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Harnessing Technology-Enhanced Learning Tools in Promoting Education for Sustainable Development among University Students in Ekiti State, Nigeria

Senimetu ILEUMA
Department of Arts and Social Science Education
Faculty of Education
Lead City University, Ibadan, Oyo State
ileumaesther@gmail.com

&

Odunola Lovelynn Boluwatife MOGBEYITEREN
Faculty of Specialized and Professional Education
Department of Educational Management, Library and Information Science
Emmanuel Alayande University of Education, Oyo, Oyo State
lovemode20022002@gmail.com

Abstract

The study investigates harnessing of technology-enhanced learning tools in promoting education for sustainable development among university students in Ekiti State, Nigeria. The objectives of the study are to examine the friendliest technology-enhanced learning tool and the factors influencing the integration in promoting education for sustainable development. Descriptive design of survey type was adopted for the study. Population comprised all the students and lecturers with the sample size of twenty (20) respondents each from the selected five faculties. through purposive and systematic random sampling technique. A total of 100 respondents each were used for the study. Two research questions were formulated and answered. Two self-constructed instruments- Students Harnessing Technology Enhanced Learning Tools Questionnaire (SHTELTQ) (r=.749) and Teachers Factors Influencing Learning Questionnaire (TFILQ) (r=.908) were used for data gathering. Data collected were analyzed using frequency counts and percentages. The findings of the study revealed that Socrative, a cloud based platform is the friendliest technology-enhanced learning tool. In conclusion, harnessing these tools empower learners to become active global citizens, equipped to build a more resilient and equitable future. Based on the findings, it was recommended that the use of Nearpod technology-enhanced learning tools should be much more encouraged amongst students in schools to access high quality teaching and learning from any place, the budget that government accrued to education should be jerked up to add colours to her influence and that government policy on technology should be implemented so that the well-designed multimedia learning materials can be more effective than traditional classroom.

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Keywords: Technology, Learning tools, Digital platforms, Traditional education and sustainable development

Introduction

As the world struggles with the challenges of sustainable development, education plays a vital role in equipping future generations with the knowledge, skills and values necessary to build a more sustainable future. Education for Sustainable Development (ESD) is a global priority aimed at equipping individuals with the necessary information to address the social, economic, and environmental challenges of time, a promising approach to bring real values into teaching and learning in order to increase communication and collaboration, to personalize learning opportunities, enhance curiosity due to engaging content, improve teachers efficiency and productivity and to transform classroom experience (Chen,Li & Han, 2020).

Technology-enhanced learning tools include online platforms, educational applications, virtual reality simulations, and interactive multimedia which offer interactive and immersive experiences that can facilitate deep understanding and engagement with sustainable development concepts. Emphasis on the potential of digital technologies such as online games, multimedia, mobile phones and social media to facilitate transformative learning experiences empower learners to critically engage in sustainability issues (Biehl, Timpf & Wernsmann, 2020). The study highlighted the importance of incorporating participatory and collaborative learning approaches to leverage the potential of technology-enhanced tools effectively through social connectivity, increase in speed of communication, versatile working enhancement, provision of greater learning opportunities, easy editing, increase in automation, information storage as well as the use of virtual reality (VR) simulations as a technology-enhanced learning tool for sustainable development education. (Corrin, De Barba & Kennedy, 2019).

Some of the challenges faced by technologically-enhanced tools usage are data security since a data breach is a primary threat, compliance requirement varies depending on the institution size and the number of students it serves, integration and upgrades are critical in digital transformation, internet of things(IoT) can be forgotten when mapping out technology, finding the right artificial intelligence and machine learning algorithm for particular institution, support to address computer

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problems for remote workforce, data management to protect files from unauthorized access and manipulations, loss in mobility focus as it affects the consistency and stability of mobile app experience since mobile phones have different hardware and software, limited talent in the IT market, infrastructural changes both within and outside can disrupt business operations, temptation of handlers to surf social media during working hours, ineffective project management, cloud solutions need clear strategy to operate (Biehl, Timpf & Wernsmann, 2020).

