AWARENESS AND UTILIZATION OF ARTIFICIAL INTELLIGENCE TOOLS FOR LEARNING OF BIOLOGY IN SENIOR SECONDARY SCHOOLS IN ENUGU NORTH LOCAL GOVERNMENT AREA OF ENUGU STATE, NIGERIA

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DOI: https://doi.org/10.5281/zenodo.13736271

Abstract: This study explored the awareness and utilization of artificial intelligence (AI) tools among secondary school students in Enugu North Local Government Area, Enugu State, Nigeria, specifically for learning Biology. Guided by two null hypotheses and four research questions, the study employed a descriptive survey design. The population consisted of 1,780 Senior Secondary School Class II (SS 2) students from nine secondary schools, with a purposive sample of 300 students (180 females, 120 males) from three coeducational schools. Data was collected using the "Awareness and Utilization of Artificial Intelligence Tools for Learning of Biology (AUAITLB)" instrument, validated by three education specialists, and with a reliability coefficient of 0.78. Descriptive statistics and t-test analysis revealed no significant gender differences in AI awareness and utilization. However, the study found that students underutilize AI tools like educational apps, virtual reality (VR), and augmented reality (AR). Recommendations include increased AI sensitization and greater use of AI tools by Biology teachers.

Keywords: Artificial intelligence, Biology, awareness, utilization, gender

Introduction

Education is the key to a person's overall growth. The process of imparting knowledge or skills from one person (the teacher) to another (the learner) through instruction is called education. The introduction of cutting-edge technologies has caused a constant change in this method of instruction. The ways that teaching and learning are conducted are impacted by the advent of new technologies. The efficiency and effectiveness of the learning outcome are determined by the content and method of instruction. The Fourth Industrial Revolution has brought with it the development of artificial intelligence technology, which is now an essential part of contemporary life. Artificial intelligence is being utilized more and more in many different fields, and it is actively used in our daily lives.

Consequently, it is now essential for humans and artificial intelligence technologies to coexist. Artificial intelligence's (AI) explosive growth has completely changed education. The application of AI in education is becoming more and clearer. AI technology is widely applied in many different fields and is constantly being updated (Pannu, 2015). According to the researcher, artificial intelligence is a machine's capacity to exhibit traits that humans share, like creativity, learning, reasoning, and planning. "Systems that exhibit intelligent behavior by

analyzing their surrounding and executing actions with some degree of autonomy to attain specific objectives" is how Davies et al (2021) define artificial intelligence. Wang (2020) defines artificial intelligence (AI) as a system's capacity to accurately interpret outside data, learn from that data, and apply that learning to accomplish particular tasks and goals through adaptable change. Artificial intelligence also can be described as a term often used to describe machines/computers that mimic" cognitive" functions that associate with the human mind, such as "learning", and "problem-solving". Another way to define artificial intelligence is as a term that's frequently used to describe devices/computers that simulate "cognitive" processes associated with human minds, like "learning" and "problem-solving." Additionally, Okoli (2023) defines artificial intelligence as a technology that enables a computer machine to mimic human thought and behaviour.

The foundation of artificial intelligence (AI) is the idea that human intelligence can be described in a way that makes it simple for a machine to replicate and carry out simple to complex tasks. It is undeniable that the most recent developments in knowledge reasoning, machine learning, and deep learning are ushering in the era of intelligence ((Khanzode and Sarode 2020)). In the modern era, educational resources are becoming more readily available and more adaptable modes, patterns, and multi-variant intelligence systems can aid teaching. According to Wang et al. (2018), there will be significant changes in the educational field over the next ten years as a result of AI applications.

Artificial intelligence (Al) solutions and their integration into formal education, especially in the classroom, have garnered significant attention recently as a potential solution to almost all educational "problems" (Mahajan & Waghimare 2020). The use of AI tools in biology classes in secondary schools is as a result of educators realizing more and more the advantages of incorporating technology into the classroom, particularly in light of recent advancements in technology. Thanks to this development, AI tools are now more widely available, reasonably priced, and useful in a variety of fields, including biology education.

