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Assessment of the Efficacy of Adaptive Learning Platform in Improving Teacher Trainee Educational Outcomes

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Assessment, efficacy, adaptive learning platform, teacher trainee, educational outcomes

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Abstract

This study investigates the perception of educators at Michael Okpara University of Agriculture (MOUAU) and Alvan Ikoku University of Education (ALVAN) regarding the efficacy of adaptive learning platforms in improving teacher trainee educational outcomes. A descriptive survey design was employed, a sample of 327 was used from a population of 845 lecturers generated through census and purposive sampling techniques. Data was collected using a questionnaire validated by experts in relevant fields. Reliability of the instrument of 0.88 was realized using Cronbach Alpha. Results indicate a positive perception overall, with both groups expressing belief in the effectiveness of adaptive learning platforms. While a slight difference in perception exists between the two groups, no significant difference was found in their mean responses. The study underscores the potential of adaptive learning platforms to enhance teacher trainee educational outcomes and promote the professionalization of the teaching profession. Recommendations include further research on long-term effects, prioritizing professional development, aligning curriculum, ensuring technological infrastructure, and addressing equity considerations. Overall, this research contributes to understanding the role of adaptive learning platforms in teacher education and highlights avenues for improving educational outcomes.

Introduction

Adaptive learning platforms are educational technologies designed to provide personalized learning experiences by dynamically adjusting content, pace, and instructional strategies based on individual learners' needs and performance (VanLehn. 2011). These platforms utilize algorithms and data analytics to assess learners' knowledge, skills, and learning preferences, thereby tailoring instruction to optimize learning outcomes (Koedinger & Corbett. 2006). These platforms begin by assessing learners' prior knowledge and skills through diagnostic assessments or interactive tasks. Based on the results, they create individual learner profiles that capture strengths, weaknesses, and learning preferences. Adaptive learning platforms dynamically adjust the sequencing and presentation of learning materials to match each learner's proficiency level and learning trajectory. They provide targeted content recommendations, scaffolded support, and adaptive feedback to promote mastery of concepts. These platforms collect and analyze vast amounts of data on learners' interactions, performance, and progress. They use this data to generate actionable insights for educators, including recommendations for instructional interventions, remediation strategies, and curriculum adjustments. Adaptive learning platforms offer personalized learning pathways that allow learners to progress through the curriculum at their own pace and direction. Learners receive customized learning activities, resources, and assessments tailored to their individual needs and goals. These platforms administer adaptive assessments that dynamically adapt difficulty levels and question types based on learners' responses. They provide immediate feedback, hints, and explanations to support learning and mastery. Adaptive learning platforms hold promise for optimizing learning experiences, improving educational outcomes, and fostering learner engagement and motivation. However, successful implementation requires careful consideration of factors such as instructional design, learner support mechanisms, data privacy, and equity considerations.

Educational learning outcomes refer to the measurable knowledge, skills, abilities, or attitudes that learners acquire as a result of educational experiences or interventions (Koedinger, & Corbett, 2006). American Educational Research Association (AERA, 2014), defines it as "statements that specify what learners will know or be able to do as a result of a learning activity" .This definition underscores the importance of clarity and specificity in articulating what learners are expected to achieve. Additionally, the Council for Higher Education Accreditation (CHEA,2006) described learning outcomes as "statements of what a learner knows, understands and can do on completion of a learning process, programme or activity, and which are related to the intended aims and objectives of that process". This definition highlights the alignment between learning outcomes and the overarching goals of the educational program or activity. In the context of assessing the efficacy of adaptive learning platforms for teacher trainees, educational learning outcomes may encompass various aspects. Mastery of subject matter knowledge, that is assessing the extent to which teacher trainees have acquired in-depth understanding and proficiency in the subject areas relevant to their teaching roles. Pedagogical skills development that is evaluating the improvement in teacher

trainees' ability to employ effective teaching strategies, instructional techniques, and classroom management practices. Differentiation and personalization that is measuring the degree to which teacher trainees can tailor their instruction to meet the diverse needs and learning styles of students, facilitated by the adaptive features of the learning platform. Reflective practice and professional growth that is examining the extent to which teacher trainees demonstrate reflective thinking, continuous improvement, and a commitment to lifelong learning as a result of engaging with the adaptive learning platform. In order to assess the efficacy of an adaptive learning platform in improving these educational learning outcomes for teacher trainees, it is essential to employ a variety of assessment methods, including pre and post-tests, performance evaluations, self-assessments, and observations. These assessments should be designed to directly measure the targeted learning outcomes and provide actionable feedback to both learners and educators.

