PUBLIC SECTOR DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE FOR ACADEMIC ENGAGEMENT IN NNAMDI AZIKIWE UNIVERSITY, AWKA.

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ABSTRACT
Using Nnamdi Azikiwe University as a case study, this research examines digital transformation and artificial intelligence (AI) for academic engagement through the lenses of Technological Determinism Theory and Institutional Theory. Technological Determinism Theory posits that technology is a driving force that shapes human behavior and institutional practices. It suggests that the adoption of advanced digital tools and AI systems fundamentally redefines patterns of teaching, learning, and scholarly interaction. Institutional Theory, however, explains how organizational adoption of such technologies is influenced by coercive, normative, and mimetic pressures to conform to governmental regulations, accreditation requirements, and global academic standards. The study adopted a descriptive survey design to obtain empirical data from the field. The population comprised 41,188 students of Nnamdi Azikiwe University, while a sample size of 397 was determined using the Taro Yamane (1964) formula. A random sampling technique was employed to ensure fair representation across faculties. Data were collected through primary sources (structured questionnaires) and secondary sources (peer-reviewed journals, institutional documents, and credible online publications). The findings reveal two key outcomes. First, digital transformation significantly improves efficiency and transparency in academic engagement within the university, particularly through digitized administrative processes and online learning management systems. Second, artificial intelligence contributes meaningfully to personalized learning environments and data-driven instructional decisions. The study concludes that integrating digital transformation and AI strengthens the university's capacity for academic innovation, operational efficiency, and global competitiveness. It recommends that Nigerian federal universities strategically leverage these technologies to enhance teaching quality, student participation, and institutional effectiveness while aligning with national education policies and international standards. This integrated theoretical and empirical approach deepens understanding of the dual forces of technological inevitability and institutional conformity that shape the impact of digital transformation and AI on higher education engagement in Nigeria.
Keywords: Public sector, Digital transformation, Artificial intelligence, Academic engagement and Federal Tertiary Institution.

INTRODUCTION
In recent decades many universities in the Western countries have made technology and artificial intelligence (AI) a normal part of education. They now use online platforms, computer-based teaching tools, automated marking and data tracking to help students learn better and stay more engaged.

Agidani (2021) demonstrated that scholars have used them as models for local reform, noting that adaptive platforms and analytics deliver faster feedback, more personalized learning pathways and improved research collaboration. These studies show how technology enabled pedagogy in Western higher education promotes flexible, student-centered engagement and more efficient academic administration.

In contrast, the level of digital adoption in Nigerian universities, Nnamdi Azikiwe University, Awka inclusive, remains inconsistent and uneven. Although institutional structures such as UNIZIK's ICT and e-learning platforms are in place, their full and systematic use across the campus is still limited. The integration of Artificial Intelligence (AI) into teaching and learning is also slow, largely due to infrastructural challenges such as unstable electricity supply, poor internet connectivity, inadequate staff training and insufficient funding (Nnamdi Azikiwe University, 2023). Oladele (2024) revealed that most digital initiatives in Nigerian universities are fragmented, this lack of a unified approach continues to hinder sustainable progress in teaching innovation, research productivity and student engagement.

Okoro (2020) defined academic engagement as a degree of attention, curiosity, interest and active cognitive, emotional and behavioral participation a student or staff demonstrates in the learning process. Academic engagement is multidimensional: cognitive engagement (investment in learning), emotional engagement (interest and belonging), and behavioral engagement (attendance, participation, assignment completion); all of which predict retention and achievement in Nigerian universities.

Nweze and Okoro (2019) showed that research in Nigeria, students who take their studies seriously perform better and are more ready for jobs, while committed teachers teach better and do more research. This is why people say student and staff involvement is important for schools and for national development.
Eze, Sefotho, Onyishi and Eseadi (2021) stated that when academic engagement is poor the consequences are acute: more students drop out, underachievement, weak research productivity, and diminished institutional performance such as the problems that are compounded by large class sizes and resources constraints in public universities. These outcomes reduce both individual student prospects and the university's contribution to regional development.

