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UTILIZATION OF ARTIFICIAL INTELLIGENCE BASED TOOLS FOR TEACHING COMPUTER SCIENCE EDUCATION COURSES IN PUBLIC UNIVERSITIES IN ENUGU STATE

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Abstract
This study investigated the utilization of artificial intelligence (AI) based tools for teaching computer science education (CSE) courses in public universities in Enugu State; using a descriptive survey research design was used, and five research questions guided the study, with five null hypotheses tested at .05 level of significance. The target population for the study comprised 19 lecturers in Faculties of Education, Enugu State University of Science and Technology (ESUT) and University of Nigeria, Nsukka (UNN). Data were collected using a research structured questionnaire. The questionnaire has two sections; A and B. Section A sought information on the respondents' bio-data while Section B has sixty (60) items in five clusters of: i (13 items); ii (12 items); iii (12 items); iv (13 items) and v (10 items). The face and content validity of the questionnaire were authenticated by three research experts in the Department of Mathematics and Computer Science Education, ESUT, Agbani. The internal consistency of the instrument was determined using Cronbach Alpha approach, because the instrument is polychotomous (on a four-point scale). The instrument had an overall reliability index of .80. The reliability co-efficient was high enough, considering Ogbazi and Okpala's (1994) criteria of .60 as acceptable for good instrument. The 19 copies of the questionnaire were distributed to the respondents with the help of two research assistants who also retrieved them on the spot. Among other things, this ensured a 100% return rate of the questionnaire which were all collated and used for data analysis. The five research questions were answered using mean ratings, standard deviation and t-test statistics. The findings of the study showed a high adoption of AI based tools among public university lecturers for teaching CSE. Apart from the utilization of AI- Tutoring Systems, there were no significant differences between the mean ratings of male and female lecturers on the extent to which they utilize Chatbots, Adaptive learning Platforms, Automated Writing Assessment and Natural Language Processing Tool, for teaching computer science education. The recommendations include: organizing awareness workshops by the University Management, to support lecturers and sharpen their already acquired knowledge on AI based teaching tools , for effective service delivery.

Key words: Artificial intelligence, Chatbots, Innovation, Technology, Tutoring, Utilization.

Introduction
Education is the process of acquiring knowledge, skills, values, beliefs and habits through various methods; such as, teaching, training, storytelling, research and experience. It encompasses formal instruction provided by schools, colleges, and universities, as well as informal learning that occurs in everyday life. Among many definitions, Arogundade and Belo (2019) defined education as the paramount tool for shaping a well-rounded individual and equipping him with the necessary skills,

knowledge, attitude and values essential for fulfilling life. Concurrently, Nsirim (2019) portrayed education as the vehicle that brings about a formative effect on the mind, character or physical ability of the individual concerned. These views showed that education plays a key role in the development of human civilization. The method of learning and education is however constantly evolving due to new technologies (Mircea, 2023). With these technologies, **e**ducation is in the digital age strengthened as a lifelong journey that often culminates in university education, where individuals delve deeper into specialized fields and acquire advanced knowledge, critical thinking and skills.

University education refers to the tertiary level of education typically provided by universities through diverse range of professional programs designed to impart advanced knowledge, skills and qualifications in various academic disciplines or fields. According to Idikwu (2014), a university is a well-defined and structured establishment known all over the world as the highest educational institution for the recognition of academic excellence. Idoko (2015) explained that a university is an acclaimed centre of excellence where intellectual cross fertilization of ideas systematically takes place towards the development of the individual intellectual capacity, resourcefulness and character for the overall societal advancement. University education therefore serves as the foundational platform for students to delve into specialized fields such as computer science education; where they acquire essential knowledge and practical skills crucial for navigating the dynamic landscape of technology.

Thus, Computer Science Education (CSE)refers to the academic discipline and instructional programs that focus on the study of computers, computing technologies and computational systems. It encompasses various aspects of computer science; including theory, algorithms, programming languages, software development, hardware systems, networking, database management, cyber security, artificial intelligence and machine learning (Guzdialand Tew, 2020). Computer science education aims to equip students with the knowledge, skills and abilities necessary to understand, analyse, design, develop and implement computational solutions to complex problems across diverse domains. According to Grover and Pea (2013), CSE aims to equip students with the knowledge and skills necessary to understand and solve complex problems using computational thinking and technology. Computer Science Education is studied at various levels of education; from elementary and secondary schools to undergraduate and graduate programs in colleges and universities. Its courses provide strong foundation in computational thinking and digital literacy, empower educators to effectively integrate technology into teaching practices and enhance student learning experiences.