Improving educational outcomes for teacher trainees is crucial for several reasons, including enhancing the quality of education, ensuring effective teaching practices, and ultimately benefiting student learning experiences. By focusing on enhancing the educational outcomes of teacher trainees, educational institutions and policymakers can contribute to the development of competent and skilled educators who are better equipped to meet the diverse needs of students in today's dynamic learning environments. One key reason for the importance of improving educational outcomes for teacher trainees is the direct impact it has on the quality of education. Research conducted by Darling-Hammond and Bransford (2005) emphasizes that teachers are the most significant school-related factor influencing student achievement. Therefore, investing in the professional development and training of teachers becomes paramount. When teacher trainees receive high-quality education and training, they are better prepared to deliver effective instruction, engage students, and facilitate learning experiences that promote academic success.

Furthermore, improving educational outcomes for teacher trainees is essential for ensuring the adoption of evidence-based teaching practices. As highlighted by Grossman et al. (2009), teacher education programs play a crucial role in introducing pre-service teachers to research-based instructional strategies and pedagogical approaches. Through rigorous coursework, supervised field experiences, and ongoing mentorship, teacher trainees can develop a deep understanding of effective teaching methods and how to apply them in diverse classroom settings. This not only benefits the trainees themselves but also translates into improved teaching practices that positively impact student learning outcomes. Moreover, investing in the educational outcomes of teacher trainees contributes to the professionalization of the teaching profession. According to Ingersoll (2012), enhancing the quality of teacher preparation programs is essential for attracting and retaining high-quality individuals in the teaching profession. When teacher trainees receive comprehensive training that aligns with professional standards and expectations, they are more likely to feel confident and competent in their roles as educators. This, in turn, fosters a sense of professional identity and commitment to continuous growth and improvement throughout their careers. In addition to benefiting

individual teachers and students, improving educational outcomes for teacher trainees can also have broader societal implications. As noted by the Organisation for Economic Co-operation and Development (OECD, 2019), investing in teacher quality is crucial for promoting equitable access to quality education and addressing disparities in educational achievement. By ensuring that all teacher trainees receive high-quality education and support, regardless of their background or location, societies can work towards creating more inclusive and equitable education systems that empower all learners to succeed.

When considering the theoretical framework for assessing the efficacy of adaptive learning platforms in improving teacher trainee educational outcomes, it's essential to draw upon relevant theories of learning and instructional design. Several theories can inform the design and evaluation of adaptive learning interventions within teacher training programs. Constructivist theories, such as those proposed by Piaget and Vygotsky, emphasize the active role of learners in constructing their understanding of concepts through interaction with the environment and social collaboration (Piaget, 1973; Vygotsky, 1978). In the context of adaptive learning platforms, constructivist principles can guide the development of interactive, learner-centered activities that engage teacher trainees in meaningful exploration and reflection (Ertmer & Newby, 2013). By providing adaptive scaffolding and opportunities for active experimentation, adaptive learning platforms can support the construction of pedagogical knowledge and skills among teacher trainees. Cognitive load theory, introduced by Sweller, focuses on the management of cognitive resources during learning tasks (Sweller, 2011). According to this theory, instructional designs should aim to reduce extraneous cognitive load and promote the effective allocation of mental effort towards essential learning tasks. Adaptive learning platforms can leverage cognitive load theory principles to dynamically adjust the level of challenge and support provided to teacher trainees based on their individual cognitive capacities and prior knowledge. By optimizing the cognitive demands of learning activities, adaptive platforms can enhance learning efficiency and retention. Social learning theory, associated with Bandura, emphasizes the importance of social interactions and observational learning in shaping behavior and cognition (Bandura, 1977). Within teacher training programs, adaptive learning platforms can facilitate social learning experiences by incorporating features such as collaborative problem-solving tasks, peer feedback mechanisms, and virtual communities of practice. By connecting teacher trainees with peers, mentors, and experts, adaptive platforms can foster collaborative learning environments that promote knowledge sharing, skill development, and professional identity formation.

