Harnessing Artificial Intelligence for 21st Century Skills Acquisition and Undergraduate Students' Preparation for Sustainable Lifelong Learning in Nigeria.

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ABSTRACT

Academic knowledge content alone is not sufficient to prepare students for the world of work. With increasing global competitiveness, undergraduates need energetic drive for skills that are challenging and inspiring to thrive in today's world. The study examined harnessing artificial intelligence for 21st century skills acquisition and undergraduate students' preparation for sustainable lifelong learning in Nigeria. Descriptive survey design was adopted for the study, four research questions and four hypotheses guided the study. Data was collected with the aid of a structured questionnaire "Harnessing AI for 21st Century Skills Acquisition and Sustainable Lifelong Learning". The instrument was standardized by three experts and a reliability coefficient of 0.81 was obtained. 250 (99 males and 151 females) respondents used for the study were selected using multi-stage sampling procedure. Analysis of data was done using mean, standard deviation and Independent t-test. Findings show that undergraduate students' awareness of available AI technology is low. In addition, it was observed that undergraduate students' preparation with learning skills, exposure to literacy skills and acquisition of life skills for sustainable lifelong learning harnessing AI technology were moderate. Findings further show that males have more awareness of AI technology and preparation in 21st century skills than females. Based on the findings of the study, it was recommended among others, that there should be concerted effort by government and universities to organize awareness and training programmes on new and emerging technologies, especially AI in teaching and learning so as to keep students abreast of, raise awareness about and improve skills and knowledge in the utilization of AI technologies. That 21st century skills be adequately integrated into the curriculum to prepare science education undergraduate students for the world of work and sustainable lifelong learning.

Keywords: Harnessing Artificial Intelligence (AI), 21st Century Skills Acquisition, Undergraduate students' preparation, Sustainable lifelong learning,

BACKGROUND

Today's modern learner is a complex, energetic and technology driven individual that needs to be challenged and inspired in his learning. He needs to be his own boss, collaborate and incorporate technology which he loves into classroom experiences as well as work with peers. It is increasingly clear that theoretical understanding alone is not enough to prepare students for lifelong learning in order to thrive

in the world of work. With increasing global competitiveness and emerging trends, learners' curiosities are spurred towards being independent and self-reliant. The 21st Century world is moving at a speed beyond imagination. From technology, to business, the health sector to military organization, everything is getting updated with the emergent of technologies. Education is an instrument for the emancipation of the individual and the society, to this end, there is need for a functional and lifelong education for the acquisition of appropriate skills and the development of mental, physical, as well as social abilities and competencies to equip the learner to live in, and contribute to the development of the society.

In 2019, UNESCO published the Beijing Consensus on artificial intelligence (AI) and education, on how best to harness AI technologies for achieving Education 2030 agenda. The consensus states that the systematic integration of AI in education has the potential of addressing some of the biggest challenges in education today, innovate teaching and learning practices and ultimately accelerate the progress towards Sustainable Development Goal-4 (Shiohira & Keevy, 2019). Sustainable development goal-4 (SDG-4) focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all by the development of skills to ensure that individuals can continue learning throughout their lives, as well as address inequality and gender disparities in education. The consensus called for support to use AI technologies for education and training. Use AI tools to offer lifelong education which enables personalized learning anytime, anywhere for anyone. Ensures that AI technologies are used to empower teachers and develop appropriate capacity building programs for teachers to work alongside AI systems. Prepare the next generation of existing workforce with values and skills for life and work most relevant in this AI and 21st century skills era, as well as promote equitable use of AI irrespective of the gender (Dhara et al., 2022).

21st Century skills are essential for individuals to thrive in the modern workplace and they are becoming increasingly important as technology, particularly AI continue to advance. AI impacts on the types of skills that are most valued in the 21st century as it automates routine tasks, there is increasing demand for skills such as critical thinking, problem-solving, creativity, emotional intelligence and adaptability (United Nation, 2021).