Evidence from Nnamdi Azikiwe University (2023) showed that low academic engagement is a widespread problem in federal universities in Nigeria. Although the university has introduced initiatives such as an e-learning platform to encourage interactive learning, reports indicate that these tools are not widely used. Researchers explain this problem as a result of broader challenges, including poor infrastructure, limited teaching skills, and weak implementation of educational policies. This situation highlights the need for a well-planned and comprehensive digital transformation across public universities in Nigeria to improve academic participation and overall institutional performance.

Journal Innovations (2024) stated that digital transformation refers to the integration of modern digital technologies into all aspects of institutional operations, fundamentally reshaping how universities deliver education that includes campus-wide learning platforms, cloud services, institutional data analytics, interact with stakeholders; as well as formal governance for digital services. It moves beyond merely digitizing records or processes, aiming instead to reimagine service delivery for greater efficiency, transparency and responsiveness.
Agidani (2021) argued that there is a clear relationship between digital transformation and academic engagement. Digital transformation creates the enabling environment in which engagement can flourish. Digital tools such as learning management systems (LMS), virtual collaboration platforms and online research databases enable students and faculty to interact seamlessly, access resources on demand, and participate in global academic discourse.

Adeyemi, Alanamu and Obisesan (2025) explained that Artificial Intelligence (AI) refers to computer systems and programs designed to perform tasks that normally require human intelligence. An algorithm is a clear set of step-by-step instructions that a computer follows to solve problems, make decisions, recognize patterns or carry out calculations. It can be compared to a recipe that guides the computer on what to do. In education, AI can be used for activities such as adapting learning content to students' needs, automated assessment, chatbots for student support, and data analysis systems that help identify students who may need early assistance. Studies in Nigeria highlights two main uses of AI: pedagogical AI, which supports teaching and learning through personalized instruction and adaptive tutoring, and administrative AI, which supports school management through enrolment forecasting and automated administrative processes.

Anayochukwu (2025) further explained the relationship between AI and academic engagement as an increasingly significant. AI-driven tools can personalize learning, identify at-risk students, and free lecturers from routine tasks so they focus on mentoring, which should raise cognitive and behavioral engagement. Yet scholars also stress challenges such as digital divide, data privacy, algorithms bias and skills shortages that could blunt benefits unless addressed through policy, capacity building and inclusive infrastructure.

Finally, Nigerian scholarship highlights a clear gap between Western universities (where integrated digital systems and AI are often part of everyday academic life) and Nigerian public universities such as Nnamdi Azikiwe University, Awka, where adoption is piecemeal and constrained (Agidani, 2021). That gap in infrastructure, policy, staff capability and scalable institutional strategy, is the central problem this study addresses. How can digital transformation and AI be harnessed, responsibly and equitably, to boost academic engagement in a federal Nigerian university?

In the light of the above, the objectives of this study are to:

1. Examine the extent to which digital transformation influences efficiency and transparency for academic engagement in Nnamdi Azikiwe University, Awka.
2. Assess the role of artificial intelligence in enhancing personalized learning and predictive analytics for academic engagement in Nnamdi Azikiwe University, Awka.

CONCEPTUAL REVIEW

Public Sector

The public sector refers to the part of the economy that is controlled, financed and operated by government entities at federal, state or local levels. It encompasses institutions and organizations that provide public goods and services, regulate economic activities and ensure social welfare. The public sector plays a vital role in governance by upholding laws, ensuring equitable resource distribution and facilitating national development. In Nigeria, the public sector includes ministries, departments, agencies and government-owned institutions such as federal public universities. These entities are expected to operate with principles of accountability, transparency, and service delivery to meet citizens' needs effectively. The efficiency of the public sector is closely tied to governance quality, policy implementation and the adoption of modern management approaches.

Digital Transformation

United Nations e-Government Survey (2022) emphasized that digital transformation is the process of integrating digital technologies into all areas of an organization, fundamentally altering how it operates and delivers value to stakeholders. It involves the strategic adoption of technologies such as cloud computing, big data analytics, artificial intelligence and digital communication platforms to improve efficiency, transparency and responsiveness. In the public sector, digital transformation extends beyond automating services, it equally entails rethinking processes, improving citizen engagement and enabling data-driven decision-making. For federal public universities such as Nnamdi Azikiwe University, digital transformation can modernize administrative procedures, enhance e-learning, improve research collaboration and promote sustainable governance practices.

