Intelligent Tutoring Systems for Learning: Awareness and Readiness of Pre-Service Teachers in Private Colleges of Education in Kwara State

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ABSTRACT

The progress in Science and Technology has brought Information and Communication Technology (ICT) into the realm of education, with Artificial Intelligence (AI) and Intelligent Tutoring Systems (ITS) increasingly being integrated into teaching and learning. ITS is often referred to as the instructional model for the 21st Century. Consequently, this study explored the awareness and readiness of pre-service teachers in private Colleges of Education in Kwara State. The research instruments for this study was a researcher's designed questionnaire and titled "Intelligent Tutoring Systems Awareness and Readiness among private Colleges of Education Pre-service teachers" with the reliability of (.79) for awareness, and (.77) for readiness. The instrument was created using Google forms and disturbed to pre-service teachers via their WhatsApp platforms. A total of 272 pre-service teachers completed and submitted the forms. The data collected were utilized to address the two research questions and test the two hypotheses started in the study, using Mean, Standard Deviation, and t-test analysis in SPSS Version 26.0. The results indicated that pre-service teachers are both aware of and ready to use Intelligent Tutoring Systems for learning. Additionally, the findings revealed no significant differences in awareness and readiness levels based on gender. It was recommended that Intelligent Tutoring Systems should be designed, developed and implemented in private Colleges of Education, as pre-service teachers are ready to adopt this technology.

Keywords: Intelligent Tutoring Systems, Pre-service teachers, Awareness, Readiness.

Introduction

Education plays a major role in unlocking individual and national development and all forms of equity and might. The alarming increase in the awareness and importance of education to the development of an individual and general society has stir in people and society a conscious effort in allocating their limited funds to acquiring measurable and assessable education, in other to achieve this development Information and Communication Technology (ICT) was introduced. ICT has transformed teaching and learning around the world, ushering in the digital revolution. This has affected lecturers, students, schools, curricula, and instructional methods. Teachers and instructors now transit from traditional approaches to using ICT to support their roles, such as delivering instruction, managing courses, and evaluating students. Technology and education are inextricably linked and mutually beneficial. (Ates Çobanoglu, 2018). Most of these ICT-based instructional models are generally categorized under the broader term known as Computer-Assisted Instruction (CAI)

Research has indicated that the use of Computer-Assisted Instruction (CAI) in traditional teaching is not a new concept. According to Okebukola (2013), CAI is an automated instructional approach where educational content is delivered to students through an interactive process using a computer system. Furthermore, Johnson et al., (2016) emphasized that CAI is a type of instructional strategy where computers, whether connected to the Internet or not, are used to present instructional content and facilitate individualized learning. Edutech202 (2012) identified key features of CAI, such as immediate feedback, the ability to accommodate multiple users, self-paced learning, adaptability of instruction, and random-access capabilities. The evolution of CAI has eventually led to the development of Intelligent Tutoring Systems (ITS), a subset of Artificial Intelligence.

The domain of Artificial Intelligence (AI), a branch of computer science and technology, focuses on creating intelligent machines, both software and hardware, that exhibit human-like capabilities in their functioning and responses. AI machines are equipped to handle diverse tasks, such as voice and face recognitions, meaning derivation, teaching, learning, planning, creative thinking and many more (Techopedia, 2019). AI provides a promise of true contact between humans and machines. When machines are intelligent, they can receive requests, communicate, process data, and gives conclusion, it has the ability to reason, analyse and give quick feedback, they can also perform intellectual processes and human characteristics like thinking ability, significance discovery, generalizing and learning from experience (Copeland, 2019; Thompson, et al., 2018).