Not all learners have equal access to digital resources as emphasis is on the need to maximize the benefits of technology-enhanced learning tools in sustainable development education (D'Souza, Perry & Ashton,2021). The back–to-basics traditional education method known as conventional education is still widely used in schools up until today having the teachers sit in silence while students one after another take turns to recite the lesson. and at the end of the exercise conducts a written test is conducted and students are rewarded for their efforts in using the class periods efficiently.

Learning in a classroom of this nature can sometimes be boring as reading, writing and memorizing for tests does not help children develop much interest in education, it leads to less learning outcomes, lack of skills based learning, lack of good teachers who have mastered the subject contents which makes it look like the students do not understand the importance of education as there is not much time or may be little period that is given for interaction between the teacher and students in the classroom irrespective of their sitting position and class engagement that may be limited to students who actively participate in the conversation, very hard for teachers to pinpoint the specific needs of the individual student and tends to focus on the larger group leading to loss of individualization and student engagement.

Students that seems to understand the teaching of the teacher may be bullied and students sitting close to each other in the classroom may likely increase the likelihood of the spread of germs, bacteria and viruses and the health of the entire class is compromised leading to physical and mental health issues. Lack of experiential learning of students make them to enjoy being spoon-fed by teachers and as it is, it seems the syllabus does not teach much about the technological realities of the world as heavy emphasis is placed on rote memorization in classrooms as students'

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success often depend on the ability to regurgitate facts not giving rooms to development of critical thinking, problem solving and decision making skills.

In many schools' students do not receive enough direct feedback as teachers do not have time to work one-on-one and students are expected to repeat things in groups allowing the more verbally timid to pretend participation, if we must move with the pace of the modern educationist then our learning, needs to be enhanced by using different types of educational software to transform and enhance education and educational institutions beyond recognition (Razuye, Deniz & Hudenyin, 2023).

Firstly, there is a lack of comprehensive research on the actual effectiveness and impact of these tools on learners' sustainable development knowledge, skills, and attitudes. While various studies have explored the potential benefits, there is a need for empirical evidence that assesses the extent to which technology-enhanced learning tools contribute to meaningful learning outcomes in sustainable development education. Secondly, the equitable access and inclusion of technology-enhanced learning tools pose a crucial problem.

The digital divide, characterized by unequal access to technology and digital resources, can exacerbate educational inequalities, particularly among disadvantaged learners. Understanding the barriers and challenges associated with equitable access is crucial for ensuring that technology-enhanced learning tools are accessible to all learners, regardless of their socio-economic background or geographical location. Additionally, exploring strategies and interventions to bridge the digital divide and promote inclusive access to these tools is essential for promoting education for sustainable development on a global scale. The researcher wishes to investigate the roles of technology-enhanced learning tools in promoting education for sustainable development: A comparative analysis of different digital platforms among the students of Ekiti State University.

Concept of Technology and Sustainable Development

Education for Sustainable Development (ESD) plays a critical role in equipping individuals with the knowledge, skills, and attitudes necessary to address global sustainability challenges. In recent years, technology-enhanced learning tools have emerged as potential resources for enhancing sustainable development education. Benson, Filippaios and Morgan (2010) examined how online

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social networks changed the face of business education and career planning. This study reports the findings of a survey of 272 UK and international business school students on career development and entrepreneurship as a part of a wider study of online social networking. The results of the study reveal key differences between undergraduate, postgraduate and international student population.

Rose (2020) investigated how a culturally specific form of social-networking, namely *guanxi,* impacts on employment outcomes from internships, for graduates within the Chinese context. This study involved the collection of longitudinal data at two-time intervals from intern-supervisor dyads (N=303), in order to determine the role of *guanxi* in predicting the conversion of an intern into an employee with their internship host-organization. These findings highlight the role of cultural context in shaping and potentially undermining desired graduate employment outcomes from Work-Integrated Learning initiatives such as internships.