CONCEPTUAL CONSIDERATIONS

Artificial Intelligence in Education

AI is human intelligence or behaviour demonstrated by machines, an innovative technical framework that encompasses the creation of computer systems with the ability to execute activities that usually need human intellect (Aina et al., 2023), in practice, AI is a computer programme-software (IDRA, 2018). Areas in which AI can transform teaching and learning include, but not limited to personalized learning, adaptive learning, special needs education, bilingual education, gamification, ideation, virtual tutor and immersive learning. According to (Afongughe et al., (2021); Aina, et al., (2023); Chatterjee et al (2022) other usefulness of AI technologies include:

Personalized /Adaptive Platforms: This creates educational contents based on individual students' performance and learning style example Knewton. It also creates personalized mathematics lessons tailored to each students' level and learning pace, example Dreambox. AI is used to adapt to learners' proficiency in language learning, examples duolingo, as well as personalize study materials and quizzes based on the learners' learning ability and memory retention.

Content creation tools: through a software, AI helps learners to generate ideas, writing, designing and creating content such as marketing, social media, blogging, generating headlines, writing articles, designing graphics and producing videos.

Virtual assistants like google assistant helps in home work, answer questions, assist educational task.

Smartboard provides real feedback interactive lessons, Chatbots answers questions, offer suggestions, guide users through learning materials. Using chatGPT device can translate passages quickly and with little need for correction (IDRA, 2023).

Harnessing AI in Education and Skill Acquisition for Sustainable Learning

Integrating AI in learning helps students to develop knowledge and skills needed to pursue careers in technology, data science and other in-demand industries. It is also essential for developing digital literacy, critical thinking skills, personalized learning skills and preparing students for future academic and career success. According to Ibrahim, (2023), using AI can inspire students to generate ideas and solutions, fostering creativity and innovation, which are essential 21st century skills necessary in today's competitive and evolving job market through the following skills:

Personalized Learning: AI powered educational platform can tailor learning experiences to the individual needs and learning style of students allowing them to progress at their own pace and focus on with additional support.

Critical Thinking and Problem Solving: AI can create interactive simulations and scenarios that require students to analyse, evaluate and solve complex problems thus fostering critical thinking and problem-solving skills.

Collaborative and Communication: AI can facilitate collaboration among students by providing virtual environment for group work as well as enabling communication and feedback through chatGPT, chatbots and virtual assistants.

Creativity and Innovation: AI tools can stimulate creativity by providing students resources for generating new ideas, design solutions and experimenting with various forms of expressions, such as through creative writing or visual arts.

Information Literacy: AI can assist students in navigating and evaluating vast amount of information, teaching them how to discern credible sources, validate information and think critically about the content they encounter.

21st Century Skills and Undergraduates Preparation in Science Education

The goals of science teaching in Nigeria are to cultivate inquiry, produce scientists, and bring about technological development as well as development of essential skills, attitude, and stimulation of creativity. With the unprecedented level of unemployment in the labour market and changing job markets, there is an increasing pressure for universities to produce graduates sufficiently exposed to a curriculum that is relevant to the workplace, equipped with related skills, and most importantly skills for survival and lifelong learning. 21st century skills are abilities, learning dispositions and competencies required for success in the 21st century society and workplace.

American Association of Colleges of Teacher Education (AACTE-2010) categorized these skills into three groups;

Learning Skills: They are skills for critical thinking, highly required for problem solving, creativity and innovation, collaboration and communication. These are skills that help students to adapt and improve upon a modern work environment. (Joshua, 2017).

Literacy Skills: These skills are concerned with elements in digital comprehension. They include; Information literacy (helps students understand facts, figures, statistics and data), Media literacy (methods

and outlets in which information is published) and Technology Literacy (machines involved in the information age with examples as computers, cloud programming and mobile devices).

Life Skills (FLIPS): Flexibility (one's ability to adapt to changing circumstances). Leadership (motivating a team or others to accomplish a goal), Initiative (self-starters and persist along the line of activities), Productivity (the drive and ambition needed to sustain lifelong learning. Students' ability to complete work in an appropriate amount of time) and Social skills (this has to do with meeting and networking with others for mutual benefits. Business is done through the connections one person makes with the others around them.

In spite of the great opportunities 21st century skills present, a wide gap still exists in knowledge-deployment of these skills among students in Nigeria's tertiary institutions.

