EFFECT OF INTELLIGENT TUTORING SYSTEMS ON TEACHING AND LEARNING OF BUSINESS EDUCATION COURSES IN TERTIARY INSTITUTIONS IN IMO STATE.

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Abstract

The study examined the effect of intelligent tutoring systems on teaching and learning of business education in tertiary institutions in Imo State. It specifically focused on the effect of domain, student, pedagogical, and user interface models on teaching and learning of business education courses. The study employed descriptive survey research design. The population of the study comprised 592 business education lecturers and students in the two tertiary institutions currently running business education programme in Imo State. 271 lecturers and students were sampled, and sample size was determined with Taro Yamane formula of sample size determination. The sample size was taken with stratified sampling technique. The instrument used for data collection was a structured questionnaire designed by the researchers. Data collected through physical contact, and data collected was analysed with Mean and two samples z-test. Data analysis revealed that domain, student, pedagogical and user interface models in intelligent tutoring systems have positive effect on teaching and learning of business education courses. It further revealed no significant difference in the mean scores of lecturers and students on the effect of the intelligent tutoring systems components on teaching and learning of business education. Hence, it was recommended that: Government should make national policies for artificial intelligent in education; management of tertiary institutions should invest in essential digital infrastructure like reliable internet and power; management of tertiary institutions should provide comprehensive teachers' training programs on using artificial intelligent technologies; and government should foster collaborations between educational institutions, tech companies, and policymakers to drive adoption and address challenges.

Keywords: Intelligent Tutoring System, Teaching and Learning, Business Education,

Introduction

Intelligent tutoring systems are computer-based educational tools that use artificial intelligence to provide personalized and adaptive instruction to learners. They aim to mimic the guidance of a human tutor by assessing student knowledge, providing feedback, and adjusting the learning path to individual needs. Alkhatlan and Kalita (2018) describedintelligent learning systems as computer-based educational systems that have independent databases, or knowledge bases for educational content in addition to teaching strategies and try to use conclusions about the

learner's ability to understand topics and identify his weaknesses and strengths so that they can adapt the learning process dynamically. They are designed to enhance learning outcomes by offering customized instruction, targeted remediation, and tracking student progress. According to Hasanov et al (2019), an intelligent system 'uses techniques of artificial intelligence to model a human tutor in order to improve learning by providing better support for the learner'. The author Furth content and that intelligent tutoring systems deliver real-time feedback, dynamically adjust difficulty, offer multimedia content, and can include elements like gamification to enhance engagement and learning outcomes.

Erümit & Çetin, (2020) classified intelligent tutoring systems into four key components: the Domain Model (subject matter expertise), the Student Model (tracking student progress and knowledge), the Pedagogical Model (deciding how to teach), and the User Interface (facilitating interaction between the student and the system). According to Karaci et al (2018), these components work together using artificial intelligence to deliver personalized, adaptive, and effective instruction to learners. The domain model of intelligent tutoring systems is a core component that stores and organizes the information needed to teach a specific subject matter. According to Koti and Kumta (2018), the domain model describes the expertise in subject matter and describes the impacted knowledge of the concepts along with various methods for solving a problem to intelligent tutoring system. It acts as the system's expertise, containing explanations, examples, exercises, and other relevant content to guide the student's learning. This module is crucial for providing accurate and comprehensive instruction tailored to the student's needs. Ahmed and Kovacs (2022) maintain that domain or knowledge model contains information that the tutor is teaching, and is the most important because without it, there would be nothing to teach the student. They further said that it requires significant engineering knowledge to represent a domain so that it can be reached by other sections of the tutor.

The student model component of intelligent tutoring systems is a component that dynamically represents a student's current knowledge, skills, and learning progress. According to Thinakaram and Chuprat (2022), a student model in an intelligent tutoring system is a component that tracks and summarizes information about an individual student's learning progress, knowledge, and other psychological states to enable adaptive instruction. It's a crucial part of the intelligent tutoring system, providing the system with the information it needs to personalize instruction and provide effective feedback. According to Chrysafiadi and Virvou (2013), the importance of a student model in intelligent tutoring systems is that it allows the system to adapt its teaching to individual learners, providing personalized instruction by storing and analysing a student's knowledge, preferences, performance, and learning history.

