



The Potentials of Emerging Contemporary Technologies in Teaching and Learning of Basic Science in Owerri West Local Government Area Imo State

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Abstract

The study examined the potentials of emerging contemporary technologies in teaching and learning of Basic Science. Basic science is very germane because it is universally accepted as core subject needed in lower basic education. The study adopted a descriptive survey design. The population consists of all one hundred and fifty students' Basic science students from the department of Integrated science in Alvan Ikoku Federal University of Education. The population is made of all 2019/2020 Education/Integrated Science from 100 to 400 levels. Four research questions guided the study. A self-developed questionnaire tagged Potentials of Emerging Contemporary Technological tools in Basic Science Teaching and Learning (PCETBSTL). The instrument used for study which had a reliability coefficient of 0.82 was considered adequate for measuring the variables in the study. Data collected were analyzed with mean scores. The results show that majority of the respondents agrees that the integration of emerging technologies in teaching and learning process brings inspiration and modernization to education, enhances inclusiveness, and promotes the achievement of teaching and learning objectives. More so, the results showed that the potentials of emerging contemporary technologies are often associated with a lot of setbacks such as unsteady electricity, insufficient professional skills, lack of good funding, lack of technological tools as well as bad interference of internet connectivity. The paper suggests that teachers of science should embark upon professional development as per enhancing their skill and updating the new knowledge of emerging contemporary technologies.

Keywords: Potentials, Emerging technological tools, teaching, learning, basic science

Introduction

Basic science education is the systematic application of body of knowledge, skills experiences to solve real life problems by harnessing the resources from their environment for the betterment of the society. Basic science education is more dynamic than ever before. As a result, Basic science students today learn in ways that are very different from how their own educational system was originally designed. With the emerging technologies and the rise of newer technologies the idea of Basic science classroom is being remoulded and redefined in a number of ways to fit the evolving need of modern digital learners. The potentials of emerging contemporary technologies in teaching and learning of Basic science is no longer a choice but a need for educators considering the level of emerging contemporary technologies on education, particularly as it relates to methodology and the needs to enhance creativity and innovations in learning. The potentials of emerging contemporary technologies have become so irresistible in the teaching and learning process and it is changing the ways teaching is structured and organized.

The potential of emerging contemporary technologies assists educators and students to interact more outside in the classroom, and to set up classes at any time and place. Emerging contemporary technologies do not only simplify the teaching and learning process but also improve the quality of content interactions and methodology. Khajeh 2011 viewed emerging contemporary technologies as becoming a critical resource because its absence can result to lack of knowledge, vague decisions and equally academic dilapidation (Javal 2014). Emerging contemporary technologies are those that have the capacity to transform the current state of affairs in education to enviable status. Many of these technologies have been emerging for a number of years.

Technologies are shaped by and in turn shape the context in which they are used. Emerging contemporary technologies can be seen in all spheres of life such as educational institutions, health, banking industry, aviation, law, security, and so on. Emerging contemporary technologies such as virtual reality, augmented reality, mobile learning, artificial intelligence, adaptive learning, learning analytic 3D printing, and others are changing value chains for creative content from the beginning to the end (WEforum, 2018). Conrine (2018) was of the view that emerging contemporary technologies clearly have an impact on performance and it motivates productivity. The potentials of emerging technologies for educators is necessary for academic effectiveness and efficiency in the teaching and learning of Basic science.

Basic science education remains one of the fields with the highest influence of emerging technologies. Dauda and kingbade (2011) asserted emerging contemporary technologies is constantly modifying the teaching and learning process thereby accommodating different kinds of learners enhancing research; improve the academic performance of students and staff. Emerging technologies have brought several modifications to the “what”, “How”, “where”, and “when” of teaching and learning of Basic science. Seyedeh, shahram, and Homayounnfir (2016) were of the view that emerging technological tools can assist students to accelerate and adjust to changing trends in science education. Parry and Battista (2019) added that emerging technologies will be of immense assistance for students to acquire their skills to fight in the future world of work. It is essential for schools and institutions to be up to date with the latest emerging technology tools. With emerging contemporary technologies becoming an integral part of society, modern students need technology enhanced to build their toolbox and stay competitive. The traditional one size fits- all approach no longer sustain the modern academic environment. Instead, institutions are investing in providing diverse, accessible, and student -centred learning experiences with digital tools. Overall, emerging contemporary technologies have opened doors to educational opportunities, facilitating flexible and tailored learning. Notwithstanding, the perceived positive effects of emerging contemporary technologies, its’ potentials in the teaching and learning of Basic science are faced with obstacles.