Concept of Sustainable Lifelong Learning

'The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn', Alvin Tofler. Lifelong learning is the capacity to progressively adapt to changing societal needs and contribute effectively towards its growth and sustainable development. The term sustainable lifelong learning refers to the continuous building of skills and acquiring of knowledge during one's life through experiences faced. It is a concept spanning an entire lifetime in a process of transferring experience into knowledge, skills, attitude, values, emotions and beliefs (Kaplan, 2016). Uko and Nnaji (2016) posit that sustainable lifelong learning is a comprehensive and visionary concept which includes formal and non-formal learning extended throughout the life span of an individual to attain the fullest development in personal, social, vocational and professional life. Zuala (2012) submitted that the objectives of lifelong learning include active citizenship, employability, social inclusion and personal fulfilment. These objectives when properly integrated and harnessed through science education teaching will enable learners accomplish life goals for sustenance.

Uko & Nnaji (2016), further stated that promoting lifelong learning in Nigeria requires giving tertiary education a facelift in the areas of infrastructure and institutional facilities, pedagogy, curricula, general administration and manpower. These will enable learners develop needed skills for global competiveness to survive in the 21st century.

LITERATURE REVIEW

Electronic and digital learning play a crucial role in the 21st century education system, this is seen from the creation of numerous platforms such as Google meet, zoom, and introduction of AI into education. However, in Nigeria, over 200 million individuals cannot maximise its full potentials (Adeyemi & Oni, 2021). Harnessing AI technology for 21st century skills acquisition makes education accessible and inclusive by producing support for students with diverse learning needs, providing equal opportunities regardless of gender, ethnicity, income, refugees and even those with disabilities or language barriers, thereby meeting SDG-4. Afonughe et al., (2021) observed that that universities and tertiary institutions are still faced with the traditional approach in teaching and learning, delivering content in the face-to- face setting; making the integration and implementation of AI in educational institution rather scarce and almost not available.

Alimi et al (2021), findings on university students' awareness and use of artificial intelligence for learning in Kwara State show that majority of the students are not aware of artificial intelligence for learning and do not have access to AI. This was attributed to the fact that AI is relatively new to the Nigerian learning environment. Even though development and adoption of new learning and teaching technologies have grown the past thirty years; but adoption in developing countries like Nigeria is relatively low. It was also

found that gender does not influence university students' awareness of, access to and competency to use AI for learning. Fahrurrozi, et al (2019) revealed that Google classroom provides for the development of learning that is exciting, active, autonomous and effective. Integrated learning design based on Google classroom has in deed improved students' digital literacy and 21st century skills. Ogbonna & Asukwo (2023) affirmed that there is significant influence of Google classroom tools on undergraduate students' acquisition of 21st century skills. This was attributed to the fact that Google classroom learning tool is stable and available and can be installed in their simple hands on phones.

Itighise & Thomas (2022) found that ICT and digital skills acquired for self-reliance by science education teachers are not high. Aina et al., (2023) study showed that greater a proportion of female students showed positive perception on the use of AI (medical chatbots) in learning. Also, in a study for ICT-based applications for male and female students from ethnic minorities and majorities in the Netherlands (Qazi et al., 2022), the girls showed positive behaviour towards computers than boys at secondary education. Ping & Issa (2011) found that the level of awareness and knowledge of students using web 2.0 technology were low, also males have more knowledge of web 2.0 technologies than do females. Itighise et al (2023) also observed that there is no significant difference in awareness and utilization of web 2.0 technology. As well as no significant difference in the opinions of male and female science teachers on awareness and utilization of emergent technologies. Etiubon & Akpan (2017) found that men were more inclined towards the use of ICTs than women. Aguboshim, et al (2022), also observed that about 16% fewer Nigerian women than men use ICT, 46% of boys use the internet, compared to 27% of girls.

Etiubon et al (2018) maintained that the acquisition of skills that can empower undergraduates for lifelong learning is low in Nigeria and are due to so many factors, some of which are non-availability of resources, as well as lack of implementation of science, technology, engineering and mathematics (STEM) curricula with activities in the universities. The theory content of STEM subjects is taught, while the practical activities that are expected to help the undergraduates acquire lifelong skills are negligible. Osaro (2014) and Wendy (2015) identified resources hindering lifelong learning in universities as poor state of facilities and materials (lack of digital facilities, laboratory, workshops, chemicals, classrooms, computer, light supply, reagents and teaching aids). Akpan et al (2023) noted lack of human resources, such as teachers who lack necessary skills and competencies needed to train students in digital literacy Poor motivation of the few available teachers as well as lack of finances to purchase the necessary resources needed, time resources and lack of adaptation of academic staff to new patterns and technologies used to disseminate knowledge. Another important factor inhibiting lifelong learning is the Nigerian education system which is theoretical and geared towards purely academic and certificate consciousness, thereby preparing its recipients for white collar jobs or paid employment. The result is that graduates at whatever level are not equipped with appropriate skills and competencies for lifelong learning.

