Assessment of the barriers to AI integration in teacher education programme through Deiph method Nigerian Universities lecturers' experience

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Abstract

The study adopted survey design to examine Michael Okpara University OF Agriculture Umudike and Alvan Ikoku University of Education Owerri teacher educators' experience on the barriers to AI integration in teacher education programme in Nigerian universities through Deiph method. Researchers' made experience response questionnaire titled" Teacher-educators Questionnaire on the barriers to Ai integration in Teacher education programme in Nigerian Universities using Deiph method" (TQBAIEEP). TQBAIEEP was used for data collection. It had reliability coefficient of 0.8 5 determined using Cronbach Alpha. The data collected was analyzed using mean and standard deviation in answering research questions. The findings showed that teacher educators' experiences indicate that barriers to AI integration in teacher education in Nigerian universities exist at the institutional, technological, and socio-cultural factors levels. Recommendations were made which span institutional, technological, and socio-cultural dimensions, emphasizing cross-cutting strategies and capacity building. The Deiph method provides a structured framework for diagnosing, evaluating, identifying, and prioritizing the barriers.

Keywords: Assessment, barriers, artificial intelligence, teacher education, Deiph

Introduction: Artificial Intelligence (AI) integration in teacher education programs has gained significant attention due to its potential to reshape teaching and learning experiences. The application of AI technologies in education aims to enhance pedagogical practices, provide personalized learning experiences, and equip educators

with innovative tools. As education systems worldwide strive to prepare teachers for the challenges of the digital era, AI is increasingly seen as a catalyst for transforming teacher education. AI technologies offer various applications in teacher education, ranging from intelligent tutoring systems to virtual classrooms and data-driven decision-making tools. Intelligent tutoring systems leverage AI algorithms to provide adaptive and personalized instruction, catering to individual learning needs (Smith & Johnson, 2019 & UNESCO, 2018). Virtual classrooms powered by AI facilitate immersive and interactive learning experiences, enabling pre-service and in-service teachers to practice and refine their skills in a simulated environment (Zhao & Alvarez-Torres, 2020). Furthermore, AI plays a crucial role in data analytics, helping educators analyze vast amounts of information to make informed decisions about instructional strategies and student progress. The integration of AI in teacher education programs holds the promise of addressing the diverse needs of learners, promoting inclusivity, and fostering continuous professional development for educators (Johnson, Becker, Cummins, Estrada, Freeman& Hall, 2018). The

landscape of education in the digital age is evolving rapidly, prompting educators and institutions to adapt to technological advancements. AI, encompassing machine learning, natural language processing, and data analytics, offers innovative tools and applications that can revolutionize teacher training. However, the adoption of AI in teacher education programs is not without challenges. These challenges may stem from institutional, technological, pedagogical, and socio-cultural factors unique to specific contexts. Nigeria, like many other nations, is navigating the intersection of traditional education and technological innovation. Understanding the impediments to AI integration in this context is crucial for informed decision-making, policy formulation, and effective implementation strategies. The identification and understanding of these challenges are essential for effective implementation. This study focuses on assessing the barriers hindering the integration of AI in teacher education programs, with a specific emphasis on Nigerian universities.

Deiph, an acronym for Diagnosis, Evaluation, Identification, and Prioritization of Hindrances, offers a structured and systematic framework for analyzing barriers

and proposing targeted interventions (Hasson & Keeney, 2011). Assessing the barriers to AI integration in teacher education programs is crucial for several reasons. Understanding and addressing these barriers are essential steps in ensuring the successful implementation and sustained effectiveness of AI technologies in the education sector. Identifying barriers provides educators, administrators, and policymakers with critical insights into the challenges that may hinder the effective integration of AI in teacher education programs. This knowledge is fundamental for making informed decisions regarding resource allocation, policy development, and strategic planning (Zhao & Alvarez-Torres, 2020). The diverse nature of barriers calls for tailored strategies. By assessing these barriers, institutions can develop targeted approaches that address specific challenges faced in AI integration. This tailored approach enhances the chances of successful implementation and mitigates the risk of encountering unforeseen obstacles (Smith & Johnson, 2019). Limited resources are often a challenge in educational settings. Understanding the barriers allows institutions to allocate resources efficiently. By identifying the key impediments, decision-makers can prioritize investments in areas

that will have the most significant impact on overcoming barriers to AI integration (Johnson et al., 2018 & Wang, 2018). Teacher education programs play a crucial role in preparing educators for the adoption of new technologies. Assessing barriers to AI integration provides insights into the specific areas where educators may need additional support and training. This knowledge facilitates the development of targeted professional development programs, ensuring that teachers are equipped with the necessary skills for effective AI utilization (Smith & Johnson, 2019). Barriers to AI integration can vary across different contexts, and certain groups may be disproportionately affected. An assessment of barriers helps in identifying potential equity issues, ensuring that the benefits of AI integration are accessible to all students and educators, regardless of their background or circumstances (Zhao & Alvarez-Torres, 2020).

