


Integration of Diffusion Innovation Theory in TVET for Improving Students' Adoption of AI-Chatbots in Nigerian Universities

Williams Kennedy George; Ntiedo Asuabanga Udom

 <https://orcid.org/0009-0007-4207-834X>

Department of Technical Education

Akwa Ibom State College of Education, Afaha Nsit, Nigeria

Eno Obot Jackson, PhD

Department of Business Education

Akwa Ibom State College of Education, Afaha Nsit, Nigeria

Corresponding Email: georgekennedyresearchers@gmail.com

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Abstract

This study examined the integration of diffusion innovation theory in Technical Vocational Education and Training (TVET) for improving students' adoption of Artificial Intelligence chatbots in Federal universities in South East geopolitical zone, Nigeria. Three research questions, three hypotheses and descriptive survey research design was used to guide the study. The population of the study was one hundred and eighty-nine (189) final year TVET students which consisted of 86 and 103 students in MOUAU and UNN respectively. A sample size of ninety-seven (97) students comprising of 46 and 51 students in Michael Okpara University of Agriculture, Umudike (MOUAU) and University of Nigeria, Nsukka (UNN) respectively were randomly selected for the study. A 30-item questionnaire consisting of four sections and 5-point rating scale used for data collection was faced validated by three experts. Cronbach alpha statistics was used to determine the reliability coefficient of the instrument which yielded overall reliability index of .76 comprising of .75, .73 and .81 for Section B, C and D respectively indicating that the instrument was reliable. The research questions were answered using Mean and Standard Deviation while independent t- test was used to test the hypotheses at .05 level of significance. The findings of the study showed that compatibility, trialability and relative advantage have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The study recommended that universities should organize training programs that emphasize the compatibility, trialability and relative advantage of AI-Chatbots with University goals and values for students. These training programmes should showcase case studies highlighting the benefits of chatbots in education such as improved accessibility to resources, faster response times, and personalized assistance, thus motivating students to adopt the technology.

Keywords: *Diffusion Innovation Theory, TVET, Students, AI-Chatbots, Nigerian, Universities*

Introduction

Universities are the pinnacle of formal education, functioning as hubs where knowledge is acquired, shared, and advanced. Central to the concept of universities is their commitment to fostering critical thinking, intellectual curiosity, and scholarly research among students and faculty members. Nigerian universities exemplify this commitment through robust academic programs across diverse fields, including humanities, social sciences, engineering, medicine, and Technical Vocational Education and Training (TVET) (Enahoro & Adeyinka, 2013; FRN, 2013; Ojo et al., 2020). TVET in Nigerian universities encompasses the study of technologies, practical skills, and relevant knowledge for various occupations in sectors such as agriculture, business, computing, industrial trades (like auto-mechanics, building, electrical/electronics, metalwork, and woodwork), as well as home economics and entrepreneurial training. The curriculum is designed to equip students with the necessary competencies for seamless integration into the workforce.

In recent years, the integration of advanced technologies in educational settings has been rapidly reshaping methods of teaching and learning worldwide (Ayanwale et al., 2022). This includes artificial intelligence (AI), Internet of Things (IoT), cloud computing, virtual and augmented reality, big data, and robotics (Ayanwale & Molefi, 2024). AI, as defined by Yau et al. (2022), refers to machines that exhibit human-like intelligence, capable of performing tasks and learning from data accumulation and analysis. AI tools such as AI-chatbots, ChatGPT, Bing Chat, paperpal, paperdigest, Elicit, Humata, Copilot, trinkin.ai, Paper Brain, and ExperAI are actively employed to streamline student assignments, research, and term papers, significantly enhancing efficiency in these processes (Ayanwale & Molefi, 2024). Among these technologies, AI-chatbots have emerged as particularly promising for improving student support services, fostering personalized learning experiences, and enhancing overall educational outcomes (Ayanwale & Molefi, 2024).

Several studies stated that in the 1950s, Alan Turing, a mathematician and logician from the United Kingdom renowned for his contributions to mathematics, cryptanalysis, logic, philosophy, and mathematical biology, as well as pioneering the field of computer science, introduced the Turing Test which marked a significant milestone in the acceptance of chatbots (Dahiya, 2017; Adamopoulou & Moussiades, 2020; Adesina, 2021). The first notable chatbot, named Eliza, was created in 1966 with the purpose of simulating a psychotherapist by responding to user inputs with questions, utilizing a basic pattern matching method and template-based responses (Adamopoulou & Moussiades, 2020). However, Eliza's conversational abilities were limited, often confusing users unfamiliar with interacting with computers at the time, which spurred further advancements in chatbot development. In 1972, Eliza was succeeded by a more sophisticated chatbot called PARRY, designed with a distinct personality upgrade. In 1995, the chatbot ALICE was introduced and subsequently won the Loebner Prize in 2000, 2001, and 2004. This prestigious award, which evaluates Turing Tests annually, recognized ALICE as the first computer to be acclaimed as the "most human computer" in computing history (Erickson & Kim, 2020).