Statement of the Problem

Education in the 21st century is changing at an unimaginable speed by the emergent of various technologies, hence, university education and science teaching are geared towards helping graduates acquire both physical and intellectual skills to enable them be self-reliant and useful to the society. However, tertiary institutions in Nigeria which serve as the formal centres for lifelong education are not fulfilling these roles, but are bedevilled with lots of challenges. This however, leads to a decline of actualization of aspirations among learners. Consequently, most undergraduates and graduates in Nigeria lack requisite skills andcompetencies that could empower them to think critically, solve problems, be creative, take initiatives, aswell as collaborate with others to be productive and become possible employers of labour for life. Thispaper focused attention on awareness of AI technology in teaching and learning in Nigeria, as well using AI technology to prepare students on 21st century skills acquisition for sustainable lifelong learning, thereby meeting provision of quality and inclusive education.

It is in the above, this study, harnessing artificial intelligence for 21st century skills acquisition and science education undergraduate preparation for sustainable lifelong learning was proposed. Specifically, the study sought to;

1. Examine the level of undergraduate students' awareness of available AI technologies.
2. Ascertain the extent of preparation in learning skills by science education undergraduate students for lifelong learning harnessing AI technologies.
3. Examine the extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology.
4. Assess the extent of preparation in life skills by science education undergraduate students for lifelong learning harnessing AI technology.

Research Questions

1. What extent are science education undergraduate students aware of available AI technology?
2. To what extent are science education undergraduate students prepared with learning skills for sustainable lifelong learning using AI technology?
3. What is the extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology?
4. What extent of life skills are acquired by science education undergraduate students for lifelong learning using AI technology?

Hypotheses

1. There is no significant difference between male and female science education undergraduate students' awareness of available AI technology.
2. There is no significant difference between male and female science education undergraduate students' prepared in learning skills for lifelong learning harnessing AI technology.
3. There is no significant difference between male and female science education undergraduate exposed to literacy skills for lifelong learning using AI technology.
4. No significant 21st century life skills have been acquired by male and female science education undergraduate students for sustainable lifelong learning using AI technology.

Research Method

Descriptive survey design was adopted for the study and was conducted in South-South geopolitical Zone of Nigeria (comprising Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers States). Multi-stage sampling technique was used for the study. In the first stage, Akwa Ibom, Rivers and Edo States were randomly sampled for the study. The population of the study comprised 2,526 Science Education students from Akwa Ibom State University, Ignatius Ajuru University of Education, Port Harcourt and University of Benin, Edo State. In the second stage, 10% of the population was randomly selected resulting in a total sample size of 253 students that participated in the study. Four research questions and hypotheses guided the study and a 34-item questionnaire on 'Harnessing AI for 21st Century Skills Acquisition for Sustainable Lifelong Learning was used for data collection. The instrument was in two parts. Part A consisted of four items that elicited information from respondents on name of school, area of specialization, sex and year of study. Part B comprised of 34-items on awareness of AI and undergraduates' preparation on 21st century skills for sustainable lifelong learning using AI technologies. The designed questionnaire was trial-tested on30 students who were not part of the original sample. The aim of the pre-test was to check the validity and reliability of the instrument and a reliability coefficient of 0.81 was obtained using Cronbach alpha index. Based on the observation of some experts in Measurement/Evaluation and Science Education, the questionnaire was reviewed accordingly and defects were corrected before administration. The

questionnaire was administered physically in hard copies and electronically through Google form (a link was created) to respondents through a WhatsApp group created specifically for the study. 253 copies of the instrument were administered and 250 copies were retrieved, which gave 99 % return rate.