Subrahmanyam and Swathi (2018) noted that with the emergence of AI, it has made it difficult to avoid an important discussion about the prospects of teaching and learning in educational institutions and what kind of option educational institutions will adopt in this context. The rapid growth of technological innovation and adoption inferred that teaching in educational institutions requires a review of teachers' roles and strategies of instruction. This can be effectively achieved through teaching and learning practices that leverage the significant advantages of AI in education. Intelligent Tutoring Systems have been a key factors in making this approach possible (Popenici & Kerr, 2017). ITS are automated teaching tools that leverage artificial intelligence to interact with students directly and deliver customized learning experiences, replicating many of

the instructional tasks typically handled by human educators. Some of the instructional functions ITS perform are one-on-one student teaching, student's assessment, automated score grading, personalized teaching, they can also provide timely feedback to students, without the teacher's presence (Ferster, 2017). ITS can help teachers by putting learners in charge of their learning activities so as to help learners develop self-regulation skills; others use pedagogical strategies for scaffolding learning to challenge and support the learner appropriately (Luckin et al., 2016). Some ITS that are currently used in education include eTeacher, Case maker, Teaching Works, Curriculum Builder, Memrise, Chem Tutor, Physics Playground, ActiveMath, Algebra Tutor PAT and ASSISTments, (Keleş et al., 2009; Mahdi et al., 2016; Mahmoud & Abo El-Hamayed, 2016).

Intelligent Tutoring Systems are designed to dynamically adjust the learning path for each student, accommodating their current level of understanding, preferred learning style, and individual growth trajectory. ITS is a system that can diagnose and adjust to students' level of knowledge and skills. ITS offer students' immediate and accurate feedback when they make mistakes, ensuring they can correct their errors and reinforce correct learning. Additionally, ITS can identify when a student is ready for new material and introduce new concepts accordingly, keeping them engaged and challenged. This signifies that ITS has not come to replace the ever-important roles of teachers, but to promote education in general.

Hilles and Naser (2017) affirmed that the development of Intelligent Tutoring Systems is not driven by the sole purpose of advancing artificial intelligence, but rather by the noble goal of enhancing education and making a significant impact on the teaching and learning process. ITS consist of four key components that work together to provide effective instruction, namely; Domain Model which serve as the knowledge base for the ITS, containing the subject matter or teaching material that the system is designed to teach; Student Model, this model continuously assess the learners progress and understanding of the subject matter. It analyzes the student interactions with the system, including their responses to question, attempts at solving problems and overall engagement; Tutor Model, functions as the decision making core of the ITS, utilizing information from the domain model and the student model to determine the most appropriate instructional strategies and interventions for each individual student; User Interface Model, this model provides the means for communication between the student and the ITS, it typically involves a graphical user interface (GUI) that presents the learning content, interactive exercises and feedback in a way that is engaging and easy to understand for students(Mahdi, et al., 2016).

ITSs comprise of four parts which can also be called the architecture of ITS, based on general agreement among researchers (Al-Aqbi, 2017; Gharehchopogh & Khalifelu, 2011; Hamed & Naser, 2017; Mahdi et al., 2016). The components are; the domain model, the student model, the tutoring model, and the user interface model also called the communication module.
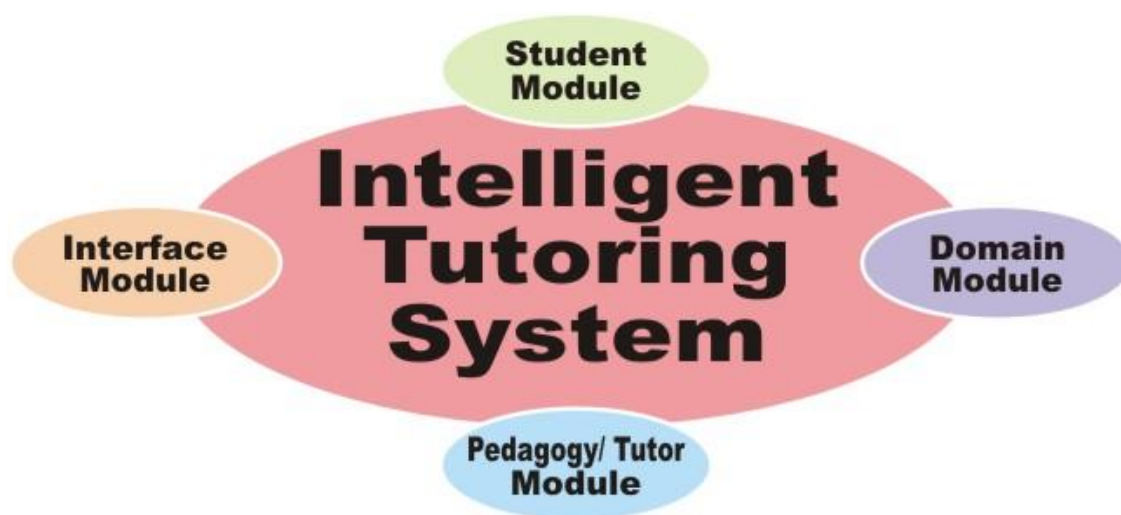
Figure 1: The Architecture of Intelligent Tutoring System.
Source: Owolabi and Adetumbi. (2021, p.18)