Biology is a natural science that studies living things and how they interact with non-living elements of their surroundings, according to Enebechi (2023). Biology is a challenging subject that necessitates a deep understanding of the relationships that exist between living things and their surroundings. AI tools have the potential to improve students' comprehension of these ideas. In secondary schools, Biology is taught using a plethora of artificial intelligence tools. Virtual labs, adaptive learning platforms, educational apps, intelligent tutoring systems, data analysis and visualization tools, natural language processing (NLP) tools, virtual reality (VR) and augmented reality (AR), and concept mapping tools are just a few of these AI tools. Reiss (2021) asserts that the use of AI tools has altered the paradigm of education, as traditional approaches to teaching biology frequently depended on lectures, textbooks, and physical models. Algorithms for machine learning, for instance, can examine data on student performance to pinpoint areas in which certain students might be having difficulty. Personalized learning plans that concentrate on the particular areas where every student needs to improve can then be created by educators using this information (Hansen et al., 2015). Additionally, student writing can be examined using natural language processing techniques, which can then be used to provide feedback on grammar, syntax, and other language-related issues (Graesser et al., 2014). Moreover, interactive simulations or visualizations of intricate biological systems are being made using AI-powered virtual reality (VR) and augmented reality (AR) technologies, providing a more intuitive and immersive understanding of the subject (Chang et al., 2018).

In a similar vein, interactive visual aids can facilitate students' understanding of challenging ideas like molecular interactions and protein folding (Marx, 2013). AI-powered platforms can offer interactive simulations, virtual labs, and adaptive learning modules that let students investigate intricate biological concepts practically (Nathaniel et al., 2023). AI tools can fill in resource gaps, particularly for educational institutions with little access to specialized equipment or laboratory space. AI tools can help biology teachers by automating administrative tasks, providing real-time feedback on student progress, and making suggestions for instructional improvement. They can also help students develop skills that are increasingly valuable in the modern workforce by allowing them to participate in virtual experiments and observe phenomena that may not be possible in a traditional classroom setting. For example, students can prepare for careers in biotechnology, pharmaceuticals, or biomedical research by becoming familiar with machine learning algorithms or bioinformatics tools. This frees up teachers to concentrate more on leading conversations, assisting students with their questions, and offering personalized support.

Numerous fields, including biology, computer science, and data science, are impacted by artificial intelligence. Students can explore interdisciplinary connections and gain a comprehensive understanding of how various fields intersect to solve complex problems by incorporating AI tools into biology education. The use of AI tools in biology classes in secondary schools, however, signals a change in the direction of more dynamic, interactive, and individualized teaching methods. This change has the potential to improve students' comprehension, engagement, and preparedness for challenges in the life sciences in the future.

Artificial intelligence (AI) in education gives teachers access to important data that they might not otherwise have; examples of this data include tracking each student's progress and comprehension of different subjects. On the other hand, Davenport and Ronanki (2018) believes that the introduction of artificial intelligence into education could displace teachers in the classroom, stifle students' innate knowledge, and impair their ability to think critically. The majorities of researchers were concerned that integrating AI into the classroom would decrease student interaction and consequently lead to communication barriers. Additionally, they think that it will make students less emotionally intelligent and more likely to be lazy (Chang and Lu, 2019).

Furthermore, the potential for transforming the pedagogical landscape exists with the incorporation of Artificial Intelligence (AI) into education. Ryu and Han (2018) delineated two possible paths—evolutionary and revolutionary—that academic institutions could pursue in order to leverage artificial intelligence within the next twenty-five years. The capabilities of AI, such as its aptitude for evaluating vast amounts of data, customizing learning experiences, and improving assessment procedures, herald a profound revolution in the field of education. According to Bharati, (2017), artificial intelligence (AI) orchestrates innovation in the field of educational planning, ushering in an era of intelligent learning.