Data obtained were analyzed using mean and standard deviation to provide answers to the research questions, while independent t-test was used to test the hypotheses at .05 level of significance. In order to take decisions as regard research questions 1 which was designed on a two point rating scale, if the cluster mean score falls between:1.00-1.49 and 1.50-2.00, it was taken to indicate low extent and high extent respectively. For research questions 2,3 and 4 which were designed on a four point scale, whenever the cluster mean score falls between: 1.00-1.49, 1.50-2.49, 2.50-3.49 and 3.50-4.00, it was taken to indicate: Low Extent (LE), Moderate Extent (ME), High Extent (HE), Very High Extent (VHE). For the hypotheses, whenever the probability value was less than .05 level of significance, the null hypotheses were rejected and also whenever the probability value was greater than .05 level of significance, the null hypotheses were retained.

DATA ANALYSIS AND RESULTS

The results obtained were analyzed in line with the research questions and hypotheses raised to guide the study.

Research Question One

To what extent are science education undergraduate students aware of available AI technology?

Table 1.1: Mean and standard deviation of the extent science education undergraduate students are aware of available AI technology

S/N	Extent science education undergraduate students are aware of available AI technology	Mean	SD	Remarks
1	Have you heard of Artificial Intelligence (AI)	**1.85**	**0.35**	**Yes**
2	Do you know the meaning of AI	**1.95**	**0.22**	**Yes**
3	Do you have knowledge of AI technologies	**1.52**	**0.50**	**Yes**
4	Have you used any of these AI tools in learning:			
A	Virtual classroom	**1.46**	**0.50**	**No**
B	Smartboard	**1.45**	**0.50**	**No**
C	ChatGPT	**1.62**	**0.49**	**Yes**
D	Virtual Assistance	**1.40**	**0.49**	**No**
E	Charttbots	**1.36**	**0.48**	**No**
F	Cerego	**1.12**	**0.33**	**No**
G	Knewton	**1.01**	**0.11**	**No**
H	Dreambox	**1.10**	**0.31**	**No**
I	Video streaming	**1.62**	**0.49**	**Yes**
J	Google assistant	**1.90**	**0.31**	**Yes**
K	Google Cloud AI	**1.45**	**0.50**	**No**
	Cluster Mean	**1.49**	**0.40**	**Low Extent**

The result in Table1.1 reveals the mean range for the responses of the students on the extent science education undergraduate students are aware of available AI technology. The result in Table 1.1 reveals that the mean range of items 1, 2 and 3 falls between 1.50-2.00, which implies that the respondents agreed they have heard of Artificial Intelligence (AI); they know the meaning of AI; and they have knowledge of AI technologies. The result of item 4 reveals the responses of the students on 4a, 4b, 4d, 4e, 4f, 4g, 4h and 4k fall between 1.00-1.49, which means that the respondents disagreed on the usage of virtual classroom, smart board, virtual assistance, charttbots, cerego,knewton, dream box and Google cloud AI. Responses on 4c, 4i and 4j falls between 1.50-2.00agreed that they have used ChatGPT, video streaming and Google assistant. It is also observed that the standard deviation scores of the respondents range from 0.01 to 0.50, the scores are small which means that the spread of scores are not wide apart. The cluster mean of 1.49 for all the items implies that to a low extent science education undergraduate students are aware of available AI technology.

Research Question Two

What extent are science education undergraduate students prepared with learning skills for sustainable lifelong learning using AI technology?

Table 1.2: Mean and standard deviation of the extent science education undergraduate students are prepared with learning skills for sustainable lifelong learning using AI technology

S/N	**Extent science education undergraduate students are prepared with learning skills for sustainable lifelong learning using AI technology.** **Please indicate the extent to which, you are able to:**	**Mean**	**SD**	**Remarks**
5	find solutions to problems	2.48	0.83	ME
6	Think beyond a situation in your environment	2.48	0.95	ME
7	Apply different strategies in solving a problem.	2.42	0.95	ME
8	See things differently from the way others view them.	2.58	1.07	HE
9	Try out some new ideas or things.	2.53	1.03	HE
10	Collaborate with others.	2.44	0.96	ME
11	Share your ideas with others.	2.48	0.99	ME
12	Adopt others' ideas.	2.39	0.84	ME
	Cluster Mean	**2.48**	**0.95**	**ME**