AI-chatbots, which are artificial intelligence-driven conversational tools or software applications, operate using advanced algorithms and intelligence on social networking platforms such as Facebook Messenger and WhatsApp (Afonughe et al., 2021). These AI-chatbots are designed to simulate human natural language, perception, and understanding to solve complex problems by providing guidance and directions to users seeking such services. The integration of AI-chatbots in university curricula is expected to enhance learning outcomes, increase student engagement and motivation, and promote the development of

digital skills crucial in today's job market (Kim et al., 2023; Oladele, Ayanwale & Ndlovu, 2023). Numerous studies have investigated the adoption and utilization of AI-based tools, particularly AI-based chatbots, in university education (Molnar & Szuts, 2018, Molnar & Szuts, 2018; Al-Ghadhban & Al-Twairsh, 2020; Malik et al., 2021; Wang & Tu, 2021; Ragheb, et al., 2022).

AI-chatbots have the potential to transform student support services significantly by offering immediate and personalized assistance to learners. AI-chatbots can handle queries, deliver course materials, provide practice questions and answers, share evaluation criteria, notify about assignment due dates, offer advice, and enhance instructional interaction to be more dynamic and engaging (Mabunda & Ade-Ibijola, 2019; Cordero et al., 2020; Adesina, 2021). AI-chatbots provide 24-hour service across different time zones and locations, enabling personalized responses at scale (Brandtzaeg & Følstad, 2017; Molnar & Szuts, 2018). These chatbots can be augmented with additional features to foster increased dialogue and discussion among students (Georgescu, 2018). Furthermore, AI-chatbots offer tutoring capabilities that help alleviate student stress by providing an alternative to face-to-face interactions with teachers or asking questions in front of peers (Agarwal & Wadhwa, 2020). Research by Molnar and Szuts (2018) indicates that chatbots can also be programmed to recognize and respond to users' learning styles and feedback, thereby building trust, strengthening connections, and inspiring continued engagement.

Understanding the psychological factors that influence students' decisions to adopt these technologies is crucial for developing effective strategies to support their implementation (Huang, 2021). However, previous research has predominantly examined students' adoption of chatbots in higher education settings outside Africa, using frameworks such as the Technology Acceptance Model (TAM), Structural Equation Modeling Approach (SEM), Unified Theory of Acceptance and Use of Technology (UTAUT), or Theory of Planned Behavior (TPB) (Tahini et al., 2017; Malik et al., 2021; Alboqami, 2023). In the same vein, Rogers' Innovation Diffusion Theory (IDT), proposed in 1995, provides a pertinent framework for analyzing the adoption process of technological tools (Roger, 2003; Pinho et al., 2021). According to Rogers (2003), IDT outlines how new ideas, products, or technologies spread within social systems through the active involvement of individuals and groups. The theory emphasizes that perceived trust in using chatbots emerges as a critical factor influencing students' behavioral intention to engage with them in higher education contexts (Al-Sharafi et al., 2016; Ragheb et al., 2022).

In Nigerian universities, characterized by large student populations and limited resources that often strain existing support systems, the potential advantages of AI-chatbots face obstacles to their successful integration in educational system. Challenges such as inadequate internet infrastructure, governance instability, insufficient funding, and unreliable electricity supply hinder the implementation of AI-chatbots for administrative tasks within Nigerian universities (Akpotohwo, 2016; Afonughe et al., 2021). These challenges underscore the necessity for a systematic approach to promote technological adoption among students. It is within this context that this study aims to examine the level of integration of the diffusion of innovation theory in Technical Vocational Education and Training (TVET) for improving students' adoption of AI-chatbots in Federal universities in South East geopolitical zone, Nigeria.

Statement of the Problem

AI-chatbots have emerged as a promising tool for delivering personalized support services to students in universities. However, despite their potential benefits, the widespread adoption of AI-chatbots among students in Nigerian universities presents significant challenges (Afonughe et al., 2021). Numerous barriers hinder this adoption, including inadequate internet infrastructure, governance instability, insufficient funding, unreliable electricity supply, low awareness and understanding among students regarding their capabilities, concerns about privacy and data security, and limited institutional support and resources (Akpotohwo, 2016; Afonughe et al., 2021). Additionally, the lack of a structured approach to promoting the adoption of technological tools for learning exacerbates these challenges associated with AI-chatbot adoption. The successful implementation of AI-chatbots hinges on understanding how the principles of the Diffusion of Innovation theory can be effectively applied within the Nigerian university context. This theory emphasizes factors such as the characteristics of the innovation, communication channels, social systems, and the role of early adopters in influencing the adoption process. Exploring these dynamics is crucial for identifying barriers and facilitators that shape Technical Vocational Education and Training (TVET) students' adoption of AI-chatbots in Nigerian universities. Therefore, this study aims to assess how the diffusion of innovation theory can enhance the adoption of AI-chatbots among students in Technical Vocational Education and Training (TVET) in Federal universities located in the South East geopolitical zone of Nigeria.