In addition to overarching learning theories, adaptive instructional design models offer practical frameworks for tailoring instruction to individual learner needs. For example, Merrill's Component Display Theory (CDT) emphasizes the sequencing of instructional components to facilitate learning transfer and problem-solving skills (Merrill, 2002). Similarly, Keller's ARCS model focuses on motivational design principles to enhance learner engagement and persistence (Keller, 2010). By integrating adaptive instructional design

models into their frameworks, adaptive learning platforms can optimize the delivery of content, feedback, and support to teacher trainees based on their unique learning profiles and motivational factors. By integrating these theories of learning and instructional design into the theoretical framework they will provide solid foundation for understanding how adaptive learning platforms can effectively support the professional development of teacher trainees and improve their educational outcomes.

Research on the assessment of adaptive learning platforms specifically in teacher training programmes is still relatively limited, leaving several gaps in the existing literature. Much of the existing research on adaptive learning platforms has been conducted in K-12 or higher education contexts, with less attention given to their application in teacher training programs specifically. Teacher training programs have unique requirements and objectives compared to other educational settings, including the need to develop pedagogical knowledge, classroom management skills, and subject-specific expertise. Therefore, there is a need for research that specifically investigates the efficacy of adaptive learning platforms in addressing the learning needs and professional development goals of teacher trainees (Baepler et al., 2014). Existing studies often focus on limited outcome measures such as student achievement or engagement, overlooking the broader range of competencies and skills that are critical for effective teaching. Teacher trainees require not only content knowledge but also pedagogical content knowledge, classroom management skills, and the ability to differentiate instruction to meet diverse student needs. Assessing the impact of adaptive learning platforms on these multifaceted aspects of teacher preparation necessitates the development and validation of comprehensive assessment measures tailored to the context of teacher training programs (Dee & Cohen, 2017). While some research has examined the potential benefits of adaptive learning platforms in teacher training, less attention has been paid to the practical challenges and barriers associated with their implementation. Factors such as technological infrastructure, faculty readiness, student access to technology, and the alignment of adaptive learning platforms with existing curriculum and instructional practices can significantly impact their effectiveness in teacher training programs (Johnson & Chung, 2017). Understanding and addressing these implementation challenges are essential for maximizing the utility of adaptive learning platforms in supporting teacher education. It is on this note that the researchers investigated teacher education perception on assessment of the efficacy of adaptive learning platform in improving teacher trainees' educational outcomes.

Research Questions

1. What is the perception of MOUAU and AIUE lecturers on the efficacy of adaptive learning platform in improving teacher trainee educational outcomes?
2. What is the difference on the perception response of MOUAU and AIUE lecturers on the efficacy of adaptive learning platform in improving teacher trainee educational outcomes?

Hypothesis

Ho1: There is no significant difference in the mean responses of teacher educators in School of Education, Michael Okpara University of Agriculture (MOUAU) and teacher-educators in School of Education Alvan Ikoku University of Education (AIUE) regarding their perception response on the efficacy of Adaptive learning platform in improving teacher trainees' educational outcome.

Methodology

A descriptive survey design was used for the study. This study sets to find out the perception response of MOUAU and AIUE lecturers on the efficacy of adaptive learning platform in improving teacher trainee educational outcomes. 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 efficacy of adaptive learning platform in improving teacher trainee educational outcomes. 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 being 327 teacher-educators. Instrument for data collection was a questionnaire titled "Teacher-educators Questionnaire on Efficacy of Adaptive Learning Platform in Improving Teacher trainee Learning Outcomes" (TOEAITLO)' This is a 15-item questionnaire designed by the researchers and validated by three experts in Department of Computer Science Education and Robotics Studies and Educational Psychology/Measurement and Evaluation, in Alvan Ikoku University of Education, Owerri. Their contributions gave rise to the final instrument used for the study. The instrument has part 1 and 2. Part one sought for demographic information of respondents while part two sought information to determine the perception response on the efficacy of adaptive learning platform in improving teacher trainees' educational outcome. 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 subjected to trial testing using Cronbach Alpha to determine its internal consistency using thirty-six lecturers outside the study population. The reliability of (TOEAITLO) was 0.88. 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. The t-test statistic was used to test the hypothesis at 0.05 level of significance.

