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Emerging Technology and Innovative Pedagogy for Entrepreneurship Education in the Digital Age

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ABSTRACT

The digital age demands a transformative approach for entrepreneurship education, one that foster adaptability, creativity and innovation, this paper explores innovative pedagogies that redefine entrepreneurship education, preparing students for success in a rapidly changing world, examining the cutting- edge methods such as gamification, simulation, micro-learning, and project-based learning which emphasize experiential learning, collaboration and digital literacy, this research highlights the effectiveness of these approaches in developing entrepreneurship mindset, skills, and competences, this also discusses the integration of emerging technologies like AI, blockchain, adaptive learning, gamification, and IOT enabling immersive and interactive learning experiences. The findings of this study provide insights for educators and policymakers seeking a create new generation of entrepreneurs equipped to thrive in the digital economy, by embracing innovative pedagogies, which will unlock the full potential of entrepreneurship education, driving innovation economic growth, and societal impact. The findings indicated that creativity and critical thinking skills are required for effective integration of technology into entrepreneurship education with mean and percentages of skills of 53.58% which is the most important skill needed for entrepreneurship education followed by Creativity (39.83%) while Communication has the lowest importance (6.58%). concluded that critical thinking and creativity are essential for entrepreneurship education in our schools. Additionally, it also found that Virtual Reality and Augmented Reality are emerging technologies that enhances the integration. with 45.67% is the most effective emerging technology in enhancing entrepreneurial mindsets and skills, followed by Augmented Reality (39.25%) while Blockchain Technology (15.08%) is the least effective emerging technology in enhancing entrepreneurial mindset and skills. The research highlights the importance of developing a digital-age entrepreneurship education framework to prepare future entrepreneurs for an evolving business landscape.

1. Introduction

In the digital age, the landscape of education has undergone a transformative shift with emerging technologies and innovative pedagogical approaches creating new opportunities for entrepreneurs to thrive. the convergence of digitalization, global connectivity, and the growing emphasis the entrepreneurship within the education realm has given rise to a dynamic field known as entrepreneurship'' where the boundaries between education, technology and entrepreneurship are blurred.

Digital technologies can be defined as the set of technologies which is based on electronics calculations, transformation, analysis including online resources, learning management systems, programs, Apps and tools such as phones, laptop, tablets, internet of things, social media, and artificial intelligence, which is used in the provision and the use of learning technologies, considered as a central component for innovation. Luo, et al., (2025). In the realm of education, a teacher is an individual who strives for excellence, constantly seeking innovative approaches in the field of teaching which also aligns with the understanding and subsequent development of instructional methods in the present era, known as the 21st Century or modern period. Implementing teaching pedagogy as an innovative technique in teacher education prompts the teacher to pose a multitude of inquiries prior to, during, and subsequent to the teaching endeavor. Academics will agree or reluctantly admit that the change in education, particularly when issues of curricula and pedagogy is in question, it is hard-fought battle, rarely won by innovators. Still like most institutions, traditional higher education finds it difficult to comprehend. (Zhang, 2021).

Integration of emerging technologies of interdisciplinary approach to solve complex problems, mirroring real-world scenarios , focusing on sustainability and environmental sciences that we enable students to become environmentally conscious citizens and contribute to a sustainable future; Collaboration and global connectivity and partnerships will expose students to diverse perspectives and enhance their understanding of the global scientific community; Ethical considerations and scientific literacy that will enable students to critically evaluate the impacts of scientific advancements on individuals, communities, and society as a whole. In the realm of education, a teacher is an individual who strives for excellence, constantly seeking innovative approaches in the field of teaching.

The term "Edupreneur" combines the more common words "Educator" and "Entrepreneur." Literature and skilled population are the foundation stone of a growing economy. The term `Edupreneur means is a person who ventures into educational sector and starts an educational institute of his/ her on own. Edupreneurship refers to the application of entrepreneurial principles in the field of education (Nurhayati & Kristiyanti, 2024). Edupreneurs identify gaps in the educational system and develop innovative solutions to address these needs. Edupreneurs bring a fresh perspective to traditional educational practices, fostering innovation and creativity. They often focus on developing tools and resources that enhance teaching efficiency and effectiveness, such as digital platforms, learning management systems, and organizational tool, additionally, it evaluates the real-world impact of the teachers' pedagogical competencies and children learnings outcomes, offering valuable implications for educational practice and policy. By bridging the gap between educational entrepreneurship practice and policy, also educational entrepreneurship and practical teaching tools.