Purpose of the study

The study sought to determine the extent to which:

1. Compatibility influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.
2. Trialability influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.
3. Relative advantage influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Research questions

The following research questions were formulated to guide the study:

1. To what extent does compatibility influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria?
2. To what extent does trialability influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria?
3. To what extent does relative advantage influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria?

Research hypotheses

The following hypotheses were generated and tested at 0.05 level of significance.

H0₁: There is no significant difference in the mean response of UNN and MOUAU students on the influence of Compatibility on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

H0₂: There is no significant difference in the mean response of UNN and MOUAU students on the influence of trialability on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

H0₃: There is no significant difference in the mean response of UNN and MOUAU students on the influence of Relative advantage on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Review of Related Literature

This section reviewed both theoretical and empirical literature related to the study. It is noteworthy that while there are numerous theories relevant to this research, only Everett Rogers' theory of innovation diffusion (Rogers, 1983; 1995; 2003) were reviewed. According to Rogers (2003), this theory posits that the dissemination of new ideas, products, or technologies within social systems hinges on the active involvement of individuals and groups. Expanding on Rogers' theoretical framework, the adoption of new technology is influenced by five critical factors: compatibility, trialability, relative advantage, complexity, and observability.

In the context of this study focusing on the adoption of AI-chatbots in education, compatibility, as conceptualized in the Diffusion of Innovation Theory (DIT), refers to the extent to which a new technology aligns with an individual's existing beliefs, values, and experiences (Karahanna et al., 1999; Rogers, 1983, 1995). According to the theory, individuals are more likely to adopt and use technology if they perceive it to be compatible with their beliefs and values (Ayanwale & Molefi, 2024). As a result, their intention to use the technology is strengthened when they find it useful and relevant (Chang & Yang, 2013; Chen, 2015; Olasina, 2019; Shin et al., 2022; Svendsen et al., 2011; Wang et al., 2020a, 2020b). Harrington and Ruppel (1999), also noted that compatibility reduces the risk of failure when implementing innovative technologies. In the context of this study, compatibility signifies the extent to which students' expectations regarding interaction with educational resources and tools are met by the technologies under investigation.

Similarly, trialability in the context of the Diffusion of Innovation Theory (DIT), refers to the extent to which individuals are willing to experiment with an innovation before committing to its adoption (Al-Jabri & Sohail, 2012; Ayanwale & Molefi, 2024). This approach often leads to higher adoption rates and greater success for the chatbot. Strategies to promote trialability include offering free trials or demo versions, providing incentives such as discounts or rewards for testing the chatbot, ensuring clear instructions during the trial period, actively seeking feedback for improvement, and extending the trial duration to allow users to fully explore the chatbot's functionalities (Ayanwale & Molefi, 2024). Pinho et al. (2021) observed that trialability significantly predicts students' intention to use a chatbot for academic advice, suggesting that students who have the opportunity to trial the chatbot are more likely to continue using it. Similarly, Davis et al. (1989) described relative advantage as the perception that technology enhances work efficiency, indicating how much the new technology is viewed as superior to existing alternatives (Kim & Park, 2019; Shin et al., 2022). Nguyen and Nguyen (2020) provided evidence supporting the predictive validity of innovation characteristics, particularly highlighting the role of relative advantage in influencing intentions to adopt chatbots.

Some empirical studies related to this study revealed that Ayanwale and Molefi (2024) investigated the factors influencing undergraduate students' adoption of AI application tools, specifically chatbots, for educational use in Lesotho. Utilizing an expanded framework of the diffusion theory of innovation, the study explored the relationships among relative advantages, compatibility, trialability, perceived trust, perceived usefulness, perceived ease of use, and behavioral intention. A questionnaire using a 7-point scale was administered to 842

undergraduate students to collect data. The analysis was conducted using Smart PLS 4.0.9.2 software with a covariance-based structural equation model, yielded significant findings. There was no significant difference in research hypotheses regarding the relative advantages, compatibility, trialability, perceived usefulness, and perceived trust associated with chatbots. It was found that students who perceive the benefits of chatbots exhibit a strong intention to use them for academic purposes. The perception of compatibility between students and chatbots positively influences adoption intentions, underscoring its importance. The finding also showed that students who have the opportunity to trial chatbots are more inclined to adopt them, highlighting the significance of trialability. These findings provide practical insights for students and contribute to the theoretical understanding of the diffusion theory of innovation.