Technology has indeed impacted almost every aspect of life today, and education is no exception (Grover and Pea, 2013). The world is currently moving towards the employment of the fifth generation of the Internet or the so-called "Internet of

Things" in education. For instance, there has been increasing interest in the integration of artificial intelligence (AI) applications in teaching and learning. This seamless integration of technology in education, evident in incorporation of artificial intelligence (AI) tools, opens new avenues for personalized learning experiences and innovative pedagogical approaches (Smith and White, 2021).

Artificial Intelligence refers to the study of intelligent machines and software that can be used to, learn, gather knowledge, communicate, manipulate and perceive objects (Verma, 2018). Mircea (2023) defined Artificial intelligence as the development of systems and machines that can simulate intelligent human behaviour; such as learning, reasoning, and problem-solving. As such, AI has great potential for enhancing cooperation within educational institutions; especially because it can automate many time-consuming administrative tasks in teaching and learning.

Artificial Intelligence also involves the use of algorithms and complex mathematical models to enable machines to accept and decode instructions and improve their performance autonomously. Thus, the fundamental purpose of AI is to enable machines to exhibit traits specific to human intelligence. In this respect, the basic definition of artificial intelligence can be expressed as the skilful imitation of human behaviour or mind by tools or programs (Mohammed and Watson, 2019).

Evidence abound of the importance of AI in the education sector; due to its use to facilitate teaching and learning, and enable teachers/lecturers and pupils/students achievement of modern educational goals. AI is accessed and delivered mainly through computers, laptops, tablets, iPads, multimedia mobiles and other technological instruments. There are several AI technology-based applications used for teaching and learning at present (Panigrahi, 2020). The importance of AI has grown significantly, particularly since the time of the closure of schools and universities as a result of the coronavirus (COVID-19) pandemic. Therefore, AI now have tremendous impact on educational practices, as it is necessitating the development of learning management systems, evaluation tools and other learning support mechanisms (D'Mello and Graesser, 2012; Hwang and Tu, 2021).

Amidst these, the presence of AI technology has transformed the educational curriculum, especially in the fields of technology, science, mathematics and engineering. In recent years, AI-based tools have even gained more prominence in facilitating teaching and learning processes. It is on this note that this study is interested in determining the utilisation of AI tools in teaching CSE courses in public Universities in Enugu State using ESUT and UNN as case studies.

Conceptual framework

The outstanding concepts in this discourse are diverse AI tools necessary in facilitating CASE courses in public Universities in Enugu State. Some of these AI - based tools.

AI-based tools for the facilitation of this teaching, according to Karsenti (2019) include; Gooru, Project Essay Grade (PEG) Writing Scholar, Grammarly, Educational Chat bots, Adaptive Learning Platforms, AI-Powered Tutoring Systems, Automated Writing Assessment, Padlet, Presentation Translator, Smartboards, among others.

Educational chatbots for instance are AI-driven systems designed to facilitate learning interactions between users and the platform through natural language processing. Among other things, educational chatbots are virtual assistants that help teach students, evaluate papers, get student and alumni data, update curriculums and coordinate admission processes (Serban, 2017). Serban (2017) stated that they are programmed to engage users in educational activities, provide explanations, answer questions and offer guidance on various topics. These chatbots can be deployed in a variety of educational settings; such as classrooms, online courses, tutoring platforms, or self-study environments, to enhance the learning experience (Rajendran and Ravindran, 2019). Educational chatbots indeed serve as interactive tools that provide personalized assistance and feedback and complement the capabilities of Adaptive Learning Platforms by offering real-time guidance and support tailored to individual learning needs.

Adaptive Learning Platforms on the other hand are educational technologies that utilize algorithms and data analytics to personalize the learning experience for individual students. VanLehn (2016) viewed adaptive educational systems as computer systems that are capable of changing their behaviour in response to input from the user. These platforms adapt instructional content, pace and assessment methods based on each student's strengths, weaknesses, preferences and learning style. They often employ machine learning techniques to analyse student performance data and dynamically adjust the learning path to optimize learning outcomes. Along this lane, AI-powered tutoring systems are educational platforms that utilize artificial intelligence (AI) techniques to provide personalized learning experiences, feedback and guidance to students. These systems employ various AI technologies such as machine learning, natural language processing (NLP)and data analytics to adapt to the individual needs and learning styles of students, and consequently enhance their educational outcomes.