Edupreneurship known as a consequential category of entrepreneurship which arose due to the market opportunity in educational sector. Pedagogical reforms are essentials to enhance teaching and learning practices in Nigeria's education system. They aim to improve the quality of education by adopting innovative teaching methods, enhancing teachers training programs, updating curricula to meet current needs, incorporating technology in classroom styles, and promoting learner-centered approaches. These reforms are crucial as they provide opportunities for students to develop critical thinking, problem-solving, and lifelong learning skills. The use of teaching pedagogy as an innovative technique in teacher education is related to the reflective teachers' endeavor to elevate their teaching to a standard level, while considering the reflective consequences (Jasper 2003; Juliet et al., 2024). Edupreneurs are one of the most important stewards of learning as an economic resource. Among the various entities that serve the vitally important but often under-appreciated third sector of education, they are the most likely to have the agility, flexibility, and creativity needed to meet rapidly evolving learning needs across our global economy. The successful educator helps to break down the boundaries, opening up the movement of learning from one to many, from localized to global, from the past and present into the future. Edupreneurs intends to make this shift in the context of labor market that will recognize and reward them for the value they create. Learners who trust they will be transformed through new knowledge, skills, and behavior gladly compensate the edupreneur who can provide the transformation.

The rise of entrepreneurship in the digital age brings about rapid advancements in digital technologies have revolutionized the way we approach education, transforming both the delivery and the content of learning (Srivastava, 2023). The proliferation of online and virtual learning platforms, the integration of artificial intelligence and augmented reality and virtual reality into pedagogical tools and the increasing emphasize on data given decision -making have all contributed to the emergence on the new educational paradigm (Srivastava,2023), the shift has open a new avenues

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for entrepreneurial minded individuals to leverage technology and innovation to address pressing educational challenges giving rise to the concept of entrepreneurship . The integration of emerging technologies in teaching and learning process is no longer a choice but a need for educators considering the level of infusion of technology on education particularly as it relates to the changing learning environment, demand for flexibility in methodology, and the need to enhance creativity and innovations in learning. The future transformation of science education involvement is poised to revolutionize the way students learn and engage with scientific concepts. Through inquiry-based learning, integration of emerging technologies, interdisciplinary approaches, and a focus on sustainability, students will be better prepared to navigate and contribute to an ever-evolving scientific landscape. entrepreneurship, may be defined as the "successful exploitation of ideas, into new products, processes, services or business practices.

Mezieobi, et al., (2015), educational research and development have shown various novel teaching strategies that can be applied equally effectively. The following instructional models were listed: individualized instruction, computer assisted instruction (CAI), mastery learning, programmed instruction, flexible scheduling, team teaching, advance organizer, concept mapping, future wheel instructional model, modular instruction, enter-educate instructional model, and micro teaching. Among these, micro teaching is likely the most popular in the Nigerian educational system. In the face of these emerging technologies and innovative education, there is absolute need to acquit the school players with the knowledge of these technologies, sufficiently and adequately supply the relevant educational resources both in quality and quantity and most importantly ensure its application in Nigerian schools. In all honesty, practical teaching of entrepreneurial courses or trade just like other courses of study requires complete awareness, and usage of the emerging technologies and satisfactory provision of educational resources which could be human and non-human. This study therefore aims to explore the intersection of emerging technologies, innovative pedagogies in the context of edupreneurship education, highlighting the potential for this synergy to foster a new generation of digitally savvy and socially conscious entrepreneurs.

1.1. Research Questions

1) Which skills do the surveyed teachers consider important for entrepreneurship education?
2) Which emerging technologies do the surveyed teachers perceive as useful for developing entrepreneurial mindsets and skills?
3) Which innovative pedagogical approaches do the surveyed teachers consider suitable for entrepreneurship education?
4) What challenges do the surveyed teachers report in integrating emerging technologies into entrepreneurship education?

2. Literature Review

Emerging Technologies play a vast role in the educational process. The application of emerging technologies in education is changing learners' experiences both inside and beyond the classrooms. (Edeh & Onyema, 2020) stated that there is an evolving relationship between education and technology, and the evolving pedagogies have also taken advantage of newly designed or emerging technologies. Oliveira et al. (2019) carried out a review of literature on emergent technologies from the field of science education. The study shows that emergent technological artifacts such as computer simulations, virtual labs, mobile devices, robots, games, and digital photography and drawing are increasing the experience of learners.

Berland and Wilensky (2015) conducted a study 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 using the virtual system were more likely to employ a top-down ("aggregate") perspective. Edgar, et al., (2017) conducted a study on "Emerging technologies in education: A systematic review of the literature published between 2006 and 2016". The result shows that Education Technology is contextual and evolving and which improves the critical thinking and problem-solving skills on students. Corinne (2018) conducted a study on "emerging technologies in higher education and the workplace: An assessment". The study shows that digital revolution poses a double challenge to higher education: in the methods and practices of learning and of teaching.