Despite the potential benefits of technology-enhanced learning tools in promoting education for sustainable development, tertiary institutions in Nigeria face a significant knowledge gap regarding effective integration, utilization and impact assessment of these tools, hindering optimal learning outcomes and sustainable development. Some of these problems include inadequate infrastructure limited teacher training, digital insufficient technological resources, outdated hardware and poor internet connectivity), digital divide, curriculum relevance, ineffective assessment methods, difficulty in maintaining students' engagement, resource constraints, cultural and language barriers, sustainability awareness and evaluation and monitoring. However, if there is a neglect on the issue touching harnessing technology-enhanced learning tools in tertiary institutions, the full potential of students may not be discovered and in the end the ripple effects are carried over to other levels of schooling and it is on this premise that the study explored to close the identified gap by carrying out this research work.

Sutherland, Davis, Terton & Visser (2018) explored undergraduate student attitudes towards the inclusion of social media training within higher education pedagogy, student perceptions of social media proficiency as professional expertise and its impact on graduate employability. Eighty-one undergraduate students studying medicine, law, science and arts volunteered to complete an online survey. Questions examined student attitudes towards the delivery of social media pedagogy at university and the perceived benefits of social media proficiency. Result showed that participants

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stated that social media skills should be taught in optional classes (85%) covering generic competencies (56%). The majority (91%) of respondents reported that social media skills and training were valuable for employability. The literature reviewed explored and synthesized the existing research from 2010 onwards supported the fact that technology-enhanced learning tools encompass a wide range of digital resources, including online platforms, educational apps, virtual reality simulations, and interactive multimedia and that the tools provide opportunities for engaging, immersive, and interactive learning experiences that can enhance understanding and engagement with sustainability concepts. For example, virtual reality simulations have been found to increase learners' understanding of complex sustainability issues by providing experiential and realistic environments (Kapici & Akcay, 2020).

Collaborative learning environments facilitated by technology-enhanced tools also encourage active participation and knowledge co-construction among learners, fostering a deeper understanding of sustainability (Alemdag, Cevikas & Baran, 2020). Learners who engage in technology-enhanced tools exhibit increased understanding of sustainability concepts and a greater ability to apply sustainable practices in real-world contexts (Biehl, Timpf & Wernsmann, 2020). Additionally, technology-enhanced learning tools have the potential to cultivate a sense of global citizenship, as learners develop a broader perspective on interconnected environmental, social, and economic sustainability issues (Razuye, Deniz & Hudenyin, 2023).

By fostering active learning experiences, higher-order thinking skills, and application of knowledge, technology-enhanced tools empower learners to become agents of positive change in addressing sustainability challenges. While technology-enhanced learning tools offer significant potential, several challenges and considerations need to be addressed for their effective integration into sustainable development education One crucial concern is equitable access to technology, as the digital divide can create disparities in accessing digital resources, particularly among disadvantaged learners. (Tosutas, Cubukcu & Beauchamp, 2021). Furthermore, aligning these tools with curricula and pedagogical approaches that prioritize sustainability education is essential for their successful integration. There seems to be inadequate resources, qualified teachers, low literacy rates, cybersecurity concerns, untapped benefits of emerging technologies and insufficient research on technology-enhanced learning in Nigeria.

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One challenge is the need for adequate infrastructure and technical support to ensure smooth implementation of these tools. This includes reliable internet connectivity, sufficient hardware, and technical assistance for educators and learners (Roussinos & Jimoyiannis,2019). Equipping teachers with the necessary skills and conceptual knowledge is to integrate these tools into their teaching practices, design engaging learning activities, and facilitate meaningful discussions on sustainability topics (Nikolopoulou, 2023).

Research Questions

1. What is the friendliest technology-enhanced learning tool used by students?
2. What are the key factors influencing the integration of technology-enhanced learning tools in promoting education for sustainable development?