Reviewing the literature has revealed that there was little agreement among researchers about how much awareness and use of AI tools for teaching and learning. Lackner (2019) found that many biology instructors feel ill-equipped to teach with AI tools, due to lack of training and resources. Similarly, Mahajan and Waghmare (2020) reported that while there is growing interest in AI tools among biology students, many students feel unsure about how to use these tools effectively. Davenport and Ronanki, 2018) however expressed surprise over the findings that most biology students have not received training on how to use AI tools in Biology Education despite the increasing emphasis on the importance of AI and data science skills in the current job market. Studies carried out by (Alimi et al., 2021), showed that there is no discernible difference in university students' awareness of the

use of artificial intelligence for learning between male and female students.

Most students are unaware that artificial intelligence can be used for learning. Research on the degree of AI awareness among engineering faculty students (Dergunova et al., 2022) found that students had a good degree of AI awareness. Owolabi et al., 2022) conducted a second study on Nigeria Polytechnic students' awareness of and readiness for implementing AI in libraries. Results showed that although the students acknowledged that they needed to have a basic understanding of computers to be more relevant in this day and age, they were aware that artificial intelligence (AI) was used in library operations and had learned about it during library orientation programs. According to a study by Kuo et al. (2019), although students' opinions of AI-supported learning were generally positive, there were also worries about the tools' accuracy and dependability as well as the possibility that they could eventually replace human teachers. These results align with earlier studies that looked at the application of AI tools. in education.

As far as the researchers are aware and as per the literature that is currently accessible, there isn't much information on how gender variations in secondary school settings, particularly in Enugu State, affect students' awareness and use of AI. Gender according to Omotayo (2014) is a social connotation that has sound psychological background and it is used to specify attributes of both males and females. The arbitrary assigning roles and expectations to different sex (male and female) within society has given rise to such misconceptions that made some people perceive science as a masculine and male domain only. The problem is even compounded by the fact that most science educators give a masculine outlook to science subjects such as physics and chemistry, encouraging females to enroll in biology, agricultural science, and home economics which they consider to be more femalefriendly science (Nnorom, 2015). According to Adeneye and Adelege (2011) males and females are fond of having different academic interests, choice of subjects, and co-curricular activities and also perform differently in their school tests and examination. Girls can spend more time reading and doing homework than boys who would rather spend their time in the virtual world contributing to their better performances. Researchers also reveal that, despite all of AI's advantages, teachers are hesitant to employ it in the classroom (Ismail, 2022; Yungei & Han, 2022). Students are probably unaware of some of the AI learning tools if teachers are hesitant to use them in the classroom.

Therefore, the purpose of this study is to determine how much knowledge and use secondary school students in Enugu State's Enugu North Local Government Area have of artificial intelligence (AI) tools for biology instruction. Research has also revealed that, since the COVID-19 pandemic, several African nations, including South Africa, Ghana, and Kenya, have incorporated artificial intelligence applications into their school systems. This study is necessary because Enugu state can perform better if South Africa, Ghana, and Kenya can.

According to the researcher, awareness is the state or capacity of perceiving, feeling, or being cognizant of things, events, or sensory patterns. When information is directly available to guide a wide range of behavioral actions, it can also be understood as a state in which a subject (teachers) is aware of that information (AI use in teaching and learning). In terms of artificial intelligence in education, awareness is divided into three categories. The first is "education for understanding Artificial Intelligence (AI)," which focuses on acquiring the skills necessary to comprehend and use AI. The second component is "AI expert training," which entails educating professionals who create AI applications and educators who employ them in the classroom. The final category is "education using AI," which covers the application of AI to improve instruction across the board. For AI to be used in education effectively, these three components must be properly integrated.

On the other hand, utilization refers to the extent or effectiveness with which something is employed. The efficient use of technological tools to complete tasks or find solutions to issues is referred to as technology utilization. Utilization quantifies the effectiveness with which something is employed or used about its potential or capacity.

Statement of the problem

Since the emergence of Artificial Intelligence (AI), some learned individuals have identified with it for problemsolving. The integration of AI tools in education has the potential to revolutionize learning experiences, particularly in subjects like biology. However, there is a gap in understanding the level of awareness and extent of utilization of AI tools for learning biology among secondary school students in Enugu North Local Government Area of Enugu state. Therefore, this study seeks to establish the level of awareness of AI tools for learning biology among secondary school students in the Enugu North local government Area. Could there be any disparities in the awareness and utilization of AI tools for learning biology caused by demographic factors like gender? Addressing these questions will provide insight into the current state of AI integration in biology education and inform strategies for improving its adoption among secondary school students in Enugu North Local Government Area of Enugu State, hence the need for this study.