Essentially, it acts as a bridge between the student and the tutoring system, allowing the intelligent tutoring system to adapt to the individual learner's needs.
The pedagogical model component of intelligent tutoring systems is responsible for determining how and when to present educational content to the student. It acts as the 'tutor,' making decisions about the learning path based on information from the student model and the domain knowledge. This module essentially decides what to teach, when to teach it, and how to present it in a way that best suits the individual student's needs and learning progress. According to Sani and Aris (2014), the goal of the pedagogical model in any intelligent tutoring system is to handle instructional decisions on a number of issues like the correct choice of the teaching methods that will suit each individual learner base on the learner's profile from the student model, choosing the right learning content for the students and deciding the right time to study the content as well as assessing the cognitive state of each learner to be able to understand each student level of understanding in order to decides whether a student is to proceed to the next learning stage or to revised the previous stage. A pedagogical model is crucial in an intelligent tutoring system because it dictates how the system provides instructional measures and adapts to the individual student's learning progress. It acts as the system's 'brain' for teaching, making decisions about

what information to present, how to explain it, and when to offer feedback. According to Hibbi et al (2022), without a strong pedagogical model, an intelligent tutoring system cannot deliver the personalized and adaptive learning experiences that are its primary benefit, leading to less effective tutoring and potentially hindering student motivation and achievement.

The user interface model of an intelligent tutoring systems is crucial for effective interaction between the student and the system. It encompasses the presentation of information, the methods for student input, and the overall design that supports learning. A well-designed user interface should be intuitive, engaging, and adaptable to individual student needs. According to Sani and Aris (2014), the interface model is responsible for providing the environment for interaction between the system and the learner. Because intelligent tutoring systems are developed using computer system, the interactive interface that is usually created using graphical user interface provides the environment for which the students can interact with the system. According to Naser (2016) user interface module acts as the central interaction platform for students. It features tools such as question, explanation, hint, and evaluation, enabling students to access tailored guidance and real-time feedback. Verdu et al (2015) opined that the user interface model is crucial in intelligent tutoring systems because it mediates interaction between the student and the system, translating complex information into an accessible format, ensuring the learning experience is intuitive, engaging, and personalized. According to the scholars, a well-designed user interface facilitates smooth dialogue, provides necessary interaction tools, and makes the intelligent tutoring systems advanced features understandable and usable for non-technical learners, ultimately increasing engagement and learning effectiveness.

Business education is a field of study that focuses on developing the knowledge, skills, and attitudes needed for success in the business world. It encompasses a range of subjects, from foundational business principles to specialized areas like accounting, finance, and marketing, and can be pursued at various educational levels. Onajite (2016) opined that business education encompasses education programme for business, office occupation, economic understanding, entrepreneurship and it seeks to develop in the learners' basic skills for personal use in the future. Business education is the education with training of the individual for business and about business, the former focusing on those who need career business, and the latter is for students in the entire school system irrespective of their career aspirations. It is also viewed as that specialized type of education which by its versatility equips its recipient with skills, competencies and attitude necessary to make him a useful and reliant citizen. Teaching and learning in business education focus on developing students' practical skills and theoretical knowledge for business careers and consumer literacy, encompassing subjects like accounting, marketing, and management, alongside soft skills such as leadership and critical thinking.

Generally, it has been ascertained in many studies that intelligent tutoring systems enhance teaching and learning by providing personalized, adaptive, and immediate support that mimics a human tutor, leading to improved student motivation, academic performance, and engagement through AI-driven analysis of individual needs. These systems diagnose knowledge gaps, deliver tailored feedback, and support self-regulated learning, making high-quality, individualized education more accessible and effective across various settings. For instance, Ahuja et al (2022) demonstrate that intelligent tutoring systems have been used in many educational fields such as information technology, engineering, languages, mathematics, programming, and medicine, and many tools are available to develop intelligent tutoring systems for non-programmers with the possibility of programming software systems such as web-based and mobile-based systems. According to Karaci et al (2018), students who utilized intelligent tutoring systems performed better academically than students who did not use the system and instead relied on conventional education.