The result in Table 1. 2 reveals the mean range for the responses of the students on the extent science education undergraduate students are prepared with learning skills for sustainable lifelong learning using AI technology. The result in Table 1. 2 reveals that the mean range of items 5,6,7, 10,11 and falls between 1.50-2.49 which indicates that to a moderate extent: they are able to find solutions to problems, think beyond a situation in their environment, they apply different strategies in solving a problem, collaborate with others, share their ideas with others and adopt others' ideas. The result in Table 2 also reveals that the mean range of items 8 and 9 falls between 2.50-3.49, which indicates that to a high extent: the respondents see things differently from the way others view them and they try out some new ideas. It is also observed that the standard deviation scores of the respondents range from 0.83 to 1.07, the scores are small which means that the spread of scores are not wide apart. The cluster mean of 2.48 for all the items implies that to a moderate

extent science education undergraduate students are prepared with learning skills for sustainable lifelong learning using AI technology.

Research Question Three

What is the extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology?

Table 1.3: Mean and standard deviation of the extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology

S/N	**Extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology.** **Please indicate the extent to which, you:**	**Mean**	**SD**	**Remarks**
13	Are interested in knowing the fact and truth of a situation	2.41	1.11	ME
14	Are interested in collecting data	2.56	1.22	HE
15	Read any materials that you come across	2.35	1.14	ME
16	Look for information online on areas of interest.	2.46	1.16	ME
17	Can operate the computer efficiently.	2.25	1.05	ME
18	Have the competence to use digital and other technologies.	2.41	1.03	ME
	Cluster Mean	**2.41**	**1.12**	**ME**

The result in Table 1.3 reveals the mean range for the responses of the students on the extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology. The result in Table 1.3 reveals that the mean range of items 13, 15, 16, 17 and 18 falls between 1.50-2.49, which indicates that to a moderate extent: they are interested in knowing the fact of a solution, they read any materials that they come across, they look for information online on areas of interest, they can operate the computer efficiently and they have the competence to use digital and other technologies. Result of item 14 falls between 2.50-3.49; which is to a high extent they are interested in collecting data. It is also observed that the standard deviation scores of the respondents range from 1.03 to 1.22, the scores are small which means that the spread of scores are not wide apart. The cluster mean of 2.41 for all the items implies that there is moderate extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology.

Research Question Four

What is the extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology?

Table 1. 4: Mean and standard deviation of the extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology

S/N	**Extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology.** **Please indicate the extent to which, you:**	**Mean**	**SD**	**Remarks**
19	adapt to changing circumstances	2.70	1.07	HE

20	listen to other people's opinions	2.70	1.03	HE
21	learn from others	2.82	1.14	HE
22	motivate others to accomplish a task	2.51	1.12	HE
23	take decisions on behalf of others.	2.04	1.01	ME
24	bring your previous knowledge to solve current problems	2.52	1.16	HE
25	always volunteer to take the lead role in activities	2.16	0.94	ME
26	are able to start a project on your own	2.40	1.20	ME
27	work on tasks outside regular official hours.	2.29	1.12	ME
28	venture into new businesses	2.32	1.16	ME
29	can complete a set task on time	2.32	1.11	ME
30	make friends with students who help you in your studies	2.48	1.17	ME
31	socialize with other students	2.30	1.12	ME
32	do other business like (trading, sewing and hair making, shoe making) alongside your studies	2.40	1.15	ME
33	want to be your own boss after graduation	2.53	1.19	HE
34	want to get a paid job after graduation	2.68	1.25	HE
	Cluster Mean	**2.45**	**1.12**	**ME**

The result in Table 1.4 reveals the mean range for the responses of the students on the extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology. The result in Table 1. 4 reveals that the mean range of items 19,20,21,22, 24, 33 and 34 falls between 2.50-3.49, which means that to a high extent, the respondents: adapt to changing circumstances, listen to other people's opinions, learn from others, motivate others to accomplish a task, bring your previous knowledge to solve current problems, want to be their own boss after graduation and want to get a paid job after graduation. Responses for 23, 25,26,27,28,29,30,31 and 32 falls between 1.50-2.49, the result implies that to a moderate extent, the respondents: take decisions on behalf of others, always volunteer to take the lead role in activities, are able to start a project on your own, work on tasks outside regular official hours, venture into new businesses, make friends with students who help you in your studies, can complete a set task on time, socialize with other students and do other business like (trading, sewing and hair making, shoe making) alongside your studies. It is also observed that the standard deviation scores range from 0.94 to 1.25, the scores are small which means that the spread of scores are not wide apart. The cluster mean of 2.45 for all the items implies that there is moderate extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology.