Presentation of result

Table: 1: Perception responses of MOUAU and ALVAN lecturers on efficacy of adaptive learning platform in improving teacher trainee educational outcomes

S/N	Item statement	Mouau			Alvan lecturers		
		$\bar{x}$	SD	REM	$\bar{x}$	SD	REM
1	The adaptive learning platform effectively enhances teacher trainees' understanding of pedagogical concepts.	3.40	0.63	Accept	3.43	0.62	Accept
2	The adaptive learning platform provides personalized learning experiences tailored to the individual needs of teacher trainees.	3.38	0.52	Accept	3.41	0.54	Accept
3	Teacher trainees demonstrate increased engagement with the educational content delivered through the adaptive learning platform.	2.82	0.44	Accept	2.84	0.47	Accept
4	The adaptive learning platform facilitates the development of critical thinking skills among teacher trainees.	3.34	0.77	Accept	3.32	0.73	Accept
5	Teacher trainees perceive the adaptive learning platform as valuable for their professional development.	3.48	0.76	Accept	3.49	0.74	Accept
6	The adaptive learning platform effectively addresses the diverse learning needs and preferences of teacher trainees.	3.23	0.61	Accept	3.20	0.68	Accept
7	Teacher trainees demonstrate improved academic performance as a result of using the adaptive learning platform.	3.01	0.47	Accept	3.00	0.45	Accept
8	The adaptive learning platform provides timely and constructive feedback to teacher trainees.	2.75	0.49	Accept	2.80	0.51	Accept
9	Teacher trainees find the adaptive learning platform easy to navigate	2.22	0.43	Accept	2.23	0.33	Accept

	and use. The adaptive learning platform provides timely and constructive feedback to teacher trainees.						
10	The adaptive learning platform effectively supports collaborative learning and knowledge sharing among teacher trainees	3.37	0.50	Accept	3.39	0.56	Accept
11	Teacher trainees perceive the adaptive learning platform as beneficial for improving their classroom teaching practices.	3.54	0.77	Accept	3.57	0.72	Accept
12	The adaptive learning platform enhances teacher trainees' ability to differentiate instruction to meet diverse student needs.	2.81	0.50	Accept	2.83	0.45	Accept
13	Teacher educators find the adaptive learning platform to be an effective tool for supporting their instructional practices	3.53	0.61	Accept	3.54	0.61	Accept
14	The adaptive learning platform aligns well with the goals and objectives of our teacher training program.	3.55	0.73	Accept	3.56	0.69	Accept
15	Teacher trainees demonstrate increased confidence in their ability to apply pedagogical principles learned through the adaptive learning platform	3.34	0.64	Accept	3.35	0.68	Accept
16	. Overall, I believe that the adaptive learning platform positively contributes to the educational outcomes of teacher trainees in our program.	3.48	0.58	Accept	3.50	0.59	Accept
	Cluster mean	3.48	0.58		3.50	0.59	
	. Average Mea	3.49					

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 (3.48) for MOUAU and (3.50) for the AIUE are greater than the scale mean. This implies that teacher educators

prevailing perception is that Adaptive learning platform is effective in improving teacher trainees learning outcomes.

Research Question2: What is the difference on the response beliefs of MOUAU and AIUE lecturers on the efficacy of Adaptive learning platform in improving teacher trainees learning educational outcomes?

Table 2: Summary of MOUAU and ALVAN lecturers mean response

Group	**N**	**Mean** $\bar{x}$	**SD**	**Difference in** $\bar{x}$
MOUAU	136	3.48	0.58	0.2
ALVAN	191	3.50	0.59	

Table 2 shows that a mean difference of 0.2 exist between response beliefs of MOUAU and ALVAN regarding their perception on the efficacy of Adaptive learning platform in improving teacher trainees' educational outcomes. What it means is that the response perception of MOUAU and ALVAN differ slightly, though they all have positive belief regarding the efficacy of Adaptive learning platform in improving teacher trainees' educational outcomes.

Hypothesis

Table 3. H_{01}: There is no significant difference in the mean responses of teacher educators in School of Education, Michael Okpara University of Agriculture (MOUAU) and teacher-educators in School of Education Alvan Ikoku University of Education (AIUE) regarding their perception response on the efficacy of Adaptive learning platform in improving teacher trainees' educational outcome.

Group	**N**	**Mean** $\bar{x}$	**SD**	**DF**	**T. cal**	**P.value**	**Decision**
MOUAU	136	3.48	0.58	326	3.49	0.57	Accepted
ALVAN	191	3.50	0.59				

The data above on table 3 indicated that the t-calculated is 3.49 at 326 degrees of freedom and p. value of 0.57 which is greater than 0.5 at 0.05 level of significance which indicated that we retain the null hypothesis. Therefore, there is no significant difference between the mean response of MOUAU and ALVAN teacher educators' regarding their perception response on the efficacy of Adaptive learning platform in improving teacher trainees' educational outcome.