Purpose of the study

The study examined awareness and utilization of artificial intelligence tools for learning of biology by students in senior secondary school in the Enugu North Local Government Area. In particular, the research aimed to:

1. Determine the percentages of male and female students' level of awareness on AI tools used in learning of Biology.

- 2. Ascertain the extent of utilization of AI tools by male and female students in learning of biology.
- 3. Determine the challenges encountered with the use of AI tools in learning biology.
- 4. Identify measures for improving the utilization of AI tools in learning biology.

Research Questions

For the study, the researchers developed the following research questions:

1. What are the percentages of male and female students' level of awareness of AI tools used in learning Biology?

- 2. What is the extent of utilization of AI tools by male and female students in the learning of Biology?
- 3. What are the challenges encountered with utilizing AI tools in Biology learning?
- 4. What steps are being taken to enhance the use of AI tools in Biology education?

Research Hypothesis

This hypothesis was developed by the researchers to direct the investigation.

HO₁: There is no discernible difference between male and female biology students' mean ratings on the utilization of AI tools to learn the subject.

Methodology

The study used a descriptive survey research design and was quantitative. Nworgu (2015) states that samples of various subgroups of a population are used in descriptive survey research design to examine similarities or differences between them at any given time. In the Enugu North Local Government Area of Enugu State, public senior secondary schools were used. A total of 1780 SS 2 students from the nine public secondary schools in the Enugu North Local Government Area made up the study's population. The three coeducational schools in the area were sampled using a purposive sampling technique. 40 males and 60 females were sampled using a balloting

simple random technique in each of the three co-educational that were examined. As a result, there were 180 females and 120 males in the sample size of 300.

The "Awareness and Utilization of Artificial Intelligence Tools for Learning of Biology Questionnaire (AUAITLBQ)" served as the data collection tool. It is divided into four clusters, each of which had items that sought data intended to address the study's research questions. A checklist called Cluster 1 is used to determine how much knowledge there is about AI tools used in biology education. A 4-point response option was used to elicit the necessary information for clusters 2, 3, and 4. Three education specialists validated the (AUAITLB). Cronbach Alpha was used to determine the instrument's reliability, and the result was a coefficient value of 0.78. The frequency and percentages of respondents that highlighted their knowledge or lack thereof of each of the recognized AI tools used in biology education were used to address research question 1. Research questions 2, 3, and 4 were addressed using the mean. Concerning research question 1, an item was considered not aware if the percentage of respondents was less than 50% whereas a question that received more than 50% of responses was considered aware. The questionnaire items for research questions 2-4 were rated using four-point response options: Strongly Agree/very high extent (3.50-4.49), high extent (2.50-3.49), Disagree/low extent (1.50-2.49), and Strongly Disagree/very low extent (0.00-1.49). Items with a mean response between 0.00 and 2.49 were agreed/used.

Results

The data collected with AUAITLB were summarized, analyzed, and then presented as follows:

Research Question 1:

What are the percentages of male and female students' level of awareness on AI tools used in learning of Biology? Table 1: Response on percentages of male and female students' level of awareness on AI tools used in learning Biology?