Moreover, Automated Writing Assessment (AWA) refers to the process of using computer algorithms to evaluate and provide feedback on written texts produced by individuals (Shermis and Burstein, 2013). These systems are designed to analyse various aspects of writing, such as grammar, spelling, coherence, organization, vocabulary usage and overall quality, often with the aim of assisting learners in improving their writing skills. Automated Writing Assessment (AWA) relies heavily on sophisticated natural language processing (NLP) tools to analyse and evaluate written content with precision and efficiency. Indeed, AI-powered tutoring systems leverage sophisticated algorithms to provide personalized learning experiences, while Automated Writing Assessment tools utilize similar technology to offer instant

feedback on writing proficiency, and collectively advance educational outcomes through intelligent automation.

Nevertheless, Natural Language Processing (NLP) tools refer to a set of computational techniques designed to enable computers to understand, interpret and generate human language. The NLP tools encompass a range of tasks such as text classification, sentiment analysis, machine translation named entity recognition. One widely used NLP tool is the Natural Language Toolkit (NLTK) developed by Steven Bird and Edward Loper (Bird and Loper, 2014. This provides libraries and algorithms for NLP tasks in Python. Overall, NLP tools however play a crucial role in facilitating human-computer interaction, information retrieval and language-based applications in diverse domains. Natural Language Processing (NLP) tools have generally become increasingly indispensable for lecturers, as it revolutionize the way lecturers analyse, interpret and interact with textual data in educational settings.

Since the contextual AI tools are mostly employed by lecturers in their interactions, there is need to unravel the person the person of a lecturer. A lecturer is an academic professional who delivers educational content, facilitates learning and assesses students' understanding in various subjects in a university or college setting (Pappas, 2016). Lecturers play a crucial role in guiding students through course materials, facilitating discussions and evaluating academic progress through assignments, exams, and other assessments (Boud and Falchikov, 2016).

Gender is also a variable worth replicating in the utilization of AI tools in teaching CSE courses in the Universities. Gender refers to the social, cultural and psychological characteristics and roles associated with being male, female or non-binary. It encompasses a wide range of identities, behaviours and attributes that societies typically associate with masculinity and femininity. Gender is distinct from biological sex, which refers to physical characteristics such as reproductive anatomy and chromosomes (Smith and White, 2021). The focus on gender was necessitated by the assertion of Pappas (2016), that there exists a significant gender gap in the utilization of AI-based tools among educators, particularly in the field of computer science education. Considering the significant challenge that the gender disparity in the utilization of AI-based tools among educators poses; which include achieving equity and excellence in computer science education, the influence of gender on the extent to which AI based tools are utilized in teaching computer science courses by lecturers were ascertained.

Statement of the Problem

One of the first and most important tasks of school computer science teaching and learning is to form a clear way of thinking in students. Hence, the form and method of teaching should be aimed at developing the thinking and creative abilities of young students. Incidentally, Artificial Intelligence (AI) has shown promise in enhancing teaching, learning and academic achievements, and thereby present an opportunity

to address the challenges faced by lecturers in the delivery of their teaching activities. Personal experiences have shown that despite the advancements in science and technology offering innovative methods and tools to support educators and researchers, the utilization of AI-based tools remains under-explored among Nigerian lecturers. For instance, most of the teaching of courses in our universities; including on Computer Science education, are given via the lecture-based teaching approach with skills and practice which provides students with few opportunities to think deeply about the relevant issues that are possible within the interaction and context afforded by the utilization of AI-based tools. This could have a negative impact on the students' learning effectiveness and technological judgement. The problem at hand may also revolve around the challenges faced by lecturers in Nigeria, including low academic achievement among the students and limited recognition in global research efforts. Hence, the determination of the extent of utilization of AI-based tools would reveal areas that require emphasis among stakeholders. In Nigeria, the cultural and arbitrary assigning of roles and expectations to the female and male gender has given rise to the perception of science and technology as being masculine. While the female or feminine gender shy away from science and competence to handle technological packages; this has become a concern to well-meaning individuals; especially as there seems to be high population of females in the teaching profession. This reality calls for the determination of the extent and influence of gender in the utilization of Artificial Intelligence based tools for teaching CSE courses in public universities in Enugu State.