Raza, (2020) asserted that the interface module serve as the pathway for students to engage with the system, while the domain module focuses on how instructional content is structured and presented within the ITS. Specifically, the domain module stores and organized problems, exercises, and learning materials related to the subject area. The student module tracks students' progress and achievements as they use the system, assessing their learning and performance and offering guidance and feedback. The tutor module, the final component, involves implementing pedagogical strategies for effective teaching within the ITS. The drives to enhance students' academic performance has led researchers to develop innovative instructional methods, with the use of computer technologies being frequently employed strategy to boost achievement and performance (Ernest, 2015). Iddrisu et al., (2019) also reported that students find intelligent tutoring systems to be effective and beneficial for learning.

The pre-service teachers in Colleges of Education stand at a critical juncture. Equipping them with the necessary skills and knowledge to navigate the evolving educational landscape is essential. Intelligent Tutoring Systems (ITS) offer a promising avenue to enhance their pedagogical approaches. However, a concerning gap exists in understanding the current state of ITS adoption among this specific group. This research seeks to investigate the awareness, and readiness of ITS among pre-service teachers in Private Colleges of Education in Kwara State. Limited awareness is a primary concern. Studies suggest a lack of widespread understanding about ITS functionalities and potential benefits. As Bolaji (2021) emphasizes, limited exposure to digital tools hinders effective integration into educational practices. This lack of awareness can impede the potential of ITS to revolutionize teacher training and future classroom environments.

While pre-service teachers might be enthusiastic about adopting innovative technologies, their readiness for ITS integration requires further examination. They might require support in developing the necessary skills and confidence for effective utilization. Without proper training and guidance, integrating ITS into their teaching repertoire could prove challenging.

Therefore, investigating these aspects is vital at this juncture because the evolving educational landscape demands equipping future teachers with innovative tools like ITS. Also, a gap exists in understanding the current state of ITS adoption among private Colleges of Education

pre-service teachers in Kwara State and finally, addressing the challenges of awareness and readiness is crucial to harness the full potential of ITS and revolutionize teacher training in private Colleges of Education in Kwara State.

Purpose of the Study

The main purpose of this study is to investigate the awareness and readiness of pre-service teachers toward Intelligent Tutoring Systems in Private Colleges of Education in Kwara State, specifically the study will:

1. Access the awareness of pre-service teachers toward ITS;
2. Find out the readiness of pre-service teachers toward ITS;
3. Access the influence of gender on pre-service teachers' awareness on ITS;
4. Determine the gender influence on pre-service teachers' readiness toward ITS.

Research Questions

1. What is the awareness of pre-service teachers' toward ITS in Private Colleges of Education in Kwara State?
2. What is the readiness of pre-service teachers' toward ITS in Private Colleges of Education in Kwara State?

Hypotheses

$H0_1$: There is no significant difference in Private Colleges of Education pre-service teachers' awareness toward ITS based on gender;

$H0_2$: There is no significant difference in Private Colleges of Education Pre-service Teachers readiness toward ITS based on gender.

Methodology

The researcher utilized a descriptive survey research design in this qualitative study, which explored the awareness and readiness of pre-service teachers in Private Colleges of Education to use Intelligent Tutoring Systems (ITS) for learning. The research was conducted in Private Colleges of Education located in Kwara State. The instrument was a researcher's designed questionnaire. Titled: Intelligent Tutoring Systems Awareness and Readiness among Private Colleges of Education Pre-service Teachers in Kwara State. The questionnaire is made up of three sections; A – C. Section A seek respondent's demographic information, section B seeks information on the respondent's awareness on Intelligent Tutoring Systems and section C seek information on respondent's readiness to use Intelligent Tutoring Systems. The Reliability value on awareness was given as 0.79, readiness was 0.77 at a significance level of 0.05. Section B and C contained 5 items, with the Likert scale of "Strongly Agreed - SA", "Agreed - A", "Disagreed - D", and "Strongly Disagreed - SD", the questionnaire was disturbed to pre-service teachers via WhatApp platform for them to complete and submit online. A total of 272 pre-service teachers, consisting of 181 males and females, responded to the questionnaire. The collected responses were compiled and used to address the research question and test the hypotheses. The research questions were analyzed using Mean and Standard Deviation, while the hypotheses were tested using an independent t-test, conducted with SPSS version 26.0.

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Results Presentation

1. **Research question 1:** What is the awareness of pre-service teachers' toward ITS in Private Colleges of Education in Kwara State?

Table 1:

Mean and Standard Deviation on Private Colleges of Education Pre-service teachers' awareness of Intelligent Tutoring Systems for learning

Items	SA	A	D	SD	Mean	Std.
Software that act in the capacity of the teacher are referred to as Intelligent Tutoring Systems.	89 (25%)	122 (52%)	35 (12%)	26 (11%)	3.04	.709
Intelligent Tutoring Systems gives room for individualized Learning.	95 (27%)	140 (60%)	31 (10%)	4 (3%)	3.11	.801
Intelligent Tutoring Systems put student in charge of the learning	91 (22%)	113 (51%)	40 (14%)	28 (13%)	3.16	.774
ITSs are online tutor for leaners.	70 (21%)	143 (55%)	41 (15%)	18 (9%)	3.32	.801
Problem solving Skills are possible when Student interact with ITS	91 (22%)	132 (56%)	33 (14%)	16 (8%)	3.12	.758

As shown in Table 1, Private Colleges of Education pre-service teachers demonstrated a high level of awareness about ITS for learning. Specifically, the results revealed that pre-service teachers are aware that ITS refers to software that simulates teacher-like interaction (mean score= 3.04). They also recognize that ITS enables individualized learning (mean score = 3.11), put students in control of their learning acttives (mean score = 3.32). Furthermore, pre-service teachers acknowledge that interacting with ITS can foster the development of problem solving skills (mean score= 3.12).

Research Question 2: What is the readiness of pre-service teachers' toward ITS in Private Colleges of Education in Kwara State?

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Table 2:

Mean and Standard Deviation on Private Colleges of Education Pre-service teachers' readiness toward ITS for learning

Items	SA	A	D	SD	Mean	Std
I am ready to utilize ITS once I have access to it	87 28%	125 45%	35 17%	25 10%	3.26	.878
I am ready to utilize ITS for difficult areas in my specialization	91 22%	113 51%	40 14%	28 13%	3.01	.964
I am ready to utilize ITS for all my learning activities	90 26%	140 53%	3030 15%	12 6%	3.23	.794
I am ready to utilize ITS because it give room for individualized learning	100 39%	110 42%	35 13%	17 16%	3.35	.896
I am ready to utilize ITS because it enhance performance	87 22%	114 51%	38 14%	30 13%	2.78	.966

According to Table 2, Private Colleges of Education pre-service teachers have expressed a high level of readiness to adopt Intelligent Tutoring Systems (ITS) for learning. Specifically, the result indicate that pre-service teachers are eager to use ITS if they have access to it (mean = 3.26), particularly for challenging areas in their specialization (mean score = 3.01) and for all their learning activities (mean score = 3.23). Furthermore, the results show that pre-service teachers are motivated to use ITS because it facilities individualized learning (mean score = 3.35) and enhance their performance (mean score = 2.78).

Hypotheses

H0₁: There is no significant difference in Private Colleges of Education pre-service teachers' awareness toward ITS based on gender;

Table 3:

T-test result showing Private Colleges of Education pre-service teachers' awareness of ITS based on gender

Variables	Gender	Mean	Std	t-cal	P-value	Remark
Awareness of Intelligent Tutoring Systems	**Male**	21.34	3.656			
	Female	22.02	2.921	-.754	.468	Not Sig

Significant p<0.05

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Table 3, presents the results for the statistical analysis, which reveals that there is no significant gender-based difference in the awareness of pre-service teachers in private Colleges of Education regarding ITS for learning. The calculated t-value (-0.754) and p-value (0.468) indicate that the difference between male and female pre-service teachers is not statistically significant (p> 0.05). Therefore, the null hypothesis was not rejected. This implies that the pre-service teachers did not differ in their awareness of ITS dor learning based on gender

H0$_2$:   There is no significant difference in Private Colleges of Education Pre-service Teachers readiness toward ITS based on gender.

Table 4:

T-test result showing Private Colleges of Education pre-service teachers' readiness to use ITS based on gender

Variable	Gender	mean	Std	t-cal	p-value	Remark
Readiness	**Male**	15.23	2.956			
to use ITS	**female**	15.12	2.321	.541	.628	Not sig.

Significant P<0.05

Table 4 shows no significant gender difference in pre-service teachers' readiness to use ITS for learning (t-cal = 0.541, p = 0.628> 0.05). The null hypothesis stands, indicating equal readiness across genders.

Discussion of Findings and Conclusions

This research has shown that pre-service teachers in private Colleges of Education in Kwara State have a high level of awareness and readiness to adopt ITS for learning. The findings are crucial for informing policy decisions related to Colleges of Education in Nigeria. Notably, the results show that pre-service teachers are aware of ITS's capabilities, including its ability to simulate human teaching, facilitate individualized learning, act as virtual teachers and enhance problem solving skills. Furthermore, the study reveals that pre-service teachers are eager to utilize ITS for learning, with no significant gender-based difference in their awareness and readiness. These insights are essential for promoting effective integration of ITS in teacher education programs.

The study further revealed that pre-service teachers are eager to utilize intelligent Tutoring Systems if they have access to them, particularly in the area where they difficulty within their specialization. Additionally, the research showed no significant difference in pre-service teachers' awareness and readiness based on gender to adopt ITS for learning. ITS can adapt to individual pre-service teachers' needs, providing personalized instructional content and immediate feedback to support teacher behavior. Iddrisu et al., (2019) suggests that students find tutoring systems effective and helpful for learning, further highlighting the potential benefits of ITS in teachers' education.

Adebayo (2016) noted that students have a positive disposition towards using computers for learning, highlighting the importance of developing Intelligent Tutoring systems to promote educational sustainability and bridge the digital divide. In line with this, Ernest (2015) suggested that leveraging computer technologies is a viable strategy to enhance academic achievement and

motivation in education. Building on these insights, this study's findings reveal that pre-service teachers in private Colleges of Education in Kwara State are both aware and ready to adopt ITS for learning.3222

Recommendations

Based on the study's findings, the following recommendations were made:

1. Educational stakeholder should prioritize the design, development and implementation of ITS in Colleges of Education.

2. Stakeholders should support programmmers and software developers in scaling up the production of ITS across various specializations in Colleges of Education.

3. Lecturers and pre-service teachers should receive comprehensive training on the effective integration and use of ITS to maximize its benefits

4. Pre-service teachers should be encourage to advocate for equal access to ITS resources and support, promoting equity and inclusivity in the use of these systems.

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