Muchowe and Kouam (2024) explored strategies for regulating AI chatbot usage in higher education to balance pedagogical innovation and cognitive skill development among graduate students. Utilizing a qualitative methodology, they conducted semi-structured interviews with 12 lecturers from 11 Zimbabwean universities. The study found that while AI chatbots can enhance learning experiences and cognitive skills, their use poses challenges that require regulation. Negative perceptions of using AI chatbots by graduate students included cheating, plagiarism, and reduced interaction, whereas positive perceptions highlighted research flexibility and affordability. To manage AI chatbot usage, lecturers employed active learning strategies and customized coursework, while universities implemented Viva Voce and AI software detectors to discourage cheating and plagiarism. The study emphasizes the role of cultural and social factors in integrating AI chatbots in education and offers practical insights for educators and institutions to regulate their use, promoting cognitive skill development while mitigating negative impacts.

Antony and Ramnath (2023) investigated the impact of AI chatbots on student engagement and support in higher education. Using a qualitative method and Interpretative Phenomenological Analysis (IPA), they conducted in-depth semi-structured interviews with 11 participants from Kerala, India. The data analysis followed a five-step Systematic Text Consideration (STC) process. By exploring themes aligned with the UTAUT2 constructs, a comprehensive understanding of the factors influencing student engagement and support was achieved. A total of eight themes were identified, encompassing effectiveness and limitations, beyond, enrichment, optimization, synergize, streamlining communication, Engage+AI, and Refine. These themes demonstrated the transformative potential of AI chatbots in enhancing communication, engagement, and support in higher education. The study highlighted the practical benefits of AI chatbots, such as efficient communication, personalized recommendations, and streamlined interactions, balancing quick assistance with human expertise. Addressing security and privacy concerns is crucial for fostering trust and successful integration. Overall, the study concluded that embracing AI chatbots can significantly improve the educational experience by making it more efficient, engaging, and supportive for students.

A key distinction between this study and previous research is that the present investigation was conducted specifically in the Federal universities in South East geopolitical zone, Nigeria. While previous studies have provided direction on factors influencing undergraduate students' adoption of AI-chatbots for educational use in Lesotho, impact of AI chatbots as a communication medium on student engagement and support in the state of Kerala higher education, India, strategies for regulating the usage of AI chatbots in Zimbabwean universities, integration of AI-chatbots in teaching, learning, and administrative tasks in universities in the South-South geopolitical zone of Nigeria with different trajectories (Ayanwale & Molefi, 2024; Muchowe & Kouam, 2024; Antony & Ramnath, 2023; Afonughe

et al., 2021), the present study focused on the integration of diffusion innovation theory in Technical Vocational Education and Training (TVET) for improving students' adoption of Artificial Intelligence chatbots in Federal universities in South East geopolitical zone, Nigeria.

Research Methodology

This section present research framework, including research design, area, population, instrument validation, reliability, data collection, analysis methods, and decision criteria for evaluation of diffusion theory of innovation in Technical and Vocational Education and Training (TVET) as a panacea for improving adoption of AI-Chatbots among students in Federal Universities in South East geopolitical zone, Nigeria. The study employed descriptive survey research design. According to Nworgu (2015), Johnny, Effiong and Sheik (2020), survey research design aims to systematically collect and describe data concerning the characteristics, features, or facts about a given population. The study was conducted in Federal universities offering Technical Vocational Education and Training (TVET) programme in the South-East geopolitical zone, Nigeria which comprised of five Federal universities namely; Alex Ekweme University, Ebonyi State (AE-FUNAI), Alvan Ikoku Federal University of Education, Owerri (AIUE), Michael Okpara University of Agriculture, Umudike (MOUAAU), Nnamdi Azikiwe University, Awka (UNIZIK), University of Nigeria, Nsukka (UNN).

The population of this study comprised all the one hundred and eighty-nine (189) final year TVET students comprising of 86 and 103 MOUAAU and UNN students respectively. According to Bornstein, Jager and Putnick (2013), the entirety of all elements under observation, which constitutes all things in any field of investigation, is the study population. A sample size of ninety-seven (97) final year TVET students consisted of 46 and 51 for MOUAAU and UNN students respectively were randomly selected for the study. A sample refers to a section or subset of the study population chosen for investigation through a sampling process (Taherdoost, 2016). In the same vein, Nardi (2018), stated that sampling technique is essential for estimating the required data volume and comprehending the data gathering process within a population to fulfill the study objectives. Yamane formula was used for calculating the sample size. According to Islam (2018), the Yamane formula provides a simplified formula to calculate sample sizes.

