementation of CCMAS in Business Education (CCMAS). This effect was statistically significant ($t = 4.804$, $p < .001$).

The positive and statistically significant coefficient for digital infrastructure aligns with previous studies that underscore the essential role of robust technological resources in driving educational outcomes. For instance, Adeleke and Ogunleye (2021) noted that a well-established digital infrastructure—characterized by reliable high-speed internet, adequate hardware, and stable power supply—is foundational for successful digital learning initiatives. Similarly, Umeh and Onwughalu (2023) demonstrated that institutions equipped with such infrastructural assets are better positioned to integrate digital tools into teaching practices, thus enhancing curriculum implementation. In the context of the Technology Acceptance Model (TAM), the availability of digital infrastructure likely increases both the perceived

ease of use and perceived usefulness of digital educational tools, thereby facilitating the adoption of innovations such as CCMAS (Davis, 1989).

Contrary to expectations and much of the extant literature, digital skill development (DS) demonstrated a negative relationship with implementation of CCMAS in Business Education (CCMAS); the coefficient for digital skill development (DS) was -0.153 ($SE = 0.082$), which approached statistical significance ($t = -1.865$, $p = 0.064$). Although the negative association between digital skill development (DS) and implementation of CCMAS in Business Education (CCMAS) did not reach conventional significance at the 0.05 level, it suggests a potential trend. Higher values of digital skill development (DS) are linked with lower implementation of CCMAS in Business Education (CCMAS) scores. The intercept was 2.449 ($SE = 0.165$, $t = 14.835$, $p < .001$), representing the predicted implementation of CCMAS in Business Education (CCMAS) score when digital infrastructure (DF) and digital skill development (DS) are zero. This finding appears counterintuitive given that previous research (e.g., Eze et al., 2022) has emphasized that equipping educators and students with digital competencies is essential for the effective use of technology in education. One potential interpretation is that in environments where digital infrastructure is lacking or inconsistent, higher levels of digital skills may lead to heightened critical awareness. Educators with advanced digital competencies might recognize the limitations of the available technological support, thereby reporting lower effectiveness in curriculum implementation.

Another perspective is that the negative trend might indicate a misalignment between the type of digital skills being developed and the practical demands of implementing CCMAS. For example, if professional development programs are overly focused on generic digital literacy rather than on context-specific applications that directly support curriculum delivery, then enhanced digital skills might not translate into improved implementation outcomes. This interpretation is consistent with findings by Njuku and Anunobi (2024), who observed that without a synchronized improvement in both infrastructure and context-specific digital competencies, the potential benefits of digital skills may not be fully realized.

Conclusion

Digital infrastructure, which is the technological foundation that supports digital activities and services, is relevant in facilitating online learning platforms, digital course contents, and virtual collaborative spaces. Quality digital infrastructure in educational institutions is capable of enhancing the skill development of educators and students, respectively, by providing the necessary platform for digital skills acquisition. The development of digital competencies enhances the abilities of educators and students to effectively utilise technological resources in educational settings. This can contribute to the successful implementation of core curriculum and minimum academic standards (CCMAS), thereby fostering an environment that supports innovative teaching and learning practices. Findings, among others, revealed that robust digital infrastructure is a significant positive predictor of CCMAS implementation, while digital skills development showed a marginally nonsignificant negative trend. These findings are not unconnected with the fact that, although high-quality digital infrastructure enhances curriculum delivery, current digital skills training may not be fully aligned with the practical needs of CCMAS, thereby limiting its effectiveness.

Recommendations

1. Curriculum developers in public universities, in collaboration with the government, policy makers, and non-governmental bodies, should develop and implement a comprehensive digital infrastructure plan that ensures reliable high-speed internet, updated technological hardware, and stable connectivity in public universities. This initiative should include regular assessments to monitor and address any infrastructural gaps that could impede the effective implementation of CCMAS in Business Education.
2. Public universities should establish targeted digital skills training programs that are directly integrated with the operational and pedagogical needs of the CCMAS curriculum. Such training should focus on building both fundamental and advanced digital competencies among educators, ensuring that these skills translate effectively into enhanced teaching practices and curriculum delivery.

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