It is of note that emerging technologies play a vast role in the educational process. The application of emerging contemporary technologies in education is transforming student’s experiences both inside and outside the classroom. Office of Educational Technology in U.S department of education in her 2017 National Educational Plan update titled: “Reimagining the role of Technology in basic science education which stated that technology can be a powerful tool for transforming learning, it can help

affirm and advance relationships between educators and students reinvent the approaches to learning and collaborations, shrink longstanding equity and accessibility gaps and adapt learning experiences to meet the needs of all learners. Diane and Stephen (2007), said that ubiquitous computing is being used for basic science education and training to provide augmented reality interface, which are characterised by the use of handheld computers to infuse the virtual world into the real one, resulting in deeply immersive simulations. Some of the emerging technologies that have improved the performance and achievement of science include:

Artificial Intelligence (AI) and Machine Learning: Artificial intelligence quickly takes its place in science education as schools and institutions learn to implement the feature. AI has clearly transformed the classroom impacting instructional planning and personalized learning. AI as a machine is capable of doing work like a human being especially in the area of practical oriented and teaching mechanism.

Virtual Reality (VR) and Augmented Reality (AR): Both virtual and augmented reality are tools that facilitate interactive learning experiences. Students engage in virtual and augmented learning environment because they give learning opportunities as they stimulate science environment. In addition, these tools can also be useful with challenging subjects –turning a complex subject into an enjoyable experience

Block chain: Block chain is an essential technology tools that secure vital useful information and verifications. This newer technology expedites digital transcripts and credentials works usually done at the background.

Internet of things: Internet of things supports the integration of sensors and smart devices like digital whiteboards. Educators can provide diversified and interactive instruction with these technologies.

Gamification: Educators can increase student engagement and satisfaction with gamification. By integrating common gaming elements such as competition, challenges, and rewards students are motivated to learn and play an active role in their learning.

Interactive whiteboards and Smart boards: Both interactive and smart boards are tools that activate dynamic presentations as well as provide teachers with interactive ways to engage students in discussions using these tools teachers can create a more engaging learning environment for their learners. According to Soyulu & Bozdogan (2019) said that the utilization of smart boards is most commonly seen during specific units such as living organism and life and teachers often acquire the necessary skills through in-service training. An example of smart boards use in the class room is online resources. More so, teachers use smart board for assessment purposes, facilitates their lesson, increased their attentiveness and active participation. Yang, Chen & Hsieh, (2019) were of the view that 3D printing technology, augmented reality, and gamification strategies empower students to construct tangible replicas of scientific structures. This approach enriches their comprehension of intricate concepts in fields such as physics, biology, and chemistry by creating learning experiences that combine virtual elements with hands-on experimentation. Students can significantly enhance their understanding and retention of complex scientific concepts by utilizing 3D printing technology to create physical models (Francis et. al, 2021).

This hands on, tactile learning experience provides a more immersive educational approach that engages multiple senses. It allows students to interact with subject matter tangibly, promoting deeper comprehension and retention of information. Furthermore, this innovative approach fosters creativity and problem-solving skills as students design and manufacture their own three-dimensional representation of scientific structures or phenomena. More importantly integration 3D printing into science education offers an exciting opportunity to revolutionize traditional teaching methods empower students with new ways to learn (Alzoubi, Aljiabali and Tmbauwala, 2023). The use of 3D printing allows for the production of precise and realistic physical models that visually depict intricate structures such as molecules, cells or anatomical components (Kim & Clayton 2022). This visual representation assists students in comprehending abstract concepts that may be difficult to grasp using conventional instructional approaches. Furthermore, integration gamification elements into these 3D models can increase students' active participation and motivation in learning anatomy. The utilization of 3D

printing expands the possibilities for an engaging and cooperative learning environment (Beng, 2020). Students can actively participate in designing and creating models, fostering teamwork abilities and communication skills. This collaborative approach encourages peer-to-peer education and nurture a culture of shared learning experiences.