The data for the study were gathered from both primary and secondary sources. The primary data were collected using questionnaire while the secondary data were gathered from text books, journals and online materials (Google Scholar, Research Gates, Scopus, among others). The researchers developed a 30-item structured questionnaire titled: Diffusion Innovation Theory in TVET for Improving Students' Adoption of AI-Chatbots in Nigerian Universities Questionnaire (DITTISAANUQ). A questionnaire according to Nardi (2018) is the most common instrument or technique used to acquire descriptive data from a sample group in survey research because the respondents have the advantage of supplying data and information from the source. The instrument was divided into four sections; A – D. Section A comprised of items eliciting information on staff demographic data, while sections B – D comprised of items on compatibility, trialability and relative advantage respectively. The instrument was designed with a 5-point rating scale of Very High Extent (VHE=4.50-5.00), High Extent (HE=3.50-4.49), Moderate Extent (ME=2.50-3.49), Low Extent (LA=1.50-2.49), Very Low Extent (VLE=1.00-1.49) used to answer research questions.

In order to establish the validity of the instrument, copies of the instrument were given to two experts in the Department of Measurement and Evaluation and one expert in Department of Industrial Technology Education, University of Uyo, Akwa Ibom State, for face validation.

To ensure the reliability of the instrument, it was trial-tested on 20 students who were not part of the study. Cronbach alpha statistics was used to determine the reliability coefficient of the instrument which yielded overall reliability index of .76 comprising of .75, .73 and .81 for Section B, C and D respectively indicating that the instrument was reliable. Cronbach's alpha test according to Taber (2017) is the most commonly used method to assess the accuracy of scales with value between 0 and 1. Cronbach's alpha coefficient should be between 0.7 and above to demonstrate the scale's reliability (Cronbach, 1951).

The administration of the instrument was done with the assistance of three research assistants who were briefed before administration of the instrument to the students. A letter of information and consent were part of the information provided to the students. Since the questionnaire was distributed face to face, the participants read the letter of information and consent form and confirmed their voluntary participation. The ninety-seven (97) copies of the questionnaire administered were all retrieved, indicating a 100% instrument retrieval. Mean scores and Standard Deviation were used in answering the research questions while t-test statistics was used to test the three null hypotheses at .05 level of significance. The data collected were analyzed using Statistical Package for the Social Sciences 26 (SPSS).

Analysis of Data and Results

Research Question 1: To what extent does compatibility influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria?

Table 1: Mean rating of UNN and MOUAU on compatibility influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

S/N	SECTION B: Compatibility influence on TVET students' adoption of AI-chatbots	UNN (N=51)			MOUAU (N=46)		
		\bar{x}	SD	Dec.	\bar{x}	SD	Dec.
1.	AI-chatbots are designed to enhance educational objectives and career goals of TVET students.	4.69	0.53	VHE	4.18	0.57	HE
2.	AI-chatbots incorporate local cultural nuances, languages, and traditions for TVET students.	4.56	0.72	VHE	4.53	0.48	VHE
3.	AI-chatbots are compatible with smartphones, tablets, and university e-learning systems used by TVET students.	4.51	0.59	VHE	4.36	0.61	HE
4.	AI-chatbots offer practical, hands-on guidance and simulations that are critical for TVET students.	4.54	0.47	VHE	4.72	0.52	VHE
5.	AI-chatbots incorporate quizzes, tutorials, and interactive exercises for TVET students.	4.48	0.83	HE	4.75	0.71	VHE
6.	AI-chatbots align with the existing assessment methods and standards used in TVET programmes.	4.65	0.65	VHE	4.42	0.67	HE
7.	AI-chatbots incorporate visual, auditory, or kinesthetic learning styles for TVET students.	4.59	0.87	VHE	4.67	0.64	VHE
8.	AI-chatbots support collaborative learning and peer interactions for TVET students.	4.73	0.58	VHE	4.47	0.47	HE
9.	AI-chatbots help TVET students with immediate queries and problems, enhancing their learning experience.	4.47	0.76	HE	4.74	0.56	VHE
10.	AI-chatbots are reliable, accurate, and transparent in their operations for TVET students.	4.46	0.84	HE	4.52	0.64	VHE
Grand Mean and Standard Deviation		4.57	0.68	VHE	4.54	0.59	VHE

*NOTE: VHE (4.50-5.00), HE (3.50-4.49), MA (2.50-3.49), LA (1.50-2.49), VLE (1.00-1.49)

The analyzed data in Table 1 revealed the mean responses of UNN and MOUAU TVET students on compatibility influence on adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The respondents Mean and Standard Deviation ranged from 4.18(0.47) to 4.75(0.87) with grand Means and Standard Deviation of 4.57(0.68) and 4.54(0.59) for UNN and MOUAU TVET students, respectively. Over all, the UNN and MOUAU TVET students'

response to research question one implies that compatibility have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Research Question 2: To what extent does trialability influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria?