Methodology

Two self-constructed questionnaires titled: Students Harnessing Technology Enhanced Learning Tools Questionnaire (SHTELTQ) consists five (5) items to be responded to by the students and Teachers Factors Influencing Learning Questionnaire (TFILQ) consists five (5) items to be responded to by the lecturers. The four (4) Likert rating scales of Strongly Agree(SA)=4, Agree (A) =3, Disagree (D) =2 and Strongly Disagree (SD) =1 were used. The participants score ranges between 5 and 20. The research instruments were validated on the basis of face and content validity in order to evaluate the extent to which operationalization of a construct actually measure what it tends to measure. The researcher showed the instruments to the experts in the Department of Arts &Social Science Education, Lead City University, Ibadan, Oyo State for their inputs and corrections. The reliability of the instruments was determined using Cronbach Alpha method of reliability for internal consistency. The instruments were taken to each sampled departments and were administered with the help of two assistants. After the instruments were retrieved from the respondents then the descriptive analysis was used. The data collected were analyzed using the descriptive statistics, simple percentage and frequency distribution.

Results

Research Question 1: What is the friendliest technology-enhanced learning tool used by students?

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In response to this question, five items were raised to determine the various technology enhanced tools used by university students in Ekiti State, Nigeria.

Table 1: Analysis of the various technology-enhanced learning tools used by students

S/N	Items	SA (%)	A (%)	D (%)	SD (%)	Mean ($\bar{x}$)	Remark
1.	Google classroom is a technology-enhanced learning tool used by the students for learning	21 (21%)	57 (57%)	10 (10%)	12 (12%)	2.87	Strongly Agree
2.	Socrative is a technology-enhanced learning tool used by the students for learning	26 (26%)	46 (46%)	20 (20%)	8 (8%)	2.90	Strongly Agree
3.	Nearpod is a technology-enhanced learning tool used by the students for learning	24 (24%)	40 (40%)	21 (21%)	15 (15%)	2.73	Strongly Disagree
4.	iPad is a technology-enhanced learning tool used by the students for learning	28 (28%)	46 (46%)	12 (12%)	14 (14%)	2.88	Strongly Agree
5.	Buncee is a technology-enhanced learning tool used by the students for learning	28 (28%)	42 (42%)	17 (17%)	13 (13%)	2.85	Agree
	Weighted Mean ($\bar{x}$)					**2.85**	

Source: Field Survey, 2024

Table 1 showed that 57(57%) of the respondents agree, 21(21%) strongly agree,10(10%) disagree and 12(12%) strongly disagree (pulling strongly agree and agree together to form agree and joining disagree and strongly disagree together in all cases) it means majority of the respondent (78%) agree while (22%) of the respondents disagree to item 1 that goggle classroom is a technology enhanced learning tool for learning with a mean score ($\bar{x}$) of 2.87, it is categorized as strongly agree considering the weighted average. The second item has 72(72%) of the respondents agreeing while 28(28%) disagree to item 2 that Socrative is a technology-enhanced learning tool used by the students for learning with a mean score($\bar{x}$) of 2.90, it is categorized as strongly agree considering the weighted average. In item 3, 64(64%) of the respondents agree while 36(36%) disagree that Nearpod is a technology-enhanced learning tool used by the students for learning with a mean score ($\bar{x}$)of 2.73 it is categorized as strongly disagree considering the weighted average.

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In item 4, it was observed that 74 (74%) agree while 26(26%) of the respondents disagree that iPad is a technology-enhanced learning tool used by the students for learning with a mean score ($\bar{x}$) of 2.88, it is categorized as strongly agree considering the weighted average. In item 5, 70(70%) of the respondents agree while 30(30%) disagree that Buncee is a technology-enhanced learning tool used by the students for learning with a mean score ($\bar{x}$) of 2.85 it is categorized as agree.

Research Question 2: What are the key factors influencing the integration of technology-enhanced learning tools in promoting education for sustainable development as noticed among university students in Ekiti state, Nigeria?

In response to this question, five items were raised to determine the key factors influencing the integration of technology enhanced learning tools in promoting education for sustainable development as noticed among university students in Ekiti State, Nigeria.