Research Questions

Based on the relevant specific purposes, the following research questions guided the study:

1. To what extent do lecturers utilize educational chat bots in teaching computer science education courses in public universities in Enugu State?
2. To what extent do lecturers utilize adaptive learning platforms in teaching computer science education courses in public universities in Enugu State?
3. To what extent do lecturers utilize AI-Powered Tutoring Systems in teaching computer science education courses in public universities in Enugu State?
4. To what extent do lecturers utilize automated writing assessment in teaching computer science education courses in public universities in Enugu State?
5. To what extent do lecturers utilize natural language processing tool in teaching computer science education courses in public universities in Enugu State?

Hypotheses

The following null hypotheses were formulated and tested at .05 level of significance:
Ho_1: There is no significant difference between the mean score of male and female lecturers on the extent to which they utilize educational chat bots in teaching computer science education courses in public universities in Enugu State.

Ho_2: There is no significant difference between the mean ratings of male and female lecturers on the extent to which they utilize adaptive learning platforms in teaching computer science education courses in public universities in Enugu State.

Ho_3: There is no significant difference between the mean ratings of male and female lecturers on the extent to which they utilize AI-Powered Tutoring Systems in teaching computer science education courses in public universities in Enugu State.

Ho_4: There is no significant difference between the mean ratings of male and female lecturers on the extent to which they utilize automated writing assessment in teaching computer science education courses in public universities in Enugu State.

$H0_5$: There is no significant difference between the mean ratings of male and female lecturers on the extent to which they utilize natural language processing tool in teaching computer science education courses in public universities in Enugu State.

Research Method and Population for the study

The researchers adopted descriptive survey research design. Kothari and Garg (2014) defined descriptive survey research design as a design that focuses on providing a narrative of the existing characteristics of individuals, groups or situations based on factual information. The design was considered appropriate because it would enable the researcher to identify the characteristics of the population objectively. The design was successfully used by earlier researchers in similar studies.

The population for the study comprised 19 respondents (11 male and 8 female lecturers) in the two public universities Enugu State teaching Computer Science Education courses. The two universities are Enugu State University of Science and Technology (ESUT), Agbani and the University of Nigeria Nsukka (UNN). The entire population of 19 lecturers was used for the study because the size is manageable. This is in agreement with the postulation made by Uzoagulu (2013) that when a population is small or manageable, the researcher can make use of the whole. The number of lecturers in computer science education at ESUT was 2 (male = 2 and female = 0). That of UNN is 17 (male = 9 and female = 8) giving the total of 19 lecturers. The instrument for data collection was a 60- items structured questionnaire titled "Utilization of Artificial Intelligence Based tools for Teaching CSE Questionnaire (UAIBTQ)". The questionnaire has two sections, A and B. Section A is on the bio-data of the respondents while section B has five clusters of 60 - items on utilization of artificial intelligence-based tools for teaching computer science education courses. The researchers used a 4-point rating scale of Very High Extent (VHE) - 4 points, High Extent (HE) - 3 points, Low Extent (LE) - 2 points and Very Low Extent (VLE) - 1 point. The validity of the instrument was ascertained by three experts in research writing and practices; and modifications were effected as pointed out by them. To ensure the reliability of the instrument, it was trial tested on 10 lecturers in Anambra State

public universities. Anambra State was used because the lecturers and institutions in Anambra State shared similar characteristics with their counterparts in Enugu State. The instrument had an overall reliability index of 0.80 which indicated that the instrument was reliable and, therefore, used for data collection. All 19 copies of the questionnaire were administered and retrieved on the spot and this ensured a 100% (percent) return rate. Their responses were collated and used for data analysis. Mean and standard deviations were used in answering the research questions. The null hypotheses were tested using t-test statistic at .05 level of significance. In rating the mean, each response option had a numerical value based on real limit of numbers: Very Great Extent (VGE)= 3.50-4.00; Great Extent (GE) = 2.50-3.49; Low Extent (LE) = 1.50-2.49; Very Low Extent (VLE) = 0.00-1.49. There was also the value for overall mean and standard deviation. The interpretation of the test of hypotheses was based on the significance (sig.) values from the SPSS output. Hence, the null hypothesis will not be rejected when the probability values are greater than .05, but will be rejected when the probability values are less than .05.