The Deiph method systematically assesses the barriers to AI integration in teacher education programs. This approach enhances the overall comprehensiveness and depth of the analysis, providing a robust foundation for developing targeted interventions and strategies. The Deiph Methodology, an

acronym for Diagnosis, Evaluation, Identification, and Prioritization of Hindrances, serves as a structured and systematic framework for assessing barriers to AI integration in teacher education programs. This method offers a comprehensive approach to understanding the multifaceted challenges faced by educational institutions in the adoption of AI technologies. The first step of the Deiph methodology involves a thorough diagnosis of the barriers to AI integration. It emphasizes the need for a detailed examination of institutional, technological, pedagogical, and socio-cultural factors. This diagnostic phase allows for the identification of specific challenges within each domain, offering a holistic view of the impediments faced by teacher education programs (Hasson & Keeney, 2011). For example, the Deiph method may uncover institutional barriers such as budget constraints, lack of leadership support, or resistance from faculty members to embrace AI technologies. Following the diagnosis, the Deiph methodology involves the evaluation of the identified barriers. This step assesses the severity and impact of each obstacle on the overall integration of AI in teacher education programs. Through a systematic evaluation process, the method

aims to quantify the challenges, providing a basis for prioritization and resource allocation (Hasson & Keeney, 2011). For instance, an evaluation might reveal that a lack of technical expertise among educators has a significant impact on the successful integration of AI, necessitating targeted training programs.

The Deiph methodology emphasizes the identification of specific barriers within each category. This step involves a nuanced analysis of the factors contributing to the challenges, allowing for the development of targeted interventions. Identification is essential for tailoring strategies that address the unique context of teacher education programs in Nigerian universities (Hasson & Keeney, 2011). For example, identification of socio-cultural barriers may involve recognizing specific cultural norms or beliefs that impact the acceptance of AI tools among educators and students. Once barriers are diagnosed, evaluated, and identified, the Deiph methodology advocates for their prioritization. This step involves determining which barriers have the most significant impact or are most urgent to address. Prioritization ensures that limited resources are directed towards overcoming obstacles that have the greatest influence on the

successful integration of AI in teacher education programs (Hasson & Keeney, 2011). For example, if the evaluation indicates that institutional barriers are more severe than technological challenges, prioritization may involve focusing initial efforts on securing additional funding and leadership support.

To gain insights into the challenges of AI integration in teacher education programs, it is crucial to examine findings from previous studies. A review by Smith and Johnson (2019) highlighted global trends in AI integration in education, emphasizing the potential benefits of AI tools in enhancing teaching and learning. The study outlined the transformative role of AI in teacher education, setting the stage for further exploration into the challenges faced during the integration process. Smith and Johnson (2019) underscored the need for a comprehensive understanding of the barriers hindering the effective adoption of AI tools in educational settings. Zhao and Alvarez-Torres (2020) conducted a study specifically focusing on the integration of AI in teacher education programs. The research identified various challenges, including pedagogical shifts, concerns about job displacement, and the need for comprehensive professional development. These insights provided a foundation for understanding the nuanced barriers encountered by educators in incorporating AI technologies into their teaching practices. Johnson et al. 2018 & Anderson & Smith, 2019) contributed to the literature by exploring technological challenges associated with AI integration in educational settings. The study discussed issues such as limited access to technology, inadequate infrastructure, and the digital divide. Understanding these technological impediments is crucial for the current study in identifying similar challenges that may exist in the context of teacher education programs in Nigerian universities.

While previous studies have contributed valuable insights into the barriers to AI integration in education, there exists a notable gap in understanding the multifaceted challenges faced by teacher education programs, particularly in the context of Nigerian universities. Existing approaches often lack a systematic and comprehensive framework for assessing barriers across diverse domains such as institutional, technological, pedagogical, and socio-cultural factors (Adeleke & Ogunnaike, 2019). This gap highlights the need for a methodological approach that can offer a

structured analysis to better inform strategies for successful AI integration. Many existing studies have focused on specific aspects of AI integration, such as technological challenges or socio-cultural factors (Adeleke & Ogunnaike, 2019). However, there is a limited use of systematic frameworks that comprehensively address barriers across multiple dimensions. The Deiph method, with its emphasis on Diagnosis, Evaluation, Identification, and Prioritization of Hindrances, provides a structured approach to systematically analyze and address barriers in a holistic manner (Hasson & Keeney, 2011). For instance, while Smith and Johnson (2019) explored global trends in AI integration, their study lacked a systematic framework for evaluating and prioritizing barriers in diverse educational contexts. Teacher education programs in Nigerian universities face unique challenges stemming from contextual factors such as cultural diversity, economic constraints, and varying levels of technological infrastructure. Existing studies may not adequately capture these context-specific challenges, necessitating a method that allows for a nuanced analysis of barriers within the specific context of teacher education in Nigerian universities (Zhao & Alvarez-