Table 2: Analysis of the key factors influencing the integration of technology-enhanced learning tools in promoting education for sustainable development

S/N	Items	SA	A	D	SD	Mean ($\bar{x}$)	Remark
1.	*The willingness of students to know how to use technology influenced the promotion of education for sustainable development*	24 (24%)	52 (52%)	10 (10%)	14 (14%)	2.86	Strongly Agree
2.	The financial status of the parents to purchase technology-enhanced learning tools for their wards influenced the promotion of education for sustainable development	20 (20%)	40 (40%)	24 (24%)	16 (16%)	2.64	Agree
3.	The budget that Government accrued to education influenced the promotion of education for sustainable development	20 (20%)	38 (38%)	22 (22%)	20 (20%)	2.58	Strongly Disagree
4.	Training of students on how to use technology- enhanced learning tools influenced the promotion of education for sustainable development	23 (23%)	48 (48%)	19 (19%)	10 (10%)	2.84	Strongly Agree
5.	*Government policy on technology influenced the promotion of education for sustainable development*	13 (13%)	24 (24%)	36 (36%)	27 (27%)	2.23	Strongly Agree
	Weighted Mean ($\bar{x}$)					**2.63**	

Source: Field Survey, 2024

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Table 2 showed that 52(52%) of the respondents agree, 24(24%) strongly agree,14(14%) strongly disagree and 10(10%) disagree (pulling strongly agree and agree together to form agree and joining disagree and strongly disagree together in all cases) it means majority of the respondent (76%) agree while (24%) of the respondents disagree to item 1 that, the willingness of students to know how to use technology influenced the promotion of education for sustainable development with a mean score ($\bar{x}$) of 2.86, it is categorized as strongly agree considering the weighted average. Item 2, 60(60%) of the respondents agreeing while 40(40%) disagree that the financial status of the parents to purchase technology-enhanced learning tools for their wards influenced the promotion of education for sustainable development with a mean score($\bar{x}$) of 2.64, it is categorized as agree considering the weighted average. In item 3, 58(58%) of the respondents agree while 42(42%) disagree that, the budget that Government accrued to education influenced the promotion of education for sustainable development with a mean score ($\bar{x}$) of 2.58, it is categorized as strongly disagree based on the decision rule though lower than the weighted average.

In item 4, it was observed that 71 (71%) agree while 29(29%) of the respondents disagree that, training of students on how to use technology-enhanced learning tools influenced the promotion of education for sustainable development with a mean score ($\bar{x}$) of 2.84, it is categorized as categorized as strongly agree considering the weighted average. In item 5, 63(63%) of the respondents disagree while 37(37%) agree that government policy on technology influenced the promotion of education for sustainable development with a mean score ($\bar{x}$) of 2.23 it is categorized as strongly disagree considering the weighted average.

Discussion of Findings

Research question one was asked to investigate the friendliest technology-enhanced learning tool used by university students in Ekiti State, Nigeria. Results in Table 1 where decision rule says that the mean of the scale used is $\bar{x}$= 2.85, hence any score above $\bar{x}$=2.85 connotes strongly agree with the item while any score below $\bar{x}$= 2.85 indicates strongly disagree with the item and since only three are higher than the weighted mean while one is lower and the last is just moderate. The results from research question one based on the mean score showed that Socrative has the highest mean score ($\bar{x}$) of 2.90 followed by iPad ($\bar{x}$) =2.88, Goggle classroom, ($\bar{x}$)=2.87, Buncee ($\bar{x}$)=2.85 and Nearpod ($\bar{x}$) =2.73 respectively. Socrative, a cloud based platform that facilitates interactive