Results

Table 1: Mean scores and standard deviations of respondents on the extent lecturers utilize educational chat bots in teaching Computer Science Education (CSE) courses.

S/n	Extent of utilization of the following educational chat bots for teaching CSE courses: Items	Male Lecturers N = 11			Female Lecturers N = 8			Overall		
			SD	Dec		SD	Dec		SD	Dec
1	Squirrel AI	3.17	0.58	HE	2.84	0.76	HE	2.91	0.73	HE
2	Duolingo	2.87	0.76	HE	2.77	0.86	HE	2.79	0.84	HE
3	Busuu	3.09	0.85	HE	2.81	0.74	HE	2.87	0.77	HE
4	Hellotalk.	3.17	0.65	HE	3.27	0.63	HE	3.25	0.64	HE
5	Quizlet	3.00	0.60	HE	2.87	0.84	HE	2.90	0.79	HE
6	Brainly	3.30	0.82	HE	3.23	0.92	HE	3.25	0.89	HE
7	Turing.com	3.09	1.12	HE	3.70	0.67	HE	3.56	0.83	HE
8	Replika	3.22	0.85	HE	3.42	0.93	HE	3.37	0.91	HE
9	Wolfram Alpha	3.26	1.14	HE	3.35	0.92	HE	3.33	0.97	HE
10	Mathway	1.65	0.65	LE	1.63	0.62	LE	1.64	0.63	LE
11	Clash Bot	3.09	0.85	HE	2.81	0.74	HE	2.87	0.77	HE
12	Mitsuku	3.22	0.85	HE	3.42	0.93	HE	3.37	0.91	HE
13	Sphero Edu	3.17	0.65	HE	3.27	0.63	HE	3.25	0.64	HE
	Grand mean	**2.98**	**0.20**	**HE**	**2.99**	**0.11**	**HE**	**2.99**	**0.11**	**HE**

Table 1 shows that the overall grand mean is 2.99. This implies that lecturers in the universities in Enugu State utilized the educational chat bots in teaching Computer Science Education to a High Extent. The closeness of the standard deviations shows that there is unanimity among the responses of the respondents. All these indicate that most items in this cluster are attributes to utilization of educational chat bots in teaching Computer Science Education.

Table 2: Mean scores and standard deviations of respondents on the extent lecturers utilize adaptive learning platforms in teaching computer science education courses.

S/n	Extent to which lecturers utilize adaptive learning platforms for teaching computer science education courses	Male Lectures N = 11			Female Lecturers N = 8			Overall		
	Items		SD	Dec		SD	Dec		SD	Dec
14	Khan Academy	3.29	0.42	LE	3.48	0.62	LE	3.42	0.59	LE
15	Smart Sparrow	3.16	0.42	LE	3.52	0.66	LE	3.45	0.62	LE
16	McGraw-Hill Connect	3.65	0.57	HE	3.30	0.82	HE	3.38	0.78	HE
17	Pearson MyLab	3.48	0.95	HE	3.66	0.62	HE	3.62	0.70	HE
18	DreamBox	1.30	0.56	LE	1.89	0.85	LE	1.75	0.83	LE
19	ALEKS	4.00	0.00	HE	3.57	0.69	HE	3.67	0.63	HE
20	Cognii	3.74	0.69	HE	3.53	0.75	HE	3.58	0.74	HE
21	Edmentum	3.39	0.89	HE	3.49	0.80	HE	3.47	0.82	HE
22	IXL Learning	3.39	0.89	HE	3.67	0.67	HE	3.61	0.73	HE
23	Cerego	3.48	0.79	HE	3.85	0.36	HE	3.76	0.51	HE
24	Quillionz	1.30	0.56	LE	1.89	0.85	LE	1.75	0.83	LE
25	Smart Learning Systems	4.00	0.00	HE	3.57	0.69	HE	3.67	0.63	HE
	Grand mean	**2.89**	**0.29**	**HE**	**3.00**	**0.14**	**HE**	**2.97**	**0.10**	**HE**

The overall grand mean of 2.97 indicates that the lecturers in the universities in Enugu State adopted the adaptive learning platforms in teaching computer science, to a High Extent.

Table 3: Mean scores and standard deviations of respondents on the extent lecturers utilize AI-Powered Tutoring System in teaching computer science education courses.