Table 2: Mean rating of UNN and MOUAU on trialability influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

S/N	SECTION C: Trialability Influence on TVET Students' adoption of AI-chatbots	UNN (N=51)			MOUAU (N=46)		
		\bar{x}	SD	Dec.	\bar{x}	SD	Dec.
1.	Trialability allows TVET students to make mistakes and learn from them without real-world consequences, increasing their confidence in using AI-chatbots.	4.49	0.73	HE	4.64	0.94	VHE
2.	Through trial use, TVET students can explore how AI-chatbots can be tailored to their specific learning needs and preferences.	4.68	0.65	VHE	4.52	0.62	VHE
3.	Through trial use, TVET students can compare the AI-chatbots performance with traditional learning methods, aiding in informed decision-making.	4.86	0.67	VHE	4.75	0.41	VHE
4.	Trial periods help TVET students understand how easily AI-chatbots can be integrated into their existing study routines.	4.64	0.74	VHE	4.47	0.54	HE
5.	Observing peers' successful trials motivate TVET students to adopt AI chatbots, leveraging social proof.	4.78	0.82	VHE	4.55	0.56	VHE
6.	During trials, TVET students access support services, helping them overcome initial technical challenges and fostering a positive user experience.	4.75	0.65	VHE	4.71	0.59	VHE
7.	TVET students interact directly with AI chatbots, gaining firsthand experience of their benefits and functionalities through trial periods.	4.51	0.71	VHE	4.73	0.72	VHE
8.	By actively using AI-chatbots in a trial phase, students retain information and understand how the technology supports their learning objectives.	4.48	0.76	HE	4.54	0.66	VHE
9.	Trials help students discover the simplicity and user-friendliness of AI-chatbots, which initially seem complex or intimidating.	4.62	0.79	VHE	4.63	0.57	VHE
10.	Trial periods allow students to explore and utilize various customization features, demonstrating the flexibility of AI-chatbots.	4.74	0.53	VHE	4.77	0.59	VHE
Grand Mean and Standard Deviation		4.66	0.71	VHE	4.63	0.62	VHE

***NOTE:** VHE (4.50-5.00), HE (3.50-4.49), MA (2.50-3.49), LA (1.50-2.49), VLE (1.00-1.49)
 The analyzed data in Table 2 revealed the mean responses of UNN and MOUAU TVET students on trialability influence on adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The respondents Mean and Standard Deviation ranged from 4.47(0.41) to 4.86(0.94) with grand Means and Standard Deviation of 4.66(0.71) and 4.63(0.62) for UNN and MOUAU TVET students, respectively. Over all, the UNN and MOUAU TVET students' response to research question one implies that trialability have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Research Question 3: To what extent does relative advantage influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria?

Table 3: Mean rating of UNN and MOUAU on relative advantage influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

S/N	SECTION D: Relative Advantage Influence on TVET students' adoption of AI-chatbots	UNN (N=51)			MOUUAU (N=46)		
		\bar{x}	SD	Dec.	\bar{x}	SD	Dec.
1.	AI-chatbots provide personalized learning experiences, making the learning process more efficient compared to traditional methods.	4.91	0.63	VHE	4.68	0.65	VHE
2.	AI-chatbots are available round the clock, offering continuous support and learning opportunities for students with varying schedules.	4.74	0.66	VHE	4.61	0.52	VHE
3.	AI-chatbots tailor learning materials and suggestions based on individual student's progress and preferences, offering a more customized educational experience.	4.48	0.59	HE	4.73	0.64	VHE
4.	Students receive instant feedback on their queries and assessments, helping in understanding and correcting mistakes promptly.	4.83	0.62	VHE	4.68	0.66	VHE
5.	Utilizing AI-chatbots reduces the need for multiple human tutors and administrative staff, thereby cutting down on educational costs for students.	4.72	0.57	VHE	4.80	0.58	VHE
6.	AI-chatbots support multiple languages, breaking down language barriers that might hinder learning.	4.77	0.73	VHE	4.67	0.45	VHE
7.	AI-chatbots adapt to the learning pace and style of each student, catering to both fast and slow learners.	4.69	0.69	VHE	4.79	0.61	VHE
8.	Using AI-chatbots helps students become more familiar with digital tools and technologies, which is a crucial skill in the modern workforce.	4.76	0.76	VHE	4.64	0.78	VHE
9.	AI-chatbots provide simulations, step-by-step guides, and troubleshooting assistance for practical tasks.	4.71	0.50	VHE	4.55	0.69	VHE
10.	AI-chatbots easily scale to accommodate a large number of students, making them an effective solution for overcrowded educational environments.	4.64	0.74	VHE	4.62	0.72	VHE
Grand Mean and Standard Deviation		4.73	0.65	VHE	4.68	0.63	VHE