It has also been revealed in many studies that the use of intelligent tutoring systems enhanced teaching and learning of some subjects or courses across all levels of education. For instance, Paneque, et al. (2017) conducted a study that revealed that tutor-teacher-student interactions produced a considerable number of mathematics learning opportunities of the 'thinking strategically' type, establishing figurative inference conjectures and promoting the transition from empirical to deductive argumentation. According to MacLellan & Koedinger, (2022) intelligent tutoring systems that use predictive models and artificial intelligence are being implemented to perform this tracking. Unlike in the field of mathematics and others, there is no specific empirical evidence of the adoption of intelligent tutoring systems and its relevance in teaching and learning of business education. Hence, the need to examine the effect of intelligent tutoring systems on teaching and learning of business education courses in tertiary institutions in Imo state.

Statement of the Problem

Business education programme in tertiary institutions is crucial in any society as it fosters national development by creating a dynamic workforce, promoting ethical business practices, enhancing critical thinking, and preparing citizens to function effectively in the complex, globalized modern economy as both producers and informed consumers. Thus, there is need for proper implementation of business education curriculum through the utilization of artificial intelligent pedagogical supplements. One of such pedagogical supplements is intelligent tutoring systems. Intelligent tutoring systems have been applied to support learning in many subject areas, such as language, Mathematics, Sciences, Computer Sciences, Medicine, History, Economics, Geometry and engineering. However, it is underutilized in Nigeria as its widespread adoption is hindered by issues such as insufficient funding for technological innovations, poor infrastructure, and lack of trained personnel. This has negatively impacted education by reducing personalized learning opportunities, hindering student motivation and engagement, limiting the development of critical soft skills, and perpetuating the risk of educational inequality. It is against this backdrop the study sought to examine the effect of intelligent tutoring systems on teaching and learning of business education courses in tertiary institutions in Imo State.

Research Questions

The following questions guided the study

1. What is the effect of domain model on teaching and learning of business education courses in tertiary institutions in Imo State?
2. What is the effect of student model on teaching and learning of business education courses in tertiary institutions in Imo State?
3. What is the effect of pedagogical model on teaching and learning of business education courses in tertiary institutions in Imo State?
4. What is the effect of user interface model on teaching and learning of business education courses in tertiary institutions in Imo State?

Hypotheses

The study was guided by the following hypotheses.

H01: There is no significant difference in the mean scores of lecturers and students on the effect of domain model on teaching and learning of business education courses in tertiary institutions in Imo State.

H02: There is no significant difference in the mean scores of lecturers and students on the effect of student model on teaching and learning of business education courses in tertiary institutions in Imo State.

H03: There is no significant difference in the mean scores of lecturers and students on the effect of pedagogical model on teaching and learning of business education courses in tertiary institutions in Imo State.

H04: There is no significant difference in the mean scores of lecturers and students on the effect of user interface model on teaching and learning of business education courses in tertiary institutions in Imo State.

Methodology

Design of the Study

The study employed a descriptive survey research design. According to Singh (2023), descriptive research is an exploratory research method that helps a researcher describe a population, circumstance, or phenomenon. The design is suitable for the study as the study explored the facts pertaining the effect of intelligent tutoring systems on teaching and learning of business education courses.

Population of the Study

The population of the study comprised 592 business education lecturers and students in the two tertiary institutions currently running business education programme in Imo State. the population distribution of the respondents is presented in table 1 below.

Table 1: Population Distribution of Respondents

S/N	Name of Institution	Lecturers	Students	Total
1.	Alvan Ikoku Federal University of Education Owerri, Imo State.	31	412	443
2.	Imo State College of Education Ihitte/Uboma, Imo State.	13	136	149
	Total	44	548	592

Source: *Department of Business Education of the Institutions*

Sample and Sampling Technique

From the population of the study, 271 lecturers and students were sampled. The sample size was determined with Taro Yamane formula of sample size determination. The sample size was taken with the means of stratified sampling technique. The sample distribution of respondents is presented in table 2 below.