S/n	Lecturers utilize the following AI-powered Tutoring Systems for teaching computer science:	Male Lecturers N = 11			Female Lecturers N = 8			Overall		
	Items		SD	Dec		SD	Dec		SD	Dec
26	Personalized Learning Paths	1.35	0.57	LE	1.32	0.69	LE	1.32	0.66	LE
27	Adaptive Assessments	1.39	0.78	LE	1.34	0.70	LE	1.35	0.71	LE
28	Intelligent Content Recommendations	1.52	0.85	LE	1.33	0.75	LE	1.37	0.77	LE
29	Natural Language Processing (NLP)	1.35	0.78	LE	1.67	0.59	LE	1.60	0.65	LE
30	Speech Recognition	3.61	0.58	HE	3.41	0.61	HE	3.45	0.61	HE
31	Machine Learning Algorithms	1.30	0.47	LE	1.23	0.42	LE	1.25	0.43	LE
32	Data Analytics	3.74	0.62	HE	3.70	0.61	HE	3.71	0.61	HE
33	Gamification Elements	1.52	0.67	LE	1.70	0.67	LE	1.66	0.67	LE
34	Interactive Simulations	1.65	0.98	LE	1.30	0.46	LE	1.38	0.63	LE
35	Automated Grading	1.04	0.21	LE	1.10	0.30	LE	1.09	0.29	LE
36	Self-paced Learning	3.74	0.62	HE	3.70	0.61	HE	3.71	0.61	HE
37	Predictive Analytics	1.52	0.85	LE	1.33	0.75	LE	1.37	0.77	LE
	Grand means	**1.85**	**0.22**	**LE**	**1.81**	**0.14**	**LE**	**1.82**	**0.14**	**LE**

Table 3 with the grand mean of 1.82 indicates that the lecturers adopted the AI-powered tutoring Systems in teaching computer science education courses, to a low extent.

Table 4: Mean scores and standard deviations of respondents on the extent lecturers utilize automated writing assessment in teaching computer science education courses.

S/n	Lecturers utilize the following automated writing assessment for teaching computer science: Items	Male Lecturers N = 11			Female lecturers N = 8			Overall		
			SD	Dec		SD	Dec		SD	Dec
38	Scoring Rubrics	1.70	0.63	LE	2.37	0.64	LE	2.22	0.70	LE
39	Real-time Feedback	3.00	0.52	HE	3.15	0.70	HE	3.12	0.66	HE
40	Interactive Editing	3.52	0.59	HE	3.29	0.70	HE	3.34	0.68	HE
41	Word Usage Analysis	3.43	0.51	HE	3.51	0.64	HE	3.49	0.61	HE
42	Audience Appropriateness	3.48	0.79	HE	3.34	0.64	HE	3.37	0.67	HE
43	Content Relevance	3.00	1.04	HE	3.51	0.73	HE	3.39	0.83	HE
44	Genre-specific Analysis	3.43	0.79	HE	3.51	0.68	HE	3.49	0.70	HE
45	Thesis Statement Evaluation	2.91	0.67	HE	2.80	0.59	HE	2.82	0.60	HE
46	Consistency Checks	3.57	0.51	HE	3.46	0.69	HE	3.48	0.66	HE
47	Style Analysis	3.48	0.51	HE	3.46	0.62	HE	3.46	0.59	HE
48	Plagiarism Detection	3.00	1.04	HE	3.51	0.73	HE	3.39	0.83	HE
49	Readability Scores	3.48	0.79	HE	3.34	0.64	HE	3.37	0.67	HE
50	Punctuation Analysis	2.91	0.67	HE	2.80	0.59	HE	2.82	0.60	HE
	Grand means	**3.15**	**0.17**		**3.24**	**0.05**		**3.22**	**0.07**	**HE**

Table 4 shows that the overall grand mean is 3.22. This presents statistical evidence that lecturers utilize automated writing assessment in teaching computer science education courses to a High Extent.

Table 5: Mean scores and standard deviations of respondents on the extent lecturers utilized natural language processing tool in teaching Computer Science Education (CSE) courses.