Discussion

The study aimed to assess the perception of educators at Michael Okpara University of Agriculture (MOUAU) and Alvan Ikoku University of Education (ALVAN) regarding the efficacy of adaptive learning platforms in improving teacher trainee educational outcomes.

Three tables summarize the findings, providing insights into the perceptions of both groups and examining any differences between them. Table 1: This table presents the perception responses of MOUAU and ALVAN lecturers on various aspects related to the efficacy of adaptive learning platforms. The responses indicate a positive perception overall, as evidenced by mean scores above the instrument scale mean of 2.50. This aligns with the arguments made by the authors in the literature, emphasizing the potential of adaptive learning platforms to enhance teacher trainee educational outcomes. The findings resonate with theories such as constructivism and cognitive load theory, which advocate for personalized, interactive learning experiences to optimize learning outcomes (Piaget, 1973; Vygotsky, 1978; Sweller, 2011). Table 2: The summary of mean responses for MOUAU and ALVAN lecturers reveals a slight difference in perception between the two groups, with a mean difference of 0.2. Despite this difference, both groups hold positive beliefs regarding the efficacy of adaptive learning platforms. This finding supports the idea that while there may be variations in perception among different educational institutions, there is a consensus on the effectiveness of adaptive learning platforms in enhancing teacher trainee educational outcomes. It aligns with the literature's emphasis on the importance of evidence-based teaching practices and the need for continuous professional development among educators (Darling-Hammond, & Bransford, 2005); (Grossman, Hammerness & McDonald 2009). Table 3: The hypothesis testing results indicate that there is no significant difference between the mean responses of MOUAU and ALVAN lecturers regarding their perception of adaptive learning platforms. This finding supports the notion that both groups share similar perceptions regarding the efficacy of adaptive learning platforms in improving teacher trainee educational outcomes. It is consistent with arguments in the literature highlighting the importance of investing in teacher education and professional development to improve teaching practices and student learning outcomes (OECD, 2019; Ingersoll, 2012). Overall, the study's findings provide empirical evidence supporting the positive perception of adaptive learning platforms among educators at MOUAU and ALVAN. The results align with theoretical frameworks and arguments in the literature, emphasizing the potential of adaptive learning platforms to enhance teacher trainee educational outcomes and contribute to the professionalization of the teaching profession.

Conclusion

This study sought to assess the perception of educators at Michael Okpara University of Agriculture (MOUAU) and Alvan Ikoku University of Education (ALVAN) regarding the efficacy of adaptive learning platforms in improving teacher trainee educational outcomes. The findings revealed a positive perception overall, with both groups of educators expressing belief in the effectiveness of adaptive learning platforms. Despite a slight difference in perception between the two groups, the study found no significant difference in their mean responses, indicating a consensus on the efficacy of adaptive learning platforms. The results of this study align with theoretical frameworks such as constructivism, cognitive load theory, and social learning theory, which emphasize personalized, interactive learning experiences to optimize learning outcomes. Additionally, the findings support the importance of investing in teacher

education and professional development to improve teaching practices and student learning outcomes, as highlighted in the literature. Overall, the empirical evidence provided by this study contributes to our understanding of the role of adaptive learning platforms in enhancing teacher trainee educational outcomes and promoting the professionalization of the teaching profession. It underscores the potential of these technologies to address the diverse learning needs and preferences of teacher trainees and foster collaborative learning environments.

Recommendations

Based on the findings of this study, the following recommendations are suggested:

- ✓ Further research is needed to explore the long-term effects of adaptive learning platforms on teacher trainee educational outcomes, including their impact on teaching practices and student learning achievements.
- ✓ Educational institutions should prioritize the integration of adaptive learning platforms into teacher training programs and provide ongoing professional development opportunities for educators to enhance their knowledge and skills in utilizing these technologies effectively.
- ✓ There is a need to ensure that adaptive learning platforms are aligned with the goals and objectives of teacher training programs, as well as with professional standards and expectations. This may require curriculum revisions and updates to incorporate adaptive learning technologies seamlessly.
- ✓ Educational institutions should invest in the necessary technological infrastructure to support the effective implementation of adaptive learning platforms, including access to devices, reliable internet connectivity, and technical support for both educators and students.
- ✓ Efforts should be made by relevant authorities to ensure equitable access to adaptive learning platforms for all teacher trainees, regardless of their background or location. This may involve providing financial assistance, training, and support to underserved communities to bridge the digital divide.

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