Diane and Seven (2007) ubiquitous computing is being used for education and training to provide augmented reality interfaces which are characterised by the use of handheld computers to infuse the virtual world onto the real one, resulting in deeply immersive simulations as in the case of robotic. According him, engaging in practical activities involving robotics kits and programming allows students to actively apply scientific principles in hands-on manner robotics kits into educational settings provides students with an interactive learning experience allowing them to actively participate in hands-on activities and engage with materials and components. This tactile approach not only enhances their understanding of scientific principles but also improves retention and memory. The process of designing and programming robots frequently requires students to tackle obstacles and find solutions. Through troubleshooting, optimizing designs, and debugging code, students develop critical skills to ensure the effective functionality of their robots. Activities in the field of robotics often involve programming robots to perform specific tasks. Through these activities, students can develop important skills such as coding, logical reasoning, and algorithmic thinking. Active participation in robotics fosters creativity as students are involved in the design and construction process of their robots. This hands-on approach allows them to explore and experiment with various solutions, cultivating a mindset that values innovation and creative thinking (Diane and Seven, 2007). Olivera (2019) carried out a review literature on emergent technologies from the field of science education.

The study shows that emergent technological artefacts such as computer simulations, virtual lab, mobile devices, robots, games and digital photography and drawing are increasing the experience of learners. Berland and Wilensky (2015) conducted research on four urban middle school classrooms comparing the effectiveness of curricular units in supporting students' complex systems and computational thinking. The result shows that students using the physical system were more likely to interpret situations from a bottom-up (agent) perspective and students from using the virtual system were more likely to employ a top-down (aggravates). Edger, Jesus and Babara (2017) conducted a study on Emerging technologies in education shows that emerging technologies are contextual and evolving and it improves the critical thinking and problem-solving skills of students. Corinne (2018) conducted a study on emerging technologies in higher education and the workplace assessment. The study shows that digital revolution poses a double challenge to higher education in the methods and practices of teaching and learning.

Diane and Steven (2007) in their study in emerging technologies in education and training discovered that the use of emerging technologies in animal care can create detailed training and education environments that allow students to learn the procedures more effectively, and more objectively. MOOCs have undoubtedly achieved some of the goals their creators had intended such as making high quality educational resources available to categories of people across the world who would not be able to attend similar courses in person (Economist, 2013); Spector (2013) carried out research on emerging technologies and research directions. He cited the 2011 Horizon Report which states that implications of emerging technologies for schools are ground shaking in the sense that significant transformation needs to occur if schools are to be responsive to such trends. The report revealed four critical problems facing emerging technologies in science education such as digital media literacy, evaluation metrics, and economic pressure associated with new media and proliferation of information, resources, tools and devices. Hematt (2018) stated that technology plays strenuous role to make teaching and learning activities more meaningful and it is one of the most efficient tools for advancing knowledge and skills while Patrick (2018) stated that emerging technologies changes the way students and teachers work and interact and try to make learning more efficient, engaging and entertaining thereby attracting both the students and the universities that enrol them. Based on these, it clear is that emerging technologies have potential in science education.

The evolution of emerging technologies usage in science education, moving from simple tools to advanced applications in university school system has contributed immensely to improve the standard

of education in Imo State. Despite its usefulness, some challenges abound most importantly in virtual learning environment, robotic tools, 3-D printing, and artificial Intelligence. Significant obstacles persist including the rapid pace of technology advances, unequal access, over reliance on these tools and privacy and security concerns. In addition, the ineffective use of these technologies coupled with poor financial support and absence of infrastructure and equipment, poor internet connectivity, epileptic power supply along with incomprehensive teacher training and lack of workshop on the use of modern technologies undoubtedly hinder the rapid advancement of these emerging technologies. The study therefore seeks to find the potentials of emerging contemporary technologies in Basic science education in Owerri, Imo state.