Artificial Intelligence (AI)

Ezeanya, Ukaigwe, Ogbaga and Kwanashie (2024) stated that artificial intelligence refers to the simulation of human cognitive processes, such as learning, reasoning and problem-solving by computer systems. OECD Observatory of Public Sector Innovation (2021) pointed out that AI technologies include machine learning, natural language processing, computer vision and robotics, which enable systems to perform tasks that typically require human intelligence. In the public sector, AI applications range from predictive analytics in policy-making to automated service delivery and fraud detection. Within federal public universities, AI can support sustainable governance by improving administrative efficiency, enhancing data accuracy, predicting enrolment trends, optimizing resource allocation and offering personalized learning experiences for students.

Academic Engagement

Okoro (2020) examined academic engagement as a degree of involvement, attention and commitment that students and academics demonstrate in teaching, learning and scholarly activities. It encompasses active participation in both the intellectual and social aspects of academic life. While often associated with students, the concept also applies to lecturers, researchers and institutional stakeholders, as engagement determines the depth and quality of knowledge creation, dissemination and application.

Scholars generally identify three interrelated dimensions of academic engagement:

1. Behavioral engagement – observable participation in class activities, regular attendance, timely completion of assignments and active involvement in academic discussions (Nweze and Okoro, 2019).
2. Emotional engagement – learners' affective responses to the academic environment, including interest, enthusiasm and a sense of belonging to the academic community (Oladele, 2024).
3. Cognitive engagement – the intellectual investment in learning, demonstrated by sustained effort, the use of deep learning strategies and critical thinking (Eze et al., 2021).

These dimensions are interconnected; high engagement in one often reinforces the others. For example, interest (emotional connection) to learning can increase participation (behavioral) and encourage deeper thinking (cognitive).

Iroegbu and Agboola (2019) assessed academic engagement as a key predictor of student success, retention and overall academic quality. Engaged students are substantially more likely to achieve higher grades, complete their programs and develop the problem-solving and communication skills essential for employability. Amaonye and

Anyaeji (2024) evaluated at institutional level, a culture of strong engagement enhances research productivity, fosters collaborative innovation and improves teaching quality. Institutions with robust engagement frameworks thus become more competitive, both nationally and globally, in attracting talented students and staff. Several factors shape levels of academic engagement in universities:

- Institutional resources – availability of learning facilities, technology and research funding (Nweze & Okoro, 2019)
- Teaching quality – use of interactive, student-centered teaching methods (Okoro, 2020).
- Digital transformation – access to learning management systems, online resources and virtual collaboration platforms (Makinde & Onasanya, 2025).
- Artificial intelligence (AI) – personalized learning experiences, predictive analytics for student performance and intelligent tutoring systems (Ezeanya et al, 2024).
- Socio-cultural context – peer influence, family support and societal expectations (Asanre, Ifamuyiwa & Abiodun, 2024).

Okoro (2020) investigated poor academic engagement that carries substantial consequences in Nigerian higher education. Studies show that low engagement among Nigerian students leads to declines in academic performance, heightened risk of dropout, limited skill acquisition and weakening of institutional reputation. For students, disengagement is often associated with reduced motivation, poor time-management and weaker problem-solving ability.

Nweze and Okoro (2019) observed that at the institutional level, persistent disengagement undermines the university's ability to fulfill its mandate of producing competent graduates and may affect its standing in the national and international academic community.

Yakubu (2024) revealed that in the twenty-first century context, digital technologies and AI are reshaping academic engagement. Digital platforms enable more active learning, flexible participation and global collaboration. AI-powered tools offer adaptive instructional content, track engagement patterns and recommend targeted interventions. Hence, digital transformation and AI can act as catalysts for enhancing cognitive, emotional and behavioral engagement in higher education.