Torres, 2020). While some studies have identified barriers, there is often a lack of emphasis on prioritizing these barriers based on their severity and impact. The Deiph method's prioritization component addresses this gap by guiding researchers and policymakers to allocate resources effectively, focusing on overcoming the most critical barriers first (Hasson & Keeney, 2011).

In light of these gaps, the Deiph method emerges as a valuable tool for the current study. By employing this systematic and structured approach, the research aims to provide a comprehensive understanding of the barriers to AI integration in teacher education programs in Nigerian universities, addressing the existing gaps in knowledge and offering actionable insights for effective implementation.

Research Questions

1. What are the institutional barriers to the integration of Artificial Intelligence (AI) in teacher education programs within Nigerian universities, as perceived by Michael Okpara University of Agriculture (MOUAU) and Alvan Ikoku University of Education Owerri (AIUE) lecturers?

2. How do technological challenges impact the successful incorporation of AI in

teacher education programmes in Nigerian universities?

3.   What is the perception of Michael Okpara University of Agriculture MOUAU and Alvan Ikoku University of Education Owerri (AIUE) lecturers on the influence of socio-cultural factors in the integration of AI in teacher education programs in Nigerian universities?

Methodology

A descriptive survey design was used for the study. This study sets to find out the response of teacher-educators on the barriers to Ai integration in teacher education programme in Nigerian Universities using Deiph method. It will specifically determine if there are differences between lecturers in School of Education Michael Okpara University of Agriculture (MOUAU) and lecturers in Alvan Ikoku University of Education Owerri (AIUE) on the on the barriers to Ai integration in teacher education programme in Nigerian Universities using Deiph method. The study was carried out in School of Education, Michael Okpara University of Agriculture (MOUAU) with a population of 136 academic staff and Alvan Ikoku University of Education Owerri (AIUE) with a population of 709 academic staff. The entire academic staff of School of Education

MOUAU was used as sample because the population is small while the purposive sampling technique was employed in selecting the second sample, in which the researchers used 191 academic staff in School of General Education AIUE. The total sample was 327 teacher-educators. Instrument for data collection was a questionnaire titled "Teacher-educators Questionnaire on the barriers to Ai integration in Teacher education programme in Nigerian Universities using Deiph method" (TQBAIEEP). This is a 12-item questionnaire designed by the researchers and validated by three experts in Department of Computer Science Education and Robotics Studies and Educational Psychology, in Alvan Ikoku University of Education, Owerri. The instrument has part 1, 2; 3 & 4. Part, one sought for demographic information of respondents; part two sought information to determine the response of teacher educators on the institutional barriers to the integration of Artificial Intelligence (AI) in teacher education programs within Nigerian universities; part three sought information to determine the response of teacher educators on the adoption of AI in assessing students' learning outcomes in Nigerian universities. Part four sought

information to determine the response of teacher educators on the on the influence of socio-cultural factors in the integration of AI in teacher education programs in Nigerian universities. The items had four response categories of Strongly agree (SA); Agree (A); Disagree (D) and strongly disagree (SD) scoring 4, 3, 2 and 1 respectively. The instrument was face validated by four experts in the Department of Computer Science Education and Robotic Studies, Alvan Ikoku University of Education, Owerri. Their contributions gave rise to the final instrument used for the study. The instrument was subjected to trial testing using Cronbach Alpha to determine its internal consistency using thirty-six lecturers outside the study population. The reliability of TQBAIEEP was 0.85. The instrument was administered to the respondents with the help of two trained research assistants which ensured 100% return. Data were analyzed using mean and standard deviation to answer the research questions. The decision rule was that any mean score of 2.50 and above was accepted otherwise it was rejected. The value of 2.50 was considered as a benchmark for decision making.