Purpose of the study:

This study examined the potentials of emerging technologies in teaching and learning of Basic science education in Owerri, Imo State and specifically, the study sought to:

1. Examine emerging technologies used in teaching and learning of Basic science in tertiary education, Imo State.
2. Identify the potentials of emerging contemporary technologies in Basic science education in tertiary education, Imo State.
3. Analyze the challenges that confront the potentials of emerging contemporary technologies in tertiary education.

Research Questions

The under listed research questions were designed by the researchers in consideration with the purpose to direct the work:

1. What emerging technologies are used in teaching and learning of Basic Science in tertiary education?
2. What are the potentials of emerging contemporary technologies in the teaching and learning of Basic Science in tertiary education?
3. What are the challenges that impede the potentials of emerging contemporary technologies in tertiary education in Imo State?

Methodology

The study adopted descriptive survey design. Data was gathered through structured questionnaires. A total of two hundred (200) questionnaires were administered to correspondents that consist of educators and students selected from the department of Integrated Science in AIFUE Owerri, Imo State. The samples were selected through purposive sampling technique, and the questionnaires contain questions that were relevant to the achievement of the stated objectives. The population of the study is made of all 2019/2020 Education/ Integrated science from 100 to 400 levels which is 300 students. By balloting 150 students were selected for the study. The researchers utilized a self –constructed ordinal rating scale as the research instrument for the collection of data. The rating scale was titled Potentials of Emerging Technologies in Basic Science Tertiary Education in Imo State. The instrument for the study had 30 items using the four-point scale of Strongly Agree (SA), Agree(A), Disagree (D) and strongly Disagree (SD) weighed as 4,3,2, and 1 point respectively. The face validity of the instrument used was carried out by three specialists from the field of Educational Measurement and Evaluation and two specialists from Educational Technology that looked at the instrument and made necessary corrections and constructive criticisms which were useful for the preparation of the final draft of the instrument. One shot method of administration was applied to test for reliability on 30 students from Abia State. With this the items in instrument were collated and scored. Internal consistency was established on a one-shot method of administration using Cronbach alpha static with an index of 0.88, indicating that the instrument is reliable. The 150 copies of the instrument were administered and retrieved on the spot so as to ensure high percent return rate. Mean score was used to answer the research questions.

Analysis of Data

Research Question 1: What are the contemporary emerging technological tools used by students of integrated science?

S/N	LATEST EMERGING TECHNOLOGIES	SA	A	D	SD	X
1	Machine learning	128	105	36	15	3.23
2	Wearable technologies	120	132	86	33	2.47
3	Mobile learning	168	105	28	9	3.40
4	WhatsApp	128	102	98	35	3.42
5	Artificial intelligence	104	75	126	36	2.27
6	Robotics	76	84	116	55	1.82
7	3-D model	112	99	102	38	2.34
8	Augmented Reality	112	114	96	36	2.39

From the above only items 1, 3 and 4 had mean scores above 2.5 showing that machine learning, mobile learning and WhatsApp are currently in use by the students of integrated science. The rest wearable technology, Artificial Intelligence, Robotics, 3-D model and augmented reality with mean scores below 2.50 are not in use by this group of students for educational purposes.

Research Question 2: What are the potentials of Emerging Technologies?

Table 2: Mean responses on potentials of Emerging technologies

S/N	Items	SA	A	D	SD	X
9	Provides a array to enhance instruction	240	174	44	10	3.12
10	Transformed and old method of teaching	292	150	34	10	3.24
11	Expose students to have a wide knowledge of technological tools and resources	368	138	10	2	3.45
12	Students create more engaging interactive learning experiences	248	111	52	25	2.91
13	Facilitates the exploration and understanding of scientific concept	212	132	54	26	2.83
14	Promotes critical thinking and problem-solving skills	148	96	70	46	2.4
15	Enhances collaboration among the students	248	147	54	12	3.07

From table 2 above items 9-13 & 15 had means scores of 3.12, 3.24, 3.45, 2.91, 2.83 and 3.07 respectively showing that Emerging technologies have potentials to Education Integrated science students. The potentials include in the areas of facilitates instruction, creating new ideas of thinking and collaboration sharing. Others were promoting problems solving skills, gaining wider knowledge of interactive learning skills and technological resources. Item 14 had a mean score of 2.4 which is below 2.5. This showed that some students are yet to identify the potentials of emerging technology.