National Universities Commission (NUC, 2023) stated that federal public university in Nigeria is a tertiary institution established, funded and regulated by the Federal Government of Nigeria. These universities operate under national education policy and receive federal budget allocations for their academic and administrative functions. Their mandate includes providing affordable, quality higher education, fostering research and contributing to national development. Compared to state or private universities, federal public universities typically have larger admission quotas and serve student populations drawn from diverse socio-cultural backgrounds across the country. Their role in sustainable governance is significant, in that they are expected to produce skilled graduates, advance knowledge and promote civic values that strengthen democratic governance.

EMPIRICAL REVIEW

Digital Transformation in the Public Sector

Jimoh and Adenekan (2024) found that digital transformation capabilities significantly influenced adaptive performance among staff in public tertiary institutions in South-West Nigeria.

Onah, Obianuju Mary and Onwuchekwa (2024) established that in Anambra State, there is a positive relationship between digital transformation and performance of public sector organizations. These findings imply that digital transformation in public universities has the potential to improve institutional performance and student learning experiences.

Artificial Intelligence in Academic Engagement

Ahmed and Amao (2023) explored AI's role in higher education and found that AI tools can enhance student engagement through personalized learning and reshaped teaching methods.

Fasinro, Udofia and Akinkuotu (2024) examined AI's impact on learning assessment in South-West Nigeria and identified improvements in student performance when AI tools were used. These studies suggest AI tools can support both faculty and students by providing real-time insights, fostering participation, and enabling data-driven teaching strategies.

Combined Studies on Digital Transformation and AI in Higher Education / Public Sector

Okoro (2020) argued that integrating AI within digital learning platforms can boost academic engagement by providing adaptive interfaces and analytics. However, the literature reveals a gap; while Western universities have widely integrated technology into academic life, Nigerian public universities, are still grappling with infrastructural, policy, staff-capability and strategic scalability deficits. This gap underpins the central problem this study addresses: how can digital transformation and AI be harnessed, responsibly and equitably, to enhance academic engagement in Nigerian university?

GAP IN THE KNOWLEDGE

Despite growing awareness of the potential of digital transformation and artificial intelligence in higher education, Nigerian federal universities continue to face significant gaps in infrastructure, policy direction and human capacity. This study therefore seeks to explore how these technologies can be strategically and inclusively deployed to strengthen academic engagement in such institutions.

THEORETICAL FRAMEWORK

The study integrates Technological Determinism Theory and Institutional Theory to explore how digital transformation and AI drive academic engagement in Nnamdi Azikiwe University, Awka. Technological Determinism Theory, as advanced by Marshall McLuhan (1964), posits that technological innovations are primary drivers of societal and institutional change, influencing the ways individuals communicate, learn and interact. Babalola and Adedokun-Shittu (2024) showed that digitalization in Nigerian higher education reshapes teaching and learning practices, indicating technology's deterministic influence. Complementing this, Institutional Theory (Paul DiMaggio and Walter Powell, 1983) explained that organizational practices are shaped by coercive, normative and mimetic pressures. Dehinsilu-Isa and Amodu (2025) applied institutional theory to show how educational institutions in Lagos State respond to government policy, professional norms and peer models in their adoption of e-governance. This theoretical combination highlights that while technology determines direction of change, institutional structures, policies and cultural norms determine the pace, method and legitimacy of such transformations.

METHODLOGY

The study adopted descriptive survey design; with both qualitative and quantitative methods to provide a comprehensive analysis of the issue. Respondents consist of all students of Nnamdi Azikiwe University Awka, totaling 41,188. Specifically, the population consists of 24,706 regular students, 12,476 part-time students, and 4,006 postgraduate students (NAU Students Affairs Unit, 2025, Office of Director, Academic Planning NAU, 2025). Three hundred and ninety-seven (397) was determined as a sample size, having used Taro Yamane (1964) formula. Data for the study were elicited from both primary and secondary sources. The primary sources of data for this study was the questionnaire, carefully structured to reflect the objectives, research questions and hypotheses of the study. The researcher was able to achieve questionnaire return of three hundred and sixty responses while thirty-seven were not returned, yielding a response rate of 90.7 percent. The study used mean and standard deviation to interpret research questions one and two. On the other hand, Pearson correlation was used to test the hypotheses at 0.005 level of significance.

DATA PRESENTATION AND ANALYSIS

Research Question One:

An indication of the extent to which the following aspects of Digital Transformation affect Academic Engagement in Nnamdi Azikiwe University Awka.