S/N	ITEMS		GENDER		TOTAL
	AI tools used in learning biology		FEMALE	MALE	
1	Virtual laboratory	Aware	115 (60.2%)	76 (39.8%)	191(100%)
		Not aware	65 (59.6%)	44 (40.4%)	109 (100%)
2	Adaptive learning platform	Aware	97 (61.4%)	61 (38.6%)	158 (100%)
		Not aware	83 (58.5%)	59 (41.5%)	142 (100%)
3	Education Apps	Aware	102 (63%)	60 (37%)	162 (100%)
		Not aware	78 (56.5%)	60 (43.5%)	138 (100%)
4	Intelligent tutoring systems	Aware	115 (63.9%)	65 (36.1%)	180 (100%)
		Not aware	65 (54.2%)	55 (45.8%)	120 (100%)
5	Data analysis and visualization	Aware	114 (60.6%)	74 (39.4%)	188 (100%
	tools	Not aware	65 959.6%)	44 (40.4%)	109 (100%)
6	Natural language processing (NLP)	Aware	97 (61.4%)	61 (38.6%)	158 (100%)
	tools	Not aware	83 (58.5%)	59 (41.5%)	142 (100%)
7	Virtual reality (VR) and	Aware	102 (63.0%)	60 (37%)	162 (100%)
	Augmented reality (AR)	Not aware	78 (56.5%)	60 (43.5%)	138 (100%)
8	Concept mapping tools	Aware	115 (63.9%)	65 (36.1%)	180 (100%)
		Not aware	65 (54.2%)	55 (45.8%)	120 (100%)
9	Machine learning Algorithm	Aware	120 (61.9%)	74 (38.1%)	194 (100%)
		Not aware	60 (56.6%)	46 (43.4%)	106 (100%)

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Results in Table 1 showed the percentage of male and female students' awareness of AI tools used in learning biology. Items 1-9 indicated that the females are more aware of AI tools used in learning biology since the percentage of respondents was more than 50% set as a benchmark. The males indicated that they were not aware of AI tools used in learning biology since their percentage of respondents was less than 50%.

Research Question 2:

What are the extents of the utilization of AI tools by male and female students in the learning of Biology

Table 2: Mean responses of male and female biology students on the extent of utilization of the AI tools used in learning biology

	ITEMS	FEM	ALE – 18	80	MALE – 120				
S/No	extent of utilization of the AI tools used in learnin biology		SD	Dec.	x -	SD	Dec.		
10	Virtual laboratory	1.36	.482	very extent	low1.37	.484	Very extent	low	
11	Adaptive learning platform		.500	Very extent	low1.49	502	Very extent	low	
12	Educational Apps	1.43	.497	Very extent	low1.50	.502	low ext	low extent	
13	Intelligent tutoring systems	1.36	.482	Very extent	low1.46	.500	Very extent	low	
14	Data analysis and visualization tools	1.38	.520	Very extent	low1.42	.588	Very extent	low	
15	Natural language processing (NLP) tools	1.46	.500	Very extent	low1.49	.502	Very extent	low	
16	Virtual reality (VR) and Augmented reality (AR)	1.43	.497	Very extent	low1.50	.502	low ext	low extent	
17	Concept mapping tools	1.36	.482	Very extent	low1.46	.500	Very extent	low	
18	Machine Learning Algorithm	1.33	.473	Very extent	low1.38	.488	Very extent	low	
	Grand Mean/ Standard Deviation	0.49	Very extent	low 1.45	5 0.5	0			

The result showed that out of the 9 items identified, only items 12 and 16 are slightly above the mean range of 0.00-1.49. This indicates that males under-utilize to a low extent educational Apps and virtual reality (VR) and Augmented reality (AR) but utilize them to a very low extent. In items 10, 11, 13, 14,

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15, 17, and 18 both males and females utilize to a very low extent the listed AI tools. This is because their mean score is below 1.50 set as a benchmark.

Research Question 3:

What are the challenges encountered with utilizing AI tools in Biology learning?

 Table 3: Mean responses of male and female biology students on the challenges encountered with the use of AI tools in learning Biology

	ITEMS	FEMA	FEMALE – 180			MALE – 120		
S/No	challenges encountered with the use of AI to in learning biology	oolsx [–]	SD	Dec.	x ⁻	SD Dec.		
19	Data privacy and security	3.30	.832	Agree	3.50 .7	745 Agree		
20	Ethical implications of AI decision making	3.27	.809	Agree	3.53	767 Agree		
21	Interpretability and transparency of algorithms	AI3.37	.716	Agree	3.62 .5	582 Agree		
22	Integration with existing laboratory techniq and workflows	ues3.41	.546	Agree	3.57 .5	530 Agree		
23	Interpretability of results	3.54	.646	Agree	3.72 .5	568 Agree		
24	Human expertise and collaboration	3.32	.698	Agree	3.15 .7	752 Agree		
25	Data quality and availability	3.57	.579	Agree	3.53 .5	579 Agree		
	Grand Mean/ Standard Deviation							