S/n	Lecturers utilize the following utilize natural language processing tools for teaching Computer Science Education: Items	Male Lecturers N = 11			Female Lecturers N = 8			Overall		
			SD	Dec		SD	Dec		SD	Dec
51	spaCy	3.39	0.50	HE	3.28	0.66	HE	3.30	0.63	HE
52	Gensim	3.39	0.50	HE	3.41	0.76	HE	3.40	0.71	HE
53	Stanford NLP	3.70	0.47	VHE	3.61	0.56	VHE	3.63	0.54	HE
54	CoreNLP	3.57	0.79	VHE	3.28	0.64	HE	3.34	0.68	HE
55	TextBlob	3.48	0.51	HE	3.30	0.63	HE	3.34	0.61	HE
56	Pattern	3.70	0.70	VHE	3.75	0.52	VHE	3.74	0.56	HE
57	AllenNLP	3.57	0.59	VHE	3.53	0.64	VHE	3.54	0.62	HE
58	OpenNLP	3.74	0.45	VHE	3.44	0.75	HE	3.51	0.70	HE

S/n	Lecturers utilize the following utilize natural language processing tools for teaching Computer Science Education: Items	Male Lecturers N = 11			Female Lecturers N = 8			Overall		
			SD	Dec		SD	Dec		SD	Dec
59	Mallet	3.57	0.79	VHE	3.63	0.64	VHE	3.62	0.68	HE
60	Word2Vec	3.52	0.79	VHE	3.52	0.78	VHE	3.52	0.78	HE
	Grand means	**3.55**	**0.14**	**VHE**	**3.47**	**0.08**	**HE**	**3.49**	**0.07**	**HE**

The overall grand mean of 3.52 shown in table 5 indicated that lecturers utilize natural language processing tools for teaching Computer Science Education (CSE) courses to Very High Extent (VHE).

Table 6: t-test of the difference between the mean rating scores of male and female lecturers on the extent to which they utilize educational chat bots in teaching computer science education courses in public universities in Enugu State.

	N	$\bar{X}$	SD	Df	t(cal)	t. value (.05)	Decision
Male	11	2.98	0.20	17	0.72	1.96	Do not reject
Female	8	2.99	0.11				

Table 6 shows that the t-calculated of 0.72 is less than the critical value of the t-test which is 1.96 at 17 degree of freedom. Hence, the null hypothesis was not rejected and there is no significant difference between the mean rating scores of male and female lecturers on the extent to which they utilize educational chat bots in teaching computer science education courses in public universities in Enugu State.

Table 7: t-test of the difference between the mean ratings of male and female lecturers on the extent to which they utilize adaptive learning platforms in teaching computer science education courses in public universities in Enugu State.

	N	$\bar{X}$	SD	Df	t(cal)	t. value (.05)	Decision
Male	11	2.89	0.29	17	0.99	1.96	Do not reject
Female	8	3.00	0.14				

From Table 7 above, it can be seen that the t-calculated of 0.99 is less than the critical value of the t-test which is 1.96 at 17 degrees of freedom. Therefore, the null hypothesis is not rejected. This reveals that there is no significant difference between the mean ratings of male and female lecturers on the extent to which they utilize adaptive learning platforms in teaching computer science education courses in public universities in Enugu State.

Table 8: t-test of the difference between the mean ratings of male and female lecturers on the extent to which they utilize AI-Powered Tutoring Systems in teaching computer science education courses in public universities in Enugu State.

	N	$\bar{X}$	SD	Df	t(cal)	t. value (.05)	Decision
Male	11	1.85	0.22	17	1.98	1.96	Reject Ho_3
Female	8	1.81	0.14				

Table 8 shows that the t-calculated of 1.98 is greater than the critical value of the t-test which is 1.96 at 17 degree of freedom. Therefore, the null hypothesis is rejected. Hence, there is a significant difference between the mean ratings of male and female lecturers on the extent to which they utilize AI-Powered Tutoring Systems in computer science education courses in public universities in Enugu State.

Table 9: t-test of the difference between the mean ratings of male and female lecturers on the extent to which they utilize automated writing assessment in teaching computer science education courses in public universities in Enugu State.

	N	$\bar{X}$	SD	Df	t(cal)	t. value (.05)	Decision
Male	11	3.15	0.17	17	1.03	1.96	Do not reject
Female	8	3.24	0.05				

Table 9 shows that the t-calculated of 1.03 is less than the critical value of the t-test which is 1.96 at 17 of degree of freedom. Therefore, the null hypothesis is not rejected. Hence, there is no significant difference between the mean ratings of male and female lecturers on the extent to which they utilize automated writing assessment in teaching computer science education courses in public universities in Enugu State.