Hypothesis One

There is no significant difference between male and female science education undergraduate students' awareness of available AI technology.

Table 1.5: Independent t-test of the difference between male and female science education undergraduate students' awareness of available AI technology (N=250)

Gender	N	Mean	SD	t-value	Sig.	Decision
Male	99	1.53	0.20	2.94	0.00	Significant

Female	151	1.46	0.16			

The result in Table 1.5 shows the t-value of 2.94 while the corresponding probability level of significance is .00 alpha at 248 degrees of freedom. This level of significance is less than .05 in which the decision is based. With this result, the null hypothesis was rejected. This result implies that there is a significant difference between male and female science education undergraduate students' awareness of available AI technology.

Hypothesis Two

There is no significant difference between male and female science education undergraduate students' prepared in learning skills for lifelong learning harnessing AI technology.

Table 1.6: Independent t-test of the difference between male and female science education undergraduate students' prepared in learning skills for lifelong learning harnessing AI technology (N=250)

Gender	N	Mean	SD	t-value	Sig.	Decision
Male	99	2.87	0.70	6.20	0.00	Significant
Female	151	2.21	0.89			

The result in Table 1.6 shows the t-value of 6.20, while the corresponding probability level of significance is .00 alpha at 248 degrees of freedom. This level of significance is less than .05 in which the decision is based. With this result, the null hypothesis was rejected. This result implies that there is a significant difference between male and female science education undergraduate students' prepared in learning skills for lifelong learning harnessing AI technology.

Hypothesis Three

There is no significant difference between male and female science education undergraduate exposed to literacy skills for lifelong learning using AI technology.

Table 1.7: Independent t-test of the difference between male and female science education undergraduate exposed to literacy skills for lifelong learning using AI technology (N=250)

Gender	N	Mean	SD	t-value	Sig.	Decision
Male	99	2.91	0.78	6.77	0.00	Significant
Female	151	2.07	1.07			

The result in Table 1.7 shows the t-value of 6.77, while the corresponding probability level of significance is .00 alpha at 248 degrees of freedom. This level of significance is less than .05 in which the decision is based. With this result, the null hypothesis was rejected. This result implies that there is a significant difference between male and female science education undergraduate exposed to literacy skills for lifelong learning using AI technology.

Hypothesis Four

There is no significant difference between male and female science education undergraduate students in the acquisition of life skills for lifelong learning using AI technology.

Table 1.8: Independent t-test of the difference between male and female science education undergraduate students in the acquisition of life skills for lifelong learning using AI technology (N=250)

Gender	N	Mean	SD	t-value	Sig.	Decision
Male	99	2.83	0.70	5.63	0.00	Significant
Female	151	2.20	0.97			

The result in Table 1.8 shows the t-value of 5.63, while the corresponding probability level of significance is .00 alpha at 248 degrees of freedom. This level of significance is less than .05 in which the decision is based. With this result, the null hypothesis was rejected. This result implies that there is a significant difference between male and female science education undergraduate students in the acquisition of life skills for lifelong learning using AI technology.

DISCUSSION OF FINDINGS

The result of analysis on the extent of science education undergraduate students' awareness of available AI technology revealed that to a low extent science education undergraduate students are aware of available AI technology; and there is significant difference between male and female science education undergraduate students' awareness of available AI technology.The finding is line with that of Alimi et al (2021), whose findings on university students' awareness and use of artificial intelligence for learning Kwara State showed that majority of the students are not aware of artificial intelligence for learning and do not have access to AI. This was attributed to the fact that AI is relatively new to the Nigerian learning environment. Finding is also in consonant with the observation of Afonughe et al., (2021) who reported that universities and tertiary institutions are still faced with the traditional approach of teaching and learning, delivering content in the face-to- face setting; making the integration and implementation of AI in educational institution rather scarce and almost not available. The finding is still in line with that of Ping &Issa (2011), whose finding showed that the level of awareness and knowledge of students using web 2.0 technology were low and also males have more knowledge of web 2.0 technologies than do females. Also, Etiubon et al (2018) and Akpan et.al (2023) attribute the low level of awareness to lack of both digital and human resources, inability of teachers to adapt to the new technologies and prepare students for a sustainable future.