Emerging technologies are those innovative changes that were introduced in education to facilitate goal achievement. They are electronically driven facilities that foster teaching/learning effectiveness. In consonance with the above avowals, Ukonu (2020) posited that emerging technologies are electronic devices plowed into the educational enterprise which involves computer-based classroom interactions, video conferencing, zoom e-mail, and entire social media applications. To give credence to the above assertion, Digital Learning Network (2019) viewed emerging technology as an overhauling of teaching/learning barriers thus making the experience more accommodating to both the teacher and the learner. It is a way of energizing teachers to create a learner-friendly atmosphere that the present generation requires. It makes education stress-free, more accessible, and quicker.

In support of the above declarations, Onyema et al. (2019) recognized emerging technologies as synonymous with

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Information Computer Technology (ICT) by describing ICT as an essential tool in teaching/learning situations that has unlocked the key to digitalizing classroom facilities. This is made possible by replacing the chalk/marker board with digital whiteboards which are of various forms like the use of smartphones, flipped classrooms and so on. Flipped classroom is a device that enables the students to listen to the lectures at home and divert the period for classroom behavior to other relevant exercises thus enhancing performance, Other e-learning devices are as follows: (1) tablets, these are mini computers that do not require keyboard or mouse to input data, it makes use of touch screen as input device; (2) interactive whiteboards, which is also referred to as smart boards, this makes it easy to showcase pictures, diagrams or any other learning materials to the students, images so projected could be moved about and/or operated according the teacher's desire to put the message across to the students; (3) e-reader, this is the kind of device that have a large compilation of thousands of books in a converged form otherwise called digital form. It provides a wide range of reading materials and makes personal study habit; (4) gamification, this is a series of games which is intended to impart desired knowledge and skills; (5) mobile phones (Omemu, 2020) this is the type of smartphone that is widely used by the students due to its moderate price when compared to other smartphones. It is used for WhatsApp, radio, television, YouTube, tweeter etc.

In line with the following expressions, that e-learning which the emerging technologies denote include but not limited to: (1) Synchronous online learning--this is an online fact to face teaching/learning process which is made possible through the use of webinars', video conferencing etc. It gives room for asking questions and getting instant answers through chats sessions and raise hand symbols. (2) Adaptive e-learning, a kind of e-learning that creates a scenario for the learner to be proactive because the subject matter is attuned to the needs, aims and objectives of the learner. (3) Linear e-learning, this is a kind of e-learning that involves the instructor and the learner; the learner is passive because there is no opportunity for interactive session because it is cup and jug type of learning; example is the teaching on air. (4) Interactive online learning--just as the name suggests, it is a participatory online teaching/learning behaviours which fosters progressive performance; the instructor and the learners are active during the session. (5) Collaborative online learning, this is a kind of online group discussion class which could be between students themselves or teachers and students; it calls for collective participation and sharing of ideas, skills or knowledge with an anchor man (Uwaezuoke, 2020).

With regards to (Gess, et al, 2021) A substantial body of research highlights key entrepreneurial skills, yet there is limited evidence on effective methods for teaching entrepreneurship. On the subject Ioanna Bellou, et.al (2016) Emerging technologies and innovative pedagogical approaches are reshaping entrepreneurship education, fostering creativity and adaptability in the digital age. Speaking about Sampson, et al. (2018). Digital technologies serve as a catalyst for sustainable innovation, enabling transformative teaching and learning practices in entrepreneurship education within the digital age.

Terry, (2022) Emerging educational technologies, such as AI-driven tools and immersive learning platforms, are paving the way for innovative pedagogies that enhance entrepreneurship education in the digital age. Apparently, emerging technologies is an innovation ploughed into education to tackle some teaching and learning challenges both on the part of the teachers and the learners as well. It is for this reason that Eimuhi and Aiwuyo (2022) posited that emerging technologies is set out to modify teaching/learning efficacy as it is very accommodating, fosters exploration, promotes positive teaching/learning outcomes among students and enhances teachers' job performances to a desirable level. As an innovation in education, emerging technologies should start from the basement which is the secondary education so as to enable the learners master and internalize various aspects of it and exhaust all the benefits therefrom for qualitative, functional and innovative education.