Table 2: Sample Distribution of Respondents

S/N	Name of Institution	Lecturers	Students	Total
1.	Alvan Ikoku Federal University of Education Owerri, Imo State.	28	174	202
2.	Imo State College of Education Ihitte/Uboma, Imo State.	12	57	69
	Total	40	231	271

Source: *Department of Business Education of the Institutions computed by the researchers*

Instrument for Data Collection

The instrument used for data collection was a structured questionnaire designed by the researchers. The instrument was divided into two sections. Section A contained the personal data of the respondents. Section B contained 22 items composed in line with the specific purposes of the study, with 4 Likert response options of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

Validity And Reliability of the Instrument

The instrument was validated by 3 experts in the field of Measurement and Evaluation, and it was found to have content, face and construct validity. The reliability of the instrument was determined with test retest. It was performed by administering the instrument to 20 respondents first. Two weeks later, same instrument was re-administered to same respondents. The results of the two tests were compared with Pearson Product Moment Correlation Coefficient formulae. A coefficient of 0.89 was obtained which was suitable for the study.

Method of Data Collection

Data for the study was collected through physical contact with the respondents in their various institutions. The researchers ensured the questionnaires are correctly completed and retrieved on the spot. A hundred percent retrieval rate was obtained.

Method of Data Analysis

Data collected were analysed with mean ($\bar{x}$) and two samples z-test. Mean was used to analyse the research questions, and the two samples z-test was used to test the hypothesis. Decision rule was based on the comparison of the calculated mean scores obtained in the analysis of each research question with the mean benchmark of 2.50. A calculated mean score of 2.50 and above was accepted. However, a calculated mean score less than 2.50 was rejected. The mean benchmark was obtained by dividing the sum of the scores of the rating scales (4+3+2+1) by the number of the scales (4). To test for significance, the results of the tested hypothesis were interpreted by comparing the p-value of the calculated z-test with 0.05 level of significance. The p-values of all the null hypothesis (H0) tested were greater than 0.05 level of significance and they were upheld.

Results and Discussion of Findings

Research question one

What is the effect of domain model on teaching and learning of business education courses in tertiary institutions in Imo State?

In response to the above research question, items 1 to 6 of the questionnaire administered to the respondents was analysed. The result of the analysis is presented in table 3 below.

Table 3: Mean Analysis of the Effect of Domain Model on Teaching and Learning of Business Education Courses

S/N	Item	SA 04	A 03	D 02	SD 01	Total 10	$\bar{x}$ 2.5	Decision
1	Domain model serves as a formal representation of subject matter.	80 320	130 390	41 82	20 20	271 812	3.00	Accepted
2	Domain model holds the ideal expert knowledge within a specific domain.	131 524	107 321	21 42	12 12	271 899	3.32	Accepted
3	Domain model assesses students' performance and identifies areas of weakness	151 604	89 267	16 32	15 15	271 918	3.39	Accepted
4	Domain model helps to detect misconceptions, or incorrect approaches that a student might be using.	132 528	134 402	00 00	05 05	271 935	3.45	Accepted
5	Domain model provides specific, accurate feedback and guidance tailored to the student's needs.	123 492	109 327	17 34	22 22	271 875	3.23	Accepted
6	Domain model identifies problems, solves them, and answers student questions within the subject matter.	161 644	88 264	08 16	14 14	271 938	3.46	Accepted
	Total	130 520	110 330	17 34	14 14	271 898	3.31	Accepted

Source: Field survey, 2025

The above revealed a calculated weighted mean of **3.31** which is greater than the criteria mean of **2.50**. Since the calculated weighted mean is greater than the criteria mean **(3.31 > 2.50)**, it is

concluded that domain model in intelligent tutoring system has positive effect on teaching and learning of business education courses in tertiary institutions in Imo State.