The result of the analysis of the extent science education undergraduate students are prepared with learning skills for sustainable lifelong learning using AI technology revealed that to a moderate extent science education undergraduate students are prepared with learning skills for sustainable lifelong learning using AI technology; and that there is a significant difference between male and female science education undergraduate students' prepared in learning skills for lifelong learning harnessing AI technology. The moderate extent in skill acquisition may be attributed to their previous knowledge and competence from the use of other digital technologies. The finding lend credence to the observation of Ibrahim, (2023) who alleged that AI harnessing can inspire students to generate ideas and solutions, fostering creativity and innovation, essential 21st century skills in today's completive and evolving job market. The finding contradicts with that of Aina et al., (2023) whose study showed that greater proportion of female students showed positive perception on the use of AI (medical chatbots) in learning. As well as Qazi et al (2022) finding on female superiority over males on acquisition of ICT skills.

The result of the analysis of the extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology revealed that there is high extent of exposure of science education undergraduate students to literacy skills for sustainable lifelong learning using AI technology; and that there is a significant difference between male and female science education undergraduate exposed to literacy skills for lifelong learning using AI technology. The finding agrees with the observation of Fahrurrozi et al (2019) that AI (Google classroom) has improved students digital literacy

and 21st century skills acquisition. It is also in line with Osaro (2014) who maintained that undergraduates need to be provided with opportunities to upgrade and expand existing skills, acquire new skills to keep them in a better position to face new challenges in the society and the world. The finding contradicts with that of Qazi et al., (2022) whose study on ICT-based applications for male and female students indicated that the girls showed positive behaviour towards computers than boys at secondary education.

The result of the analysis of the extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology revealed that there is moderate extent of acquisition of life skills by science education undergraduate students for lifelong learning using AI technology. This moderate extent could be attributed to Ogbonna & Asukwo (2023) that AI tools and other digital apps easily installed in simple hand-on phones are available to the students. There is a significant difference between male and female science education undergraduate students in the acquisition of life skills for lifelong learning using AI technology. The finding corresponds with Aguboshim et al (2022) that about 16% fewer Nigerian women than men use ICT and 46% of boys use the internet, compared to 27% of girls. The overall significant difference between male and female students in the acquisition of 21st century skills in favour of males supports the findings of Etiubon & Akpan (2017) that men were more inclined to the use of ICTs and internet compared to women.

CONCLUSION

Findings from the study have shown that students have low awareness of artificial intelligence technology and are moderately prepared with 21st century skills for sustainable lifelong learning. It was found that males have more awareness of AI technology than females. Many undergraduates in higher institutions in Nigeria face serious challenges of acquiring relevant skill, fostering creativity and innovation essential in today's 21st century competitive world and evolving job market. Based on the findings of the study, it was concluded that, harnessing artificial intelligence in teaching and learning will enhance undergraduate students' 21stcentury skills acquisition and preparation for sustainable lifelong learning in Nigeria.

RECOMMENDATIONS

Following the findings and conclusion of the study and in line with best practices, recommendations were made that:

1. Government should intensify efforts in the provision of ICT facilities and resources, as well as the improvement of power supply in the universities.
2. Teachers should organize lessons and other activities bothering on the use of AIs to keep students abreast of, raise awareness and improve skills and knowledge in the utilization of these emergent technologies.
3. Universities should create awareness and utilization of the different AI technologies in teaching and learning activities. University authorities should put into practice user education programmes for students to encourage them learn how to use AI and other technologies for academic purposes and other activities.
4. The university curriculum should be reviewed, so that 21stcentury skills be adequately integrated into the curriculum to prepare science education undergraduate students for the world of work and lifelong learning.
5. Tertiary institutions administrators and managers should device effective strategies to attract, motivate and retain the learning population of unskilled, inactive and unemployed citizens in Nigeria in order to enable the development of skills and knowledge that will make them active and functional in the society.

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