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learning assessment and feedback between teachers and students. It can be used to create and administer quizzes, tests and exams; gather student's opinion in polls and surveys and to track students' performance. There are many alternative tools such as Kahoot, Quizlet & Edmodo. IPad in education is portable and accessible learning device, can be used for multimedia creation and presentation. It is versatile and user –friendly. Google classroom is a free, web- based platform that streamlines teaching and learning. It integrates Goggle Drive, Docs, Sheets and Slides to create a paperless, organized and collaborative environment. It can be used for course creation where classes are set up and students are invited to learn and enrolment is managed, assignment distribution where materials are shared and feedback is received, grading system for tracking students' progress and assign grades, communicate through sharing of questions, discussions and announcements and for students to collaborate by working together on documents, presentations and projects. Buncee is for interactive multimedia presentations, digital storytelling and creation and for collaborative learning and feedback, finally Nearpod are tools used for virtual field trips and simulations; for interactive presentations and lessons and integrates with Learning Management System (A digital platform that manages tracks, and delivers educational courses, training programs, and learning resources). This finding implies that Socrative is the friendliest technology- enhanced learning tools where students learn different skills. This is similar to the opinion of Alharbi &Meccawy (2020) who emphasized the potential of digital technologies, such as use of mobile phones that facilitate in-class interactions and have better engagement in tasks and higher motivation over paper based tests. It facilitates transformative learning experiences that empower learners to critically engage with sustainability issues.

Results in Table 2 where decision rule says that the mean of the scale used is $\bar{x}$=2.63, hence any score above $\bar{x}$=2.63 connotes strongly agree with the item while any score below $\bar{x}$=2.63 indicates strongly disagree with the item and since only two are higher than the weighted mean, two are lower and the last is just moderate.The interpretation of research question two revealed that, the willingness of students to know how to use technology influenced the promotion of education for sustainable development has the highest mean score($\bar{x}$) of 2.86,followed by training of students on how to use technology-enhanced learning tools with the mean score ($\bar{x}$) of 2,84, which can be looked at from the angle of student benefit, academic benefit, career benefit, teacher benefit as well as institutional benefit. Considering student benefit one can say that the training of students

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on how to use technology-enhanced learning tools influences the promotion of education for sustainable development by enhancing digital literacy,increase confidence in using technology,accessibility to vast educational resources,development of critical thinking and problem solving skills.Looking at the academic benefit it will improve engagement and participation, enhance learning outcomes through better retention and reduction of dropout rates. The career benefits can lead to competitive advantage in job market, enhance adaptability and flexibility and development of skills for lifelong learning. Teacher benefits would be in the area of improved teaching efficiency, better monitoring and feedback and to gain professional development opportunities and finally the institution benefits by having improved institutional reputation, increased student satisfaction and enhanced educational quality. D'Souza, Perry & Ashton (2021) noted that there is need for appropriate pedagogical approaches and effective integration of technology within existing educational frameworks to maximize the benefits of technology-enhanced learning tools in sustainable development education.

Conclusion

Technology-enhanced learning tools can reach remote and undeserved areas through the expansion of access to quality education and bridging the gap for marginalized communities. Adaptive technologies and learning analytics enable personalized learning experiences, catering to individual needs and abilities while multimedia content, simulations and gamification make learning more engaging, interactive and fun as it promotes deeper understanding and retention. Technology facilitates global connections, enabling students to collaborate, share perspectives and develop empathy and understanding. Technology-enhanced learning tools improve engagement and participation, increase accessibility and inclusivity for better retention and reduction of dropout rates. Technology provides opportunities for teachers to upskill and reskill enhancing their capacity to integrate sustainable development into their teaching practices. Technology-enhanced learning tools can accommodate diverse learning needs, ensuring equal access for all. Technology-enhanced learning tools have the potential to transform education for sustainable development, making it more accessible, engaging and effective. By harnessing these tools, we can empower learners to become active global citizens, equipped to address the complex challenges of sustainable development and build a more resilient and equitable future. From the findings, it can be concluded that Socrative, iPad and Google classroom are technology-enhanced learning tools

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used by the students for learning and that the budget the Government accrued to education if jerked up may go a long way to influence the promotion of education for sustainable development.

Recommendations

1. Students should be encouraged to make use of Nearpod technology-enhanced learning tools so that they can easily relate well with it when it comes to working from different place and at different time.
2. Government should jerk up the budget accrued to education in order to add colours to her influence in promoting education for sustainable development.
3. Government should implement policy on technology so that the well-designed multimedia learning materials can be more effective than traditional classroom.

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