Research question two

What is the effect of student model on teaching and learning of business education courses in tertiary institutions in Imo State?

In response to the above research question, item 7 to 11 of the questionnaire administered to the respondents was analysed. The result of the analysis is presented in table 4 below.

Table 3: Mean Analysis of the Effect of Student Model on Teaching and Learning of Business Education Courses

S/N	Item	SA 04	A 03	D 02	SD 01	Total 10	x̄ 2.5	Decision
7	Student model in intelligent tutoring systems personalized tutoring.	158	91	14	08	271		
		632	273	28	08	941	3.47	Accepted
8	Student model provides adaptive feedback and remediation.	126	114	12	19	271		
		504	342	24	19	889	3.28	Accepted
9	Student model helps students understand the underlying reasons for their mistakes.	138	124	06	03	271		
		552	372	12	03	939	3.46	Accepted
10	Student model helps in pedagogical decision making.	126	124	21	00	271		
		504	372	42	00	918	3.39	Accepted
11	Student model helps to keep students engaged and motivated.	160	86	05	20	271		
		640	258	10	20	928	3.42	Accepted
		142	108	11	10	271		
	Total	568	324	22	10	924	3.41	Accepted

Source: Field survey, 2025

The above revealed a calculated weighted mean of **3.41** which is greater than the criteria mean of **2.50**. Since the calculated weighted mean is greater than the criteria mean **(3.41 > 2.50)**, it is concluded that student model in intelligent tutoring system has positive effect on teaching and learning of business education courses in tertiary institutions in Imo State.

Research question three

What is the effect of pedagogical model on teaching and learning of business education courses in tertiary institutions in Imo State?

In response to the above research question, item 12 to 16 of the questionnaire administered to the respondents was analysed. The result of the analysis is presented in table 5 below.

Table 5: Mean Analysis of the Effect of Pedagogical Model on Teaching and Learning of Business Education Courses

S/N	Item	SA 04	A 03	D 02	SD 01	Total 10	x̄ 2.5	Decision
12	Pedagogical model provides personalized instruction.	128	132	07	02	271		
		512	396	14	02	924	3.41	Accepted
13	Pedagogical model provides adaptive guidance and intervention.	144	109	16	02	271		
		576	327	32	02	937	3.46	Accepted
14	Pedagogical model provides content sequencing and delivery.	116	138	16	01	271		
		464	414	32	01	911	3.36	Accepted
15	Pedagogical model analyses student's cognitive capabilities and	111	142	06	12	271		

	mistakes.	444	426	12	12	894	3.30	Accepted
16	Pedagogical model facilitates	180	61	22	08	271		
	exploration and exploration.	720	183	44	08	955	3.52	Accepted
		136	117	13	05	271		
	Total	544	351	26	05	926	3.42	Accepted

Source: Field survey, 2025

The above revealed a calculated weighted mean of **3.42** which is greater than the criteria mean of **2.50**. Since the calculated weighted mean is less than the criteria mean **(3.42 < 2.50)**, it is concluded that pedagogical model in intelligent tutoring system has positive effect on teaching and learning of business education courses in tertiary institutions in Imo State.

Research question four

What is the effect of user interface model on teaching and learning of business education courses in tertiary institutions in Imo State?

In response to the above research question, item 17 to 22 of the questionnaire administered to the respondents was analysed. The result of the analysis is presented in table 6 below.

Table 6: Mean Analysis of the Effect of User Interface Model on Teaching and Learning of Business Education Courses

S/N	Item	SA 04	A 03	D 02	SD 01	Total 10	x̄ 2.5	Decision
17	User interface model	120	142	00	09	271		
	facilitates communication.	480	426	00	09	915	3.38	Accepted
18	User interface model	118	132	16	05	271		
	enhances engagement.	472	396	32	05	905	3.34	Accepted
19	User interface model provides							
	visual and interactive	121	136	10	04	271		
	elements.	484	408	20	04	916	3.80	Accepted
20	User interface model emulates	144	92	12	23	271		
	a human tutor.	576	276	24	23	899	3.32	Accepted
21	User interface model supports							
	key intelligent tutoring							
	systems components.	123	121	21	06	271		
		492	363	42	06	902	3.33	Accepted
22	User interface model enables							
	access to complex	145	100	13	13	271		
	functionality.	580	300	26	13	919	3.39	Accepted
		128	120	11	12	271		
	Total	512	360	22	12	906	3.34	Accepted