- To what extent does digital transformation imporove efficiency and transparency for academic engagement in Nnamdi Azikiwe University Awka?

S/N	Item Statements	N	Mean	SD	Decision
1.	Digital systems are used to improve the efficiency of academic service delivery	360	3.66	0.705	VHE
2.	Digital tools are used to enhance transparency in academic and administrative processes	360	3.02	0.906	HE

3.	Flexible and engaging digital learning environments are implemented.	360	3.70	0.494	VHE
4.	Virtual learning platforms are used to increase access to academic resources.	360	3.49	0.797	HE
5.	Data-driven decision making tools are used to improve teaching and learning	360	3.29	0.834	HE
6.	Online collaboration tools are used to improve interactions between students and lecturers.	360	3.49	0.797	HE
7.	Digital transformation is used to support innovative teaching and continuous learning	360	3.29	0.834	HE
	Grand Mean		**3.42**	**0.766**	**HE**

Very High Extend (VHE) = 3.50 – 4.00
High Extent (HE) = 2.50 – 3.49
Low Extent (LE) = 1.50 – 2.49
Very Low Extent (VLE) = 0.00 – 1.49

Research Question Two:
Indication of the extent to which the following applications of AI affect academic engagement in Nnamdi Azikiwe University, Awka.

- How does artificial intelligence contribute to personalized learning and predictive analytics for academic engagement in Nnamdi Azikiwe University Awka?

S/N	Item Statements	N	Mean	SD	Decision
1.	AI is used to provide personalized learning experiences tailored to individual needs	360	3.78	0.511	VHE
2.	AI systems are used to identify at risk students early for targeted interventions.	360	3.11	0.765	HE
3.	AI is used to improve grading efficiency and feedback through automated systems.	360	3.63	0.516	VHE
4.	AI predictive analytics are used for monitoring and improving student performance	360	3.46	0.830	HE
5.	AI is used to create immersive and interactive learning simulations.	360	3.17	0.845	HE
6.	AI is used to complement human instruction for more dynamic learning experiences.	360	3.11	0.765	HE
7.	AI is used to enhance student motivation and comprehension.	360	3.63	0.516	VHE
	Grand Mean		**3.41**	**0.678**	**HE**

Very High Extend (VHE) = 3.50 – 4.00
High Extent (HE) = 2.50 – 3.49
Low Extent (LE) = 1.50 – 2.49
Very Low Extent (VLE) = 0.00 – 1.49

Research Question Three

This reflects the extent to which academic engagement at Nnamdi Azikiwe University is responsive to digital transformation and artificial intelligence interventions.

- An assessment of the extent to which academic engagement at Nnamdi Azikiwe University is influenced by digital technology and artificial intelligence.

S/N	Item Statements	N	Mean	SD	Decision
1.	To what extent do students actively participate in class or online academic activities?	360	3.74	0.557	VHE
2.	To what extent do students complete academic tasks within the required deadlines?	360	3.19	0.747	HE
3.	To what extent do students seek academic support from lecturers when needed?	360	3.71	0.491	VHE
4.	To what extent do students use the university's academic resources to support their studies?	360	3.58	0.629	VHE
5.	To what extent are students motivated to understand course materials in depth?	360	3.43	0.688	HE
6.	To what extent do students collaborate with fellow students in academic projects or discussion?	360	3.60	0.625	VHE
7.	To what extent do students dedicate focused time and attention to their academic work?	360	3.42	0.700	HE
	Grand Mean		**3.52**	**0.594**	**VHE**

Very High Extend (VHE) = 3.50 – 4.00
High Extent (HE) = 2.50 – 3.49
Low Extent (LE) = 1.50 – 2.49
Very Low Extent (VLE) = 0.00 – 1.49

Test of Hypotheses 1

H_1: Digital Technology has a significant relationship with Academic Engagement among students in Nnamdi Azikiwe University, Awka.