3. Methodology

The study employed descriptive survey research design. The population of the study consists of all the teachers and the targeted population was 1,200 teachers and higher education institutions for the study. Stratified random sampling technique was used. The instrument was self-designed and entitled "Emerging Technologies and Innovative pedagogy for Ideapreneurship Education in the digital age Questionnaire" (ETIPEDAQ). The instrument has two sections; A and B. Section A was used to demographic information from the teachers, example Age, Gender, Educational Level, Year of teaching Experience and Subject taught while Section B was used to draw Emerging technologies, Innovative Pedagogy, Entrepreneurship Education. The instrument has 3 items in each section. The response is familiar, not familiar, and somewhat familiar type which involves all the participants to get the percentage for each question. 50% benchmark of the percentage score indicates the awareness while below 50% is applicable to the unawareness of the digital devices. Face and content validity were ensured. Test re-test method was used to determine the reliability of the instrument. The scores obtained were subjected to Cronbach Alpha Correlation Coefficient which gave rise to 0.79. Simple percentage was used to answer the research questions. The administration of the instrument was carried out by the researchers and five trained research assistants. The responses were retrieved from the participants and used for data analysis.

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4. Data Analysis and Results

Research Question One: What skills are most important for entrepreneurship education?

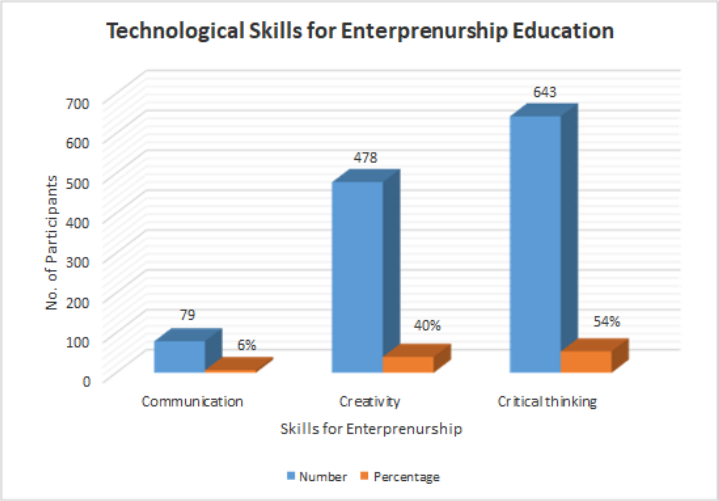


Figure 1. Skills for Entrepreneurship Education

From Figure 1, it is observed that Critical thinking with 643(54%) is the most important skill needed for entrepreneurship education followed by Creativity 478(40%) while Communication has the lowest importance 79(6%). It can be concluded that critical thinking and creativity are essential for entrepreneurship education in our schools.

Research Question Two: What are the most effective emerging technologies in enhancing entrepreneurial mindsets and skills?

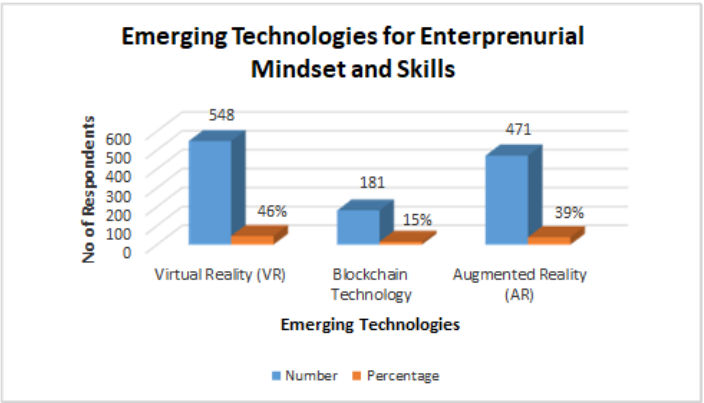


Figure 2. Effectiveness of Emerging Technologies in Enhancing Entrepreneurial Mindsets and Skills

From Figure 2, it is observed that Virtual Reality with 548 (46%) is the most effective emerging technology in enhancing entrepreneurial mindsets and skills, followed by Augmented Reality 471(39%) while Blockchain Technology 181(15%) is the least effective emerging technology in enhancing entrepreneurial mindset and skills. It can be concluded that virtual and augmented reality are effective technologies for strengthening entrepreneurial mindsets and skills.

Research Question Three: What innovative Pedagogy is most effective for entrepreneurship education?