Presentation of result Table: 1:

Prevailing responses of MOUAU and ALVAN lecturers regarding the institutional barriers to the integration of Artificial Intelligence (AI) in teacher education programs within Nigerian universities

S/N	ITEM STATEMENT	MOUAU			ALVAN LECTURES		
		$\bar{x}$	SD	REM	$\bar{x}$	SD	REM
1	The budget constraints in our institution pose a significant barrier to the integration of AI in teacher education programs	3.58	0.75	Accept	3.56	0.72	Accept
2	Lack of leadership support within the university hinders the effective implementation of AI in teacher education perceive	3.00	0.46	Accept	3.12	0.44	Accept

3	Resistance from faculty members to embrace AI technologies is a challenge in our teacher education program	2.51	0.41	Accept	2.59	0.40	Accept
4	The existing institutional policies do not adequately support the integration of AI in teacher education.	3.46	0.67	Accept	3.41	0.63	Accept
c.mean		3.14	0.57	Accept	3.17	0.55	Accept

Table1. Shows that all the items on the questionnaire were accepted as they had response mean greater than the instrument scale mean of 2.50. Also, the average mean (3.14) for MOUAU and (3.17) for the AIUE are greater than the scale mean. This implies that teacher educators' opinions are that budget constraints, lack of leadership support within the university, resistance from faculty members to embrace AI technologies and existing institutional policies that do not adequately support the integration of AI in teacher education are the institutional barriers to the integration of Artificial Intelligence (AI) in teacher education programs within Nigerian universities.

Table: 2: Prevailing beliefs responses of MOUAU and ALVAN lecturers regarding the technological challenges impact of the successful incorporation of AI in teacher education programs in Nigerian universities

S/N	ITEM STATEMENT	MOUAU			ALVAN LECTURES		
		x	SD	REM	x	SD	REM
1	Limited access to technology negatively impacts the successful incorporation of AI in our teacher education programs	3.48	0.69	Accept	3.50	0.70	Accept

S/N	ITEM STATEMENT						
2	Inadequate technological infrastructure within the university is a barrier to the effective use of AI in teaching	3.59	0.72	Accept	3.60	0.71	Accept
3	The digital divide among students and educators creates challenges for implementing AI in our teacher education courses.	2.71	0.44	Accept	2.69	0.50	Accept
4	Insufficient technical expertise among educators affects the successful integration of AI in teaching practices.	3.54	0.77	Accept	3.52	0.76	Accept
	Cluster mean	3.33	0.66		3.58	0.66	

Table 2. Shows that all the items on the questionnaire were accepted as they had response mean greater than the instrument scale mean of 2.50. Also, the average mean (3.33) for MOUAU and (3.58) for the AIUE are greater than the scale mean. This implies that teacher educators prevailing beliefs that limited access to technology, inadequate technological infrastructure within the university, digital divide among students and educators and insufficient technical expertise among educators are among the technological challenges that impact the successful incorporation of AI in teacher education programs in Nigerian universities.

Table: 3: Prevailing responses of MOUAU and ALVAN lecturers regarding the influence of socio-cultural factors in the integration of AI in teacher education programs in Nigerian universities

S/N	ITEM STATEMENT	MOUAU	ALVAN LECTURES

		x	SD	REM	x	SD	REM
1	Cultural norms and beliefs impact the acceptance of AI tools among educators and students "	3.19	0.45	Accept	3.06	0.42	Accept
2	Socio-economic factors influence the willingness of educators to embrace AI technologies in teaching.	3.55	0.42	Accept	3.52	0.44	Accept
3	Diversity in student backgrounds and perspectives poses a challenge in implementing inclusive AI practices in education	2.61	0.74	Accept	2.63	0.72	Accept
4	The level of awareness and understanding of AI among educators affects its integration in teacher education programs	3.64	0.77	Accept	3.65	0.73	Accept
c.mean		3.25	0.59	Accept	3.22	0.57	Accept

Table 3. Shows that all the items on the questionnaire were accepted as they had response mean greater than the instrument scale mean of 2.50. Also, the average mean (3.25) for MOUAU and (3.22) for the AIUE are greater than the scale mean. This implies that teacher educators are of the opinion that socio-cultural factors impact the integration of AI in teacher education programs in Nigerian universities.

Discussion of result

The findings from the three tables provide valuable insights into the prevailing opinions of MOUAU and ALVAN lecturers regarding institutional, technological, and socio-cultural barriers to the integration of Artificial Intelligence (AI) in teacher

education programs within Nigerian universities. These results align with the broader context of the study, which aims to assess barriers to AI integration using the Deiph method. Institutional Barriers (Table 1): The results indicate that both MOUAU and ALVAN lecturers perceive budget constraints, lack of leadership support, resistance from faculty members, and inadequate institutional policies as significant barriers to the integration of AI in teacher education programs. The cluster mean of means (3.14 for MOUAU and 3.17 for ALVAN) suggests a relatively high consensus among the lecturers from both institutions. The standard deviations (0.57 for MOUAU and 0.55 for ALVAN) reveal a moderate level of agreement among respondents. These institutional barriers align with existing literature (Smith & Johnson, 2019; Zhao & Alvarez-Torres, 2020) and underscore the importance of addressing organizational challenges to facilitate successful AI integration. The Deiph method's systematic approach aids in understanding the nuanced barriers within the institutional context.