Research Question 3: What are the challenges confronting the use of emerging technologies in Alvan Ikoku Federal University of Education?

Table 3: Mean responses on the challenges confronting the use of emerging technologies in Alvan Ikoku Federal University?

S/N	Items	SA	A	D	SD	X
16	Poor internet service	300	135	26	17	3.19
17	Lack of funds to purchase data plan	324	147	28	6	3.37
18	Technophobia	156	120	86	28	2.6
19	Inability to use the appropriate search engine	188	156	72	15	2.87
20	Negative attitude to emerging technologies	244	132	66	12	3.03
21	Information overload	220	153	70	9	3.01
22	Download delay	264	129	56	13	3.08
23	Power outages/epileptic power	292	132	50	8	3.21

Table 3 above shows items of 3.19, 3.37, 2.6, 2.87, 3.3, 3.01, 3.08, and 3.21 respectively all above 2.50. This shows that these factors are obstacles impeding the use of emerging contemporary technologies in teaching and learning of Basic science. These factors which include poor internet service, lack of funds, technophobia, inability to use the appropriate search engine, negative attitude to emerging contemporary technologies and power outages/epileptic power supply.

Discussion

The study revealed that mobile learning and WhatsApp are the most current technologies Basic science students use in learning of science. The study further showed that emerging technologies are used by students for academic purposes in the following ways such as doing assignment, students' use for interaction among classmates over topics of interest, to exchange ideas with lectures over issues not clear while in the class, for giving assignments by lecturers and lastly for self-development of inner competencies. The study identified a number of contemporary emerging technologies that have potentials in teaching and learning Basic science. These include machine learning, wearable technologies, tablet computing, virtual reality, cloud computing, Artificial Intelligence (AI), Robotics, IoT, 5D, printing and Big Data. The result is consistent with an earlier assertion by Olivera et al (2019) that technologies have been increasingly shaped students' experiences with science as well as influenced their relationship with natural and physical world.

The use of emerging contemporary technologies into scientific education has several potentials. Emerging technologies have the ability to customize leaning experiences, tailoring them to the specific needs and learning preferences of each individual learner. The flexibility facilitates the accommodation of a wide range of student capabilities and promotes a more inclusive educational setting. Furthermore, emerging contemporary technologies enhance dynamic and captivating learning experiences by

integrating simulations virtual experiments, and practical application. These not only improve students' understanding of scientific topics but also ignite curiosity and excitement for the subject. Moreover, emerging contemporary technologies has the capability to promptly offer feedback to both students and teachers, facilitating quick intervention and adaption of tactics (Rose and Kim, 2018). In Nigeria, where access to high-quality education may vary the potential advantages of emerging contemporary in scientific education include narrowing educational disparities, enhancing educational achievements, and equipping students for a future when technology is more integrated into every part of life. Furthermore, the respondents expressed serious concerns about several problems that impede the successful use of potentials. Some of the major setbacks identified are poor internet service, lack of fund, technophobia, inability to use search engine, negative attitude, and information overload, download delay, power outage as well as epileptic power supply. These problems are interconnected and surmountable through the combination of efforts by the shareholders. This confirms to the findings of Spector (2013) that the problems of emerging contemporary technologies are interrelated and it is not possible to address just one without taking into consideration the others.

Conclusion

This research work discusses the growing need to tackle the problems that hinders the potentials of emerging contemporary technologies in teaching and learning of Basic science in Imo State. The results signify that the potentials of emerging technologies are increasingly significant and central to the achievement of teaching /learning of Basic Science in the 21st century. From the study it is crystal clear that emerging contemporary technologies help to modify outdated contents and methods used in the traditional teaching and learning process which often position the teacher as master, oracle or sole disseminator of knowledge. Therefore, emerging contemporary technologies are an interactive media format that makes the delivery of educational services easy for lectures through Information communication technological devices.

Recommendations:

1. Students should be encouraged to use emerging contemporary technologies by interacting with students on them.
2. Tertiary institutions should provide free Wi-Fi for students to use to master the potentials and have knowledge of contemporary technologies
3. The Government and stakeholders should work in synergy to alleviate the problems of emerging contemporary technologies, especially the provision of funds.

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