Results presented in Table 3 revealed that item 19, 20, 21, 22, 23, 24 and 25 with mean value of 3.27 minimum and 3.72 maximum for both females and males respectively are perceived as challenges encountered with the use of AI tools in learning biology

Research Question 4:

What steps are being taken to enhance the use of AI tools in biology education? Table 4: Mean responses of male and female students on the measures for improving the utilization of AI tools in learning biology

	ITEMS	FEMA	LE – 18	0	MALE – 120)
S/No	Measures for improving the utilizat of AI tools in learning biology	tionx [–]	SD	Dec.	x [–] SD	Dec.
26	Development of AI-driven education platforms	onal3.51	.647	Agree	3.55 .548	Agree
27	Interactive simulations and vir laboratories	tual3.42	.740	Agree	3.33 .747	Agree
28	Natural language processing personalized feedback	for3.74	.511	Agree	3.69 .547	Agree
29	Machine learning-based con recommendation systems	tent3.56	.541	Agree	3.33 .613	Agree
30	Provide more training and support enhance students experience with AI to	to3.45 ols	.695	Agree	3.46 .634	Agree
31	AI-driven insights for educators	3.22	.809	Agree	3.21 .798	Agree
32	Gamification with AI	3.43	.550	Agree	3.53 .517	Agree
33	Collaborative AI tools for group projec	ts 3.54	.563	Agree	3.72 .553	Agree
34	Accessibility and inclusivity	3.63	.589	Agree	3.73 .546	Agree
35	Continuous improvement thro feedback	ugh3.30	.776	Agree	3.42 .668	Agree
36	Teacher professional Development	3.71	.457	Agree	3.88 .332	Agree
37	Curriculum integration	3.60	.613	Agree	3.77 .561	Agree
38	Student engagement and collaboration	3.65	.501	Agree	3.83 .461	Agree
39	Ongoing support and evaluation	3.62	.486	Agree	3.83 .374	Agree
	Grand Mean/ Standard Deviation					

Table 4 showed that items 26-39 as measures for improving the utilization of AI tools in learning biology. The items have minimum mean rating of 3.22 for the females and 3.21 for the males

Research Hypothesis

This hypothesis was developed by the researchers to direct the investigation.

HO₁: There is no significance difference between male and female biology students' mean ratings of the awareness of AI tools used in learning biology.

 Table 5: Summary of t-test Analysis on the mean rating scores of male and female Biology students on the awareness of AI tools used in learning biology

Variables	Ν	x –	S	df	F	Level of	Decision
						Sig.	
Female Students	180	1.39	.295				
				298	.197	.128	NS
Male Students	120	1.45	.303				

Key: N = Sample Size, x = Mean, S = Standard Deviation, df = Degree of freedom, Dec = Decision, NS = Not Significant

Data in Table 5 on the mean rating scores of male and female Biology students on the awareness of AI tools used in learning biology has F-value of .197 with associated probability of .128, which is greater than.05 level of significance. The null hypothesis of no significant difference should be retained. This implies that there is no significant difference in the mean rating scores of male and female Biology students on the awareness of AI tools used in learning biology.

HO₂: There is no discernible difference between male and female biology students' mean ratings of how well they use AI tools for learning biology

Table 6: Summary of t-test Analysis on the mean rating scores of male and female Biology students on their utilization of AI tools used in learning biology

		-						
Variables	Ν	Mean	SD	df	F	Level Sig.	of Decision	
Female Students	180	2.24	.849					
				298	.181	.671	NS	
Male Students	120	2.11	.884					

Key: N = Sample Size, x = Mean, S = Standard Deviation, df = Degree of freedom, Dec = Decision, NS = Not Significant

Data in Table 5 on the mean rating scores of male and female Biology students on the utilization of AI tools used in learning biology has F-value of .181 with associated probability of .671, which is greater than .05 level of significance. The null hypothesis of no significant difference should be retained. This implies that there is no significant difference in the mean rating scores of male and female Biology students on the utilization of AI tools used in learning biology.