*NOTE: VHE (4.50-5.00), HE (3.50-4.49), MA (2.50-3.49), LA (1.50-2.49), VLE (1.00-1.49)

The analyzed data in Table 3 revealed the mean responses of UNN and MOUUAU TVET students on relative advantage influence on adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The respondents Mean and Standard Deviation ranged from 4.48(0.45) to 4.91(0.78) with grand Means and Standard Deviation of 4.73(0.65) and 4.68(0.63) for UNN and MOUUAU TVET students, respectively. Over all, the UNN and MOUUAU TVET students' response to research question one implies that relative advantage has very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Hypotheses 1: There is no significant difference in the mean response of UNN and MOUUAU students on the influence of Compatibility on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Table 4: *t-test analysis of the mean scores of UNN and MOUUAU students on the influence of Compatibility on TVET students' adoption of AI-chatbots for learning in Nigerian Universities.*

Variable	N	\bar{x}	SD	df	t-cal.	t-value	Decision
UNN	51	4.57	0.68	95	0.10	1.98	NS
MOUUAU	46	4.54	0.59				

Note, NS = Not Significant

From Table 4, the calculated t-value is 0.10 ($t_{cal}=0.10$) and the critical t-value is 1.98 ($t_{crit}=1.98$) at 95 degrees of freedom and at 0.05 level of significance. Since the $t_{cal}=1.98$ is

greater than the $t_{cal}=0.10$, the null hypothesis is upheld; indicating that there is no significant difference in the mean response of UNN and MOUAU students on the influence of Compatibility on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. This implies that compatibility have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria

Hypotheses 2: There is no significant difference in the mean response of UNN and MOUAU students on the influence of trialability on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Table 5: *t-test analysis of mean scores of UNN and MOUAU students on the influence of trialability on TVET students' adoption of AI-chatbots for learning in Nigerian Universities.*

Variable	N	\bar{x}	SD	df	t-cal.	t-value	Decision
UNN	51	4.66	0.71	95	0.09	1.98	NS
MOUAU	46	4.63	0.62				

Note, NS = Not Significant

From Table 5, the calculated t-value is 0.09 ($t_{cal}=0.09$) and the critical t-value is 1.98 ($t_{crit}=1.98$) at 95 degrees of freedom and at 0.05 level of significance. Since the $t_{crit}=1.98$ is greater than the $t_{cal}=0.09$, the null hypothesis is upheld, indicating that there is no significant difference in the mean response of UNN and MOUAU students on the influence of trialability on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. This implies that trialability have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Hypotheses 3: There is no significant difference in the mean response of UNN and MOUAU students on the influence of Relative advantage on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Table 6: *t-test analysis of mean scores of UNN and MOUAU students on the influence of Relative advantage on TVET students' adoption of AI-chatbots for learning in Nigerian Universities.*

Variable	N	\bar{x}	SD	df	t-cal.	t-value	Decision
UNN	51	4.73	0.65	95	0.02	1.98	NS
MOUAU	46	4.68	0.63				

Note, NS = Not Significant.

From Table 6, the calculated t-value is 0.02 ($t_{cal}=0.02$) and the critical t-value is 1.98 ($t_{crit}=1.98$) at 95 degrees of freedom and at 0.05 level of significance. Since the $t_{crit}=1.98$ is greater than the $t_{cal}=0.02$, the null hypothesis is upheld, indicating that there is no significant difference in the mean response of UNN and MOUAU students on the influence of Relative advantage on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. This implies that relative advantage has very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Discussion of Findings

This study focused on the diffusion innovation theory and its application to the adoption of AI chatbot tools for academic purposes among TVET undergraduate students in Federal universities in South East geopolitical zone, Nigeria. The findings of the study for research question one revealed that UNN TVET students responded that high extent of compatibility with educational formats, such as quizzes, tutorials, and interactive exercises making AI-chatbots more approachable for students; real-time support and troubleshooting through AI-chatbots help students with immediate queries and problems, enhancing their learning experience; AI-chatbots reliability, accuracy, and transparency in their operations influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. Similarly, the findings of the study revealed that MOUAU TVET students responded that high extent of compatibility with the devices and digital platforms commonly used by students, such as smartphones, tablets, and university e-learning systems; feedback and assessments which align with the existing assessment methods and standards used in TVET programs; collaborative learning and peer interactions influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria.