Source: Field survey, 2025

The above revealed a calculated weighted mean of **3.34** which is greater than the criteria mean of **2.50**. Since the calculated weighted mean is greater than the criteria mean **(3.34 > 2.50)**, it is concluded that user interface model in intelligent tutoring system has positive effect on teaching and learning of business education courses in tertiary institutions in Imo State.

Hypothesis one

H0: There is no significant difference in the mean scores of lecturers and students on the effect of domain model on teaching and learning of business education courses in tertiary institutions in Imo State.

H1: There is a significant difference in the mean scores of lecturers and students on the effect of domain model on teaching and learning of business education courses in tertiary institutions in Imo State.

In testing the above hypothesis, the response of lecturers and students to item 1 to 6 of the questionnaire administered was tested using two samples z-test. The summary of the result is presented in table 7 below.

Table 7: Summary of z-test of the Difference between Mean Score of Lecturers and Students on the Effect of Domain Model on Teaching and Learning of Business Education Courses

Group	N	Mean (x̄)	Standard Deviation	Standard Error	z-Calculated	z-Critical	P	Decision
Lecturers	40	3.53	0.632					No
Students	231	3.43	0.576	0.1069	0.9357	1.960	0.3494	Significance

Source: Field survey 2025

The above table of z-test summary revealed a p-value of 0.3494 which is greater than the 0.05 level of significance. Since the p-value is greater than the level of significance **{(P > 0.05) (0.3494 > 0.05)}**, the null hypothesis is upheld. It means there is no significant difference in the mean scores of lecturers and students on the effect of domain model on teaching and learning of business education courses in tertiary institutions in Imo State.

Hypothesis two

H0: There is no significant difference in the mean scores of lecturers and students on the effect of student model on teaching and learning of business education courses in tertiary institutions in Imo State.

H1: There is a significant difference in the mean scores of lecturers and students on the effect of student model on teaching and learning of business education courses in tertiary institutions in Imo State.

In testing the above hypothesis, the response of lecturers and students to item 7 to 11 of the questionnaire administered was tested using two samples z-test. The summary of the result is presented in table 8 below.

Table 8: Summary z-test of the Difference between Mean Score of Lecturers and Students on the Effect of Student Model on Teaching and Learning of Business Education Courses

Group	N	Mean (x̄)	Standard Deviation	Standard Error	z-Calculated	z-Critical	P	Decision
Lecturers	40	3.20	0.872					No
Students	231	3.42	0.729	0.146	-1.5756	1.960	0.1152	Significance

Source: Field survey 2025

The above table of z-test summary revealed a p-value of 0.1152 which is greater than the 0.05 level of significance. Since the p-value is greater than the level of significance **{(P > 0.05) (0.1152 > 0.05)}**, the null hypothesis is upheld. It means there is no significant difference in the mean scores of lecturers and students on the effect of student model on teaching and learning of business education courses in tertiary institutions in Imo State.

Hypothesis three

H0: There is no significant difference in the mean scores of lecturers and students on the effect of pedagogical model on teaching and learning of business education courses in tertiary institutions in Imo State.

H1: There is a significant difference in the mean scores of lecturers and students on the effect of pedagogical model on teaching and learning of business education courses in tertiary institutions in Imo State.

In testing the above hypothesis, the response of lecturers and students to item 12 to 16 of the questionnaire administered was tested using two samples z-test. The summary of the result is presented in table 9 below.