Technological Challenges (Table 2): Regarding technological challenges, both sets of lecturers' express concerns about limited access to technology, inadequate technological infrastructure, the digital divide, and insufficient technical expertise. The cluster mean of means (3.33 for MOUAU and 3.58 for ALVAN) suggests a consensus among respondents. The standard deviations (0.66 for MOUAU and 0.667 for ALVAN) indicate moderate agreement. These findings align with the global trends outlined by Smith and Johnson (2019) and emphasize the need for addressing technological challenges to ensure effective AI integration. The Deiph method's focus on the evaluation and prioritization of barriers helps identify key technological impediments for targeted interventions.

Socio-Cultural Factors (Table 3): The lecturers from both institutions recognize the impact of socio-cultural factors on AI integration in teacher education programs. Cultural norms, socio-economic factors, diversity among students, and the level of awareness and understanding of AI are acknowledged as influential. The cluster mean of means (3.25 for MOUAU and 3.22 for ALVAN) indicates a general agreement among respondents, and the standard deviations (0.59 for MOUAU and 0.57 for ALVAN) suggest a moderate level of consensus. These socio-cultural factors align

with the work of Zhao and Alvarez-Torres (2020), emphasizing the need for a nuanced understanding of cultural contexts in AI integration. The Deiph method's systematic approach allows for the identification and prioritization of socio-cultural barriers for targeted interventions. The discussion aligns with previous studies conducted by Smith and Johnson (2019), Zhao and Alvarez-Torres (2020), and Johnson et al. (2018). These studies provided a foundation for understanding global trends, technological challenges, and socio-cultural factors related to AI integration in education. However, the current study fills a notable gap by employing the Deiph method, offering a structured and systematic framework for assessing barriers across diverse dimensions.

Recommendations:

1.   Relevant authorities in Nigerian universities should establish a task force or committee dedicated to addressing budget constraints in educational institutions. This team should work on identifying alternative funding sources and developing proposals for additional resources.

2.   Nigerian University Commission (NUC), should advocate for stronger leadership support for AI integration. And fashion leadership development programmes that educate universities administrators about the benefits of AI in education and how to facilitate its effective implementation.

3.   Both government and public sector should invest in improving access to technology and upgrading technological infrastructure in Nigerian universities. This may involve seeking partnerships with technology companies or government initiatives to enhance the overall technological ecosystem.

4.   Relevant universities authorities should develop and implement training programmes to enhance technical expertise among educators. They should collaborate with technology experts and organizations to provide workshops, courses, and resources to bridge the gap in technical skills.

5.   Relevant universities authority should promote awareness and understanding of AI among educators and students. Launch campaigns, workshops, and seminars to increase knowledge about AI and its potential benefits in education.

Conclusion

This study utilized the Deiph method to comprehensively assess the barriers to AI integration in teacher education programs within Nigerian universities. The findings

revealed substantial consensus among lecturers from Michael Okpara University of Agriculture (MOUAU) and Alvan Ikoku University of Education Owerri (AIUE) regarding institutional, technological, and socio-cultural barriers. At the institutional level, budget constraints, lack of leadership support, resistance from faculty members, and inadequacies in existing institutional policies were identified as significant hindrances. Technological challenges, including limited access to technology, inadequate infrastructure, the digital divide, and insufficient technical expertise, were acknowledged by educators from both institutions. Socio-cultural factors, such as cultural norms and beliefs, socio-economic influences, diversity in student backgrounds, and the level of awareness and understanding of AI, were recognized as impacting AI integration. The Deiph method provided a systematic framework for diagnosing, evaluating, identifying, and prioritizing barriers, allowing for a nuanced understanding of challenges and targeted interventions. Based on the result, appropriate recommendations were made.

Declarations

Funding

Competing Interest Declaration

Not applicable

Availability of data and materials

The data of lecturers' school of education, Michael Okpara University of Agriculture, Umudike, Nigeria can be accessed from the university website (www. mouau.edu.ng). The data of lecturers School of General Education, Alvan Ikoku University of Education, Owerri (AIUE) can be accessed from the university web site (www.alvanikoku.edu.ng).

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