Overall Mean and Standard Deviation of UNN and MOUAU TVET students' response to research question one implies that compatibility have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The corresponding hypothesis one revealed that there is no significant difference in the mean response of UNN and MOUAU students on the extent to which Compatibility influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. This finding aligns with research conducted by Chiang (2013), Agag and El-Masry (2016), Kim and Park (2019), Olasina (2019), Shin et al. (2020) and Ayanwale and Molefi (2024) that individuals perceived greater compatibility with AI tools, which led them to interact and engage with the chatbot more frequently. As a result, users are more likely to engage in desired behaviors, such as continued usage or adoption of the chatbot, if they have a positive user experience and a sense of alignment with its capabilities, personality, and communication style. Furthermore, the study conducted by Ayanwale and Molefi (2024), found that compatibility between individuals and chatbots has a direct and significant effect on behavioral intention. Students who perceive a sense of compatibility with AI tools are more likely to embrace them as useful tools for learning.

The findings of the study for research question two revealed that UNN TVET students responded that high extent of trialability allows students to make mistakes and learn from them without real-world consequences, increasing their confidence in using AI chatbots; students can better retain information and understand how the technology supports their learning objectives. Similarly, the findings of the study revealed that MOUAU TVET students responded that high extent of trial periods help students understand how easily AI chatbots can be integrated into their existing study routines. Overall Mean and Standard Deviation of UNN and MOUAU TVET students' response to research question two implies that trialability have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The corresponding hypothesis two showed that there is no significant difference in the mean response of UNN and MOUAU students on the extent to which trialability influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. This aligns with previous research that highlights the significance of trialability as a means to reduce uncertainty and encourage adoption (Almeida, 2023, Pinho et al., 2021; Rogers, 1983, 2003). This also align with Pinho, Franco and Mendes (2021), who

stated that trialability of chatbots allows students to experiment with the tool and experience its potential benefits, thus increasing their intention to use it. In the same vein, Almeida (2023) found trialability to be a significant predictor of students' intention to use a chatbot for academic advice, indicating that students who had the chance to try the chatbot were more likely to use it again.

The findings of the study for research question three revealed that UNN TVET students responded that high extent of relative advantage of AI-chatbots can tailor learning materials and suggestions based on individual student's progress and preferences, offering a more customized educational experience. Overall Mean and Standard Deviation of UNN and MOUAU TVET students' response to research question three implies that relative advantage have very high influence on TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. The corresponding hypothesis three showed that there is no significant difference in the mean response of UNN and MOUAU students on the extent to which Relative advantage influence TVET students' adoption of AI-chatbots for learning in Universities in South-East, Nigeria. This finding aligns with the innovation diffusion theory, which suggests that individuals are more likely to adopt an innovation if they perceive it as advantageous (Nguyen & Nguyen, 2020). In the same vein Chiang (2013), Agag and El-Masry (2016), Kim and Park (2019), stated that the rate and extent of new technology adoption vary based on simulations, step-by-step guides, and troubleshooting assistance for practical tasks. Additionally, Nguyen and Nguyen (2020) found modest support for the predictive validity of innovation characteristics, particularly the role of the relative advantage of chatbots in predicting adoption intentions.

Conclusion

The study on the diffusion theory of innovation in TVET as a panacea for improving students' adoption of AI-Chatbots in universities in South East, Nigeria provides compelling evidence that compatibility, trialability, and relative advantage, as key elements of the Diffusion Innovation Theory (DIT), significantly influence the adoption of AI-chatbots among students. The research demonstrates that AI-chatbots are more readily adopted when they align well with existing values and experiences (compatibility), when students can experiment with the technology on a limited basis before full-scale implementation (trialability), and when the benefits of AI-chatbots clearly outweigh the existing methods (relative advantage). These findings highlight the critical role of tailored implementation strategies that address these elements, suggesting that educational institutions should focus on these factors to facilitate smoother transitions and greater acceptance of AI technologies. Ultimately, the study underscores the transformative potential of AI-chatbots in enhancing educational experiences and outcomes among TVET undergraduate students in Federal universities in South East geopolitical zone, Nigeria, provided the diffusion process is strategically managed according to the principles of Diffusion Innovation Theory (DIT).

Recommendations

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

1. Universities should offer training programs that highlight the compatibility, trialability, and advantages of AI-Chatbots for students, using case studies and testimonials to showcase benefits like improved accessibility, faster responses, and personalized assistance.

2. Establish a continuous feedback mechanism to gather student experiences with AI-Chatbots, improving the technology and demonstrating that student input is valued.
3. Design user-friendly AI-Chatbot interfaces with clear instructions for effective student engagement.
4. Integrate AI-Chatbots into the TVET curriculum to increase student familiarity, comfort, and adoption.
5. Launch peer influence initiatives where early adopters share their positive AI-Chatbot experiences to encourage wider adoption.
6. Develop clear policies for AI-Chatbot use in Nigerian universities, addressing data privacy, ethics, and intellectual property.

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