Table 9: Summary of z-test of the Difference between Mean Score of Lecturers and Students on the Effect of Pedagogical Model on Teaching and Learning of Business Education Courses

Group	N	Mean (x̄)	Standard Deviation	Standard Error	z-Calculated	z-Critical	P	Decision
Lecturers	40	3.55	0.497					No
Students	231	3.45	0.642	0.0892	1.1209	1.960	0.2624	Significance

Source: Field survey 2025

The above table of z-test summary revealed a p-value of 0.2624 which is greater than the 0.05 level of significance. Since the p-value is greater than the level of significance **{(P > 0.05) (0.2624 > 0.05)}**, the null hypothesis is upheld. It means there is no significant difference in the mean scores of lecturers and students on the effect of pedagogical model on teaching and learning of business education courses in tertiary institutions in Imo State.

Hypothesis four

H0: There is no significant difference in the mean scores of lecturers and students on the effect of user interface model on teaching and learning of business education courses in tertiary institutions in Imo State.

H1: There is a significant difference in the mean scores of lecturers and students on the effect of user interface model on teaching and learning of business education courses in tertiary institutions in Imo State.

In testing the above hypothesis, the response of lecturers and students to item 17 to 22 of the questionnaire administered was tested using two samples z-test. The summary of the result is presented in table 10 below.

Table 10: Summary z-test of the Difference between Mean Score of Lecturers and Students on the Effect of User Interface Model on Teaching and Learning of Business Education Courses

Group	N	Mean (x̄)	Standard Deviation	Standard Error	z-Calculated	z-Critical	P	Decision
Lecturers	40	3.18	0.771					No
Students	231	3.02	0.933	0.1365	1.1723	1.960	0.2410	Significance

Source: Field survey 2025

The above table of z-test summary revealed a p-value of 0.2410 which is greater than the 0.05 level of significance. Since the p-value is greater than the level of significance **{(P > 0.05) (0.2410 > 0.05)}**, the null hypothesis is upheld. It means there is no significant difference in the mean scores of lecturers and students on the effect of user interface model on teaching and learning of business education courses in tertiary institutions in Imo State.

Discussion of Findings

The analysis of the first research question revealed that domain model in intelligent tutoring system has positive effect on teaching and learning of business education. This outcome supported the tested hypothesis which revealed no significance difference in the mean response of lecturers and students on the said positive effect of domain model of intelligent tutoring systems on teaching and learning of business education. The finding agrees with the postulation

of Ahmed and Kovacs (2022). The scholars maintain that domain or knowledge model contains information that the tutor is teaching, and is the most important because without it, there would be nothing to teach the student.

The analysis of the second research question revealed that student model in intelligent tutoring system has positive effect on teaching and learning of business education. This outcome supported the tested hypothesis which revealed no significance difference in the mean response of lecturers and students on the positive effect of student model of intelligent tutoring systems on teaching and learning of business education. The finding concurs with the opinion of Chrysafiadi and Virvou (2013). According to the scholars the importance of a student model in intelligent tutoring systems is that it allows the system to adapt its teaching to individual learners, providing personalized instruction by storing and analysing a student's knowledge, preferences, performance, and learning history.

The analysis of the third research question revealed that pedagogical model in intelligent tutoring system has positive effect on teaching and learning of business education. This outcome supported the tested hypothesis which revealed no significance difference in the mean response of lecturers and students on the positive effect of pedagogical model of intelligent tutoring systems on teaching and learning of business education. The finding agrees with the postulation of Hibbi et al (2022). According to Hibbi et al (2022), without a strong pedagogical model, an intelligent tutoring system cannot deliver the personalized and adaptive learning experiences that are its primary benefit, leading to less effective tutoring and potentially hindering student motivation and achievement.

The analysis of the fourth research question revealed that user interface model in intelligent tutoring system has positive effect on teaching and learning of business education. This outcome supported the tested hypothesis which revealed no significance difference in the mean response of lecturers and students on the positive effect of user interface model of intelligent tutoring systems on teaching and learning of business education. The finding agrees with the assertion of Verdu et al (2015). The scholars opined that the user interface model is crucial in intelligent tutoring systems because it mediates interaction between the student and the system, translating complex information into an accessible format, ensuring the learning experience is intuitive, engaging, and personalized.