Discussion of the findings

The findings of the study revealed lack of awareness of Artificial Intelligence tools for learning biology in secondary schools in Enugu North Local Government Area of Enugu state. This finding is in agreement with Studies carried out by (Alimi et al., 2021), who showed that there is no discernible difference in university students' awareness of the use of artificial intelligence for learning between male and female students. The majority of students are unaware that artificial intelligence can be used for learning. Researchers also reveal that, despite all of AI's advantages, teachers are hesitant to employ it in the classroom (Ismail, 2022; Yungei & Han, 2022). It's probable that students are unaware of some of the AI learning tools if teachers are hesitant to use them in the classroom.

The study also showed that males under-utilize to a low extent educational Apps and virtual reality (VR) and Augmented reality (AR) but utilize to a very low extent other AI tools for learning biology while the females utilize to a very low extent other AI tools for learning Biology. According to Adeneye and Adelege (2011) males and females are fond to have different academic interest, choice of subjects, extracurricular activities and as well perform differently in their school tests and examination. The girls have ability to spend more time reading and doing homework than boys who would rather spend their time in virtual world contribute to their better performances.

In addition, the respondents agreed to the seven challenges encountered with the use of AI tools in learning biology in Enugu North L. G. A. This is in agreement with Kuo et al. (2019), whose finding revealed that although students' opinions of AI-supported learning were generally positive, there were also worries about the tools' accuracy and dependability as well as the possibility that they could eventually replace human teachers. These results align with earlier studies that looked at the application of AI tools.

However, the findings of the study equally agreed with all the solutions/ measures for improving the utilization of AI tools in learning biology. The t-test Analysis on the mean rating scores of male and female Biology students on the awareness of AI tools used in learning biology has F-value of .197 with associated probability of .128, which is greater than.05 level of significance. Therefore the null hypothesis of no significant difference should be retained. This implies that there is no significant difference in the mean rating scores of male and female Biology students on the awareness of AI tools used in learning biology. Similarly, t-test Analysis on the mean rating scores of male and female Biology students on their utilization of AI tools used in learning biology shows F-value of .181 with associated probability of .671, which is greater than.05 level of significance. The null hypothesis of no significant difference in the mean rating scores of male and female Biology students on their utilization of AI tools used in learning biology. The t-test Analysis on the mean rating scores of male and female Biology students on their utilization of AI tools used in learning biology shows F-value of .181 with associated probability of .671, which is greater than.05 level of significance. The null hypothesis of no significant difference should be retained. This implies that there is no significant difference in the mean rating scores of male and female Biology students on the utilization of AI tools used in learning biology. **Conclusion and Recommendations**

Artificial intelligence is the order of the current century. With technology making new ways and breaking new grounds, it is very important to be aware of all the benefits that can come with it so as to look into the downside as well. The general findings of this study show that there is lack of awareness of Artificial Intelligence tools for learning biology in secondary schools in Enugu North Local Government Area of Enugu state. However, males under-utilize to a low extent some AI tools like: educational Apps and virtual reality (VR) and Augmented reality (AR) but utilize to a very low extent other AI tools for learning biology while the females do not utilize any of the AI tools for learning Biology. In addition, there is no significant difference in the mean rating scores of male and female Biology students on the awareness of AI tools used in learning biology.

Furthermore, there is no significant difference in the mean rating scores of male and female Biology students on the utilization of AI tools used in learning biology.

Based on the above conclusions, the researchers made the following recommendations:

1. Schools should carry out sensitization seminars on the awareness of Artificial Intelligence tools in Biology and their utilization so as to foster better Knowledge of AI among students.

2. Biology teachers should use more AI tools in preparing and administering their lessons in classrooms so as to encourage students towards the use of Artificial Intelligence.

3. There should be periodic workshops and training to motivate both teachers' and students to embrace innovations.

4. Educators should consider incorporating AI tools into their teaching methods to enhance students' learning experiences and understanding of complex biology concepts.

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