Table 10: t-test of the difference between the mean ratings of male and female lecturers on the extent to which they utilize natural language processing tool in teaching computer science education courses in public universities in Enugu State.

	N	$\bar{X}$	SD	Df	t(cal)	t. value (.05)	Decision
Male	11	2.98	0.81	17	0.71	1.96	Do not reject
Female	8	2.70	0.64				

Table 10 shows that t-calculated of 0.71 is less than the critical value of the t-test which is 1.96 at 17 degree of freedom. Therefore, the null hypothesis is not rejected. Hence, there is no significant difference between the mean ratings of male and female

lecturers on the extent to which they utilize natural language processing tool in teaching computer science education courses in public universities in Enugu.

Discussion of Findings

The findings of the study revealed that lecturers in public universities in Enugu State utilize chat bots, adaptive learning platforms, automated writing assessment and natural language processing tools to a great extent, but utilize the AI powered tutoring systems to a low extent; in teaching computer science education courses. These findings are contrary to the reports of Ukeh and Anih (2024), Thomas and Gambari (2021) and Tella (2022) that the utilization of AI-tools in teaching, was to a low extent; even in some federal universities (Ukeh and Anih, 2024).

Indeed, the benefits of the utilization of AI based tools in teaching include
That lecturers can leverage AI features in providing targeted instruction and resources, addressing students' strengths and weaknesses and facilitating their effectiveness of lecture delivery. Moreover, the utilization of automated writing assessment in teaching computer science education courses enable the effective handling of large volume of students' assessments and thus reduces workload for lecturers (Attali and Burstein, 2016).

On the other hand, accessing learning materials, instant feedback, interactive learning experiences, assistance for homework and revision; language learning support and support for Special Needs Students in CSE require chat bots (Brown and Jones, 2020). The lecturers also benefit from utilization of education chatbots as they can leverage the vast data generated through the tool on students' progress. As such, chat bots enables easy identification of areas of improvement and refining of lecturers teaching strategies.

Apart from the above stated benefits of the use of education chatbots, AI based tools are faced with challenges and limitations including: technical issues (Kim and Kim,2021); lack of personalization (Chen, Wang and Huang, 2020); privacy and data security concerns (Zhang and Sun, 2019); and integration with pedagogy (Liu, Han, Zhang and Yang, 2022).

Meanwhile the result of the tested null hypothesis showed that there is no statistically significant difference in the ratings of male and female lecturers' utilization of education chatbots based on gender. Due to the fact that gender has no influence on the extent of this utilization, the null hypothesis was not rejected.

Moreover, lecturers' high utilization of adaptive learning platforms in teaching CSE, runs contrary to the report of Ukeh and Anih (2024). This is as these researchers state that lecturers in the Federal University Otu-Oke in Bayelsa State utilize Adaptive Learning Platforms (ALP) to a very low extent. This difference in finding is surprising because it contradicts the hitherto impression that a Federal University would at all-

time be a reference point in promoting digital technology-based approaches to teaching and learning.

Conclusion

This study examined utilization of artificial intelligence-based tools in teaching computer science education courses by lecturers in public Universities in Enugu State. The findings of the study revealed that lecturers utilize the educational chatbots, adaptive learning platforms, automated learning assessment and natural language processing tools, to a High Extent. They utilize AI-Powered Tutoring System to a low extent. Whereas significant differences do not exist between the mean ratings of male and female lecturers in utilization of chatbots, adoptive learning platforms, automated writing assessment and natural language processing tools; significant difference exist between the lecturers in their utilization of AI-Powered Tutoring System, based on gender.

Recommendations

Based on the findings, conclusion and implication of the study, the following recommendations are made:

1. University lecturers should intensify their efforts in the use AI tools, to enhance effective teaching, students' motivation and interest in learning computer Science Education.
2. University lecturers and education administrators should utilize AI programmes and AI-based tools while organizing symposia, seminars and workshops for University students. This is to enable the students acquire personal, interpersonal, communication, problem-solving and thought process skills that would develop their social, mental, psychological and emotional abilities and enhance their regular application of ICT based learning.
3. Education and curriculum planners at Federal, State and Local Government Areas GAs levels should mount sensitization campaigns through billboard, print and electronic media; encouraging lecturers to take active participation in the learning of contemporary modern IT.

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