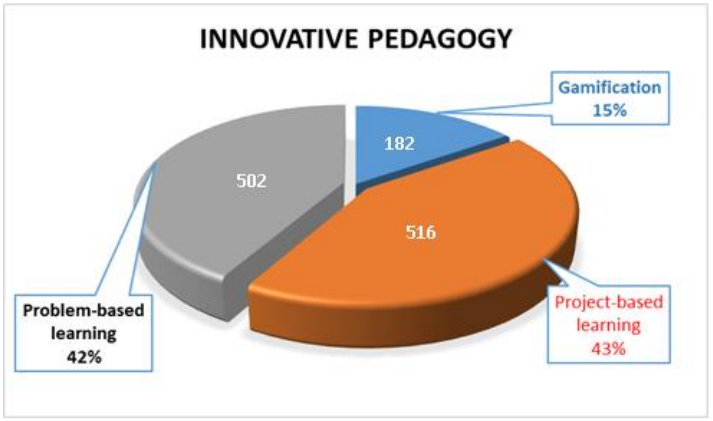


Figure 3. Innovative Pedagogy for Entrepreneurship Education

Figure 3 shows that project-based learning 516(43%) is the most effective innovative pedagogy for entrepreneurship education, followed by problem-based learning 502(42%) and the least effective innovative pedagogy for entrepreneurship education is gamification 182(15%). It can therefore be concluded that project-based and problem-based learning are more effective innovative pedagogies for entrepreneurship education in our schools.

Research Question Four: What are the challenges of integrating emerging technologies on student's entrepreneurial education?

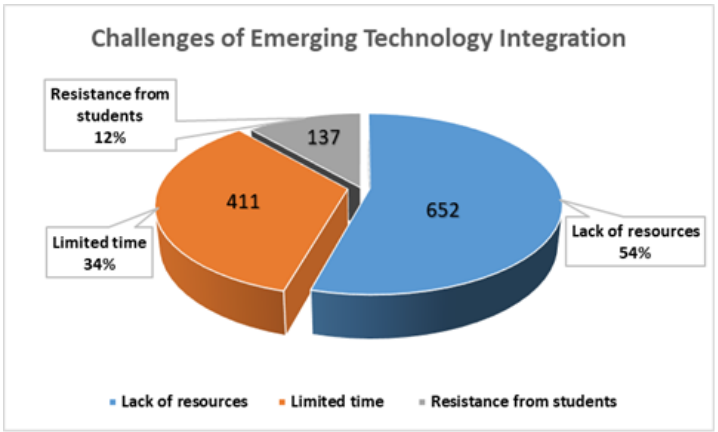


Figure 4. Challenges of Integrating Emerging Technologies on Student's Entrepreneurial Education

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From Figure 4, it is observed that lack of resources 652(54%) is the most challenging factor against integrating emerging technologies into students' entrepreneurship education, followed by limited time 411(34%) and the least challenge is resistance from the students 137(12%). It can therefore be judged that limited resources and time are the major challenges facing during integration of emerging technologies into students' entrepreneurship education in our schools.

5. Discussion

The findings indicated that critical thinking and creativity received the highest percentages among the entrepreneurial skills examined. This suggests that respondents placed considerable emphasis on students' ability to analyze problems and generate ideas. These skills may support opportunity identification and business decision-making, although the findings represent respondents' selections rather than an objective ranking of entrepreneurial competencies.

Virtual reality and augmented reality received higher percentages than blockchain technology among the emerging technologies examined. This pattern indicates a relative preference for immersive technologies among respondents. Their practical application in entrepreneurship education, however, depends on accessibility, infrastructure, teacher preparedness, and alignment with learning objectives. The descriptive findings do not establish that these technologies produce better learning outcomes.

Project-based learning and problem-based learning were the most frequently selected pedagogical approaches. Both approaches may provide opportunities for students to investigate business problems and develop practical solutions. The relatively small difference between their reported percentages does not establish the superiority of one approach over the other.

Lack of resources and limited time were the leading reported challenges. These findings highlight the need to consider institutional capacity, access to technology, and instructional planning when developing technology-supported entrepreneurship programmes. Further research should examine how these factors influence implementation and student learning outcomes.

Overall, the findings provide a descriptive account of respondents' perspectives on entrepreneurship education. Their interpretation should take account of the sampling procedure, questionnaire design, and limitations of frequency-and-percentage analysis. The findings should not be interpreted as evidence of causal relationships or the comparative effectiveness of the technologies and pedagogies examined.

6. Conclusion

This study examined respondents' perspectives on entrepreneurial skills, emerging technologies, innovative pedagogies, and challenges associated with technology integration in entrepreneurship education. Critical thinking and creativity received the highest percentages among the skills examined, while virtual reality and augmented reality received the highest percentages among the technologies. Project-based and problem-based learning were the most frequently selected pedagogical approaches. Lack of resources and limited time were the leading reported challenges.

These findings provide