Correlations

		DigitalTechnology	Academic Engagement
DigitalTechnology	Pearson Correlation	1	.788**
	Sig. (2-tailed)		.000
	N	360	360
Academic Engagement	Pearson Correlation	.788**	1
	Sig. (2-tailed)	.000	
	N	360	360

**. Correlation is significant at the 0.01 level (2-tailed).

Test of Hypotheses 2

H_1: Artificial intelligence (AI) has a significant relationship with Academic Engagement among students in Nnamdi Azikiwe University, Awka.

Correlations

	Artificial Intelligence	Academic Engagement

Artificial Intelligence	Pearson Correlation	1	.323**
	Sig. (2-tailed)		.000
	N	360	360
Academic Engagement	Pearson Correlation	.323**	1
	Sig. (2-tailed)	.000	
	N	360	360

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION OF THE FINDINGS

Given the results in hypotheses 1: The Pearson correlation coefficient of 0.788 indicates a strong positive relationship between Digital Technology (DT) and Academic Engagement (AE). That means as students' use of digital technology increases, their academic engagement also increases significantly. The relationship is not just noticeable; it is strong.

The p-value = 0.000, which is less than 0.05, indicates that the relationship is highly statistically significant. In simple terms, the strong positive relationship observed is real and not due to random chance. Since $p < 0.05$, the null hypotheses (H_0) is rejected. Therefore, the alternative hypotheses is accepted: Digital Technology significantly and positively influences Academic Engagement among students. In summary, there is a very strong and meaningful positive connection between students' use of digital technology and their academic engagement. This relationship is statistically proven, meaning students who make greater use of digital tools tend to be far more engaged in their learning.

Given the results in hypotheses 2: The Pearson correlation coefficient of 0.323 indicates a moderate positive relationship between Artificial Intelligence (AI) and Academic Engagement (AE). That means as students use AI tools more in their studies, their level of academic engagement tends to increase. The relationship is not extremely strong, but it is meaningful and not weak either.

The p-value = 0.000, which is far below 0.05, indicates that the relationship is highly statistically significant. This implies that the observed relationship is real and not due to chance; AI actually contributes to changes in academic engagement. Since $p < 0.05$, the null hypotheses (H_0) is rejected. Therefore, the study accepts the alternative hypotheses: Artificial Intelligence has a statistically significant positive relationship with Academic Engagement among students. There is a moderate and statistically proven positive relationship between AI use and academic engagement. This means the more students interact with AI-based learning tools, the more academically engaged they become.

CONCLUSION

The study concludes that the integration of digital transformation and artificial intelligence (AI) has significantly reshaped academic engagement in federal public universities. Digital systems enhance the efficiency, transparency, and accessibility of academic and administrative services, while AI introduces adaptive and data-driven learning models that promote personalized education and active participation. Guided by Technological Determinism Theory and Institutional Theory, these innovations not only drive educational modernization but also reinforce institutional legitimacy in a competitive and evolving academic environment. Therefore, embracing these technologies remains crucial for improving learning quality, fostering innovation, and sustaining relevance in Nigeria's higher education system, particularly in Nnamdi Azikiwe University.

RECOMMENDATIONS

The researchers made the following recommendations:

Capacity Building: Universities should prioritize continuous training for academic and administrative staff to effectively utilize digital and AI tools for teaching, research and management.

Infrastructure Investment: The federal government should strengthen digital infrastructure such as broadband connectivity, learning management systems and data analytics platforms, to support efficient digital transformation.

Ethical and Regulatory Frameworks: Institutions should establish policies that guide responsible use of AI to prevent bias, protect data privacy and ensure transparency in academic decision-making.

Collaborative Innovation: Partnerships between universities, technology firms and policymakers should be encouraged to co-develop sustainable AI-driven educational models suited to Nigeria's local context.

IMPLICATION OF THE STUDY

The findings imply that digital transformation and AI adoption in higher education can profoundly influence the quality and inclusiveness of academic engagement. By aligning educational systems with technological innovation, universities can achieve greater efficiency, transparency and adaptability. The study also indicates that technological integration reinforces institutional credibility, aligning with global educational standards. However, without adequate investment, skilled personnel and ethical oversight, the potential benefits of digital and AI-driven transformation may remain unrealized. Thus, the research underscores the need for proactive policy frameworks and institutional readiness to ensure that these emerging technologies translate into measurable academic and developmental outcomes.

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