Conclusion

Intelligent Tutoring Systems are relevant to business education because they offer personalized learning, instant feedback, and real-time monitoring of student progress to address individual needs and knowledge gaps. This necessitated this study which centres on the effect of intelligent tutoring systems on teaching and learning of business education in Imo state. The study which specifically examine the effect of domain, student, pedagogical, and user interface models on teaching and learning of business education, revealed positive effect of the components of intelligent tutoring systems on teaching and learning of business education. Thus, using intelligent tutoring systems as a supplement to the existing pedagogies of teaching and learning of business education courses in tertiary institutions is inevitable.

Recommendations

Based on the findings of the study, the following recommendations were made.

1. Government should make national policies for artificial intelligent in education.
2. Management of tertiary institutions should invest in essential digital infrastructure like reliable internet and power.
3. Management of tertiary institutions should provide comprehensive teacher training programs on using artificial intelligent technologies.

4. Government should establish ethical guidelines for data privacy and artificial intelligent fairness.
5. Government should foster collaborations between educational institutions, tech companies, and policymakers to drive adoption and address challenges

References

Ahmed, H. A. G. & Kovacs, L. (2022). Ontology domain model for e-tutoring system. Journal of Software Engineering and Intelligent Systems, 5 (1), 37-44

Ahuja, N. J., Dutt, S., Choudhary, S. L., & Kumar, M. (2022). Intelligent tutoring system in education for disabled learners using human computer interaction and augmented reality. *International Journal of Human-Computer Interaction, 2 (2), 334-342*

Alkhatlan, A., & Kalita, J. (2018). Intelligent tutoring systems: A comprehensive historical survey with recent developments. *arXivpreprint arXiv:.09628.*

Chrysafiadi, K. & Virvou, M. (2013. An empirical evaluation method of a student model of an intelligent e-learning environment for computer programming. *https//www.sciencedirect.com*

Erümit, A., & Çetin, İ. (2020). Design framework of adaptive intelligent tutoring systems. *Education and Information Technologies, 25(5), 4477–4500*

Hasanov, A., Laine, T. H. & Chung, T. S. (2019). A survey of adaptive context-aware learning environments. *Journal of Ambient Intelligence and Smart Environments, 11, 403-428*

Hibbi, F. Z., Abdoun, O., & Hamoudi, E. K. (2022). Bayesian network modelling for improved knowledge management of the expert model in the intelligent tutoring system. *International Journal of Advance Computer Science Applications, 13(6), 187-192*

Karaci et al (2018). Effects of web-based intelligent tutoring systems on academic achievement and retention. *International Journal of Computer Applications, 181 (16), 35-41*

Koti, M. S. & Kumta, S. D. (2018). Role of intelligent tutoring system in enhancing the quality of education. *https://ssrn.com/abstract=3326678*

MacLellan, C. J., & Koedinger, K. R. (2022). Domain-general tutor authoring with apprentice learner models. *International Journal of Artificial Intelligence in Education, 32(1), 76-117.*

Naser, A. S. S. (2016). Intelligent tutoring system builder: An intelligent tutoring system authoring tool. *Journal of Scientific and Engineering Research, 3(5),63-71*

Paneque, J. J., Cobo, P., & Fortuny, J. M. (2017). Intelligent tutoring and the development of argumentative competence. *Technology, Knowledge and Learning, 22(1), 83-104*

Sani, M. S. & Aris, M. N. T. (2014). Modelling student/tutor components of intelligent tutoring systems: a review. *17ef9e423b48cf030274da950f5d0d2b.pdf*

Singh, S. (2023). What is descriptive research? Definition, methods, types, and examples. *https://researcher.life/blog/article/what-is-descripyive-research-definition-methods-ypes-and-examples/*

Thinakaram, R. & Chuprat, S. (2022). Students' characteristics of student model in intelligent programming tutor for learning programming: A systematic literature review. *International Journal of Advanced Computer Science and Applications, 13 (7), 669-676*

Verdu et al (2015). Intelligent tutoring interface for technology enhanced learning in a course of computer network design. *10.1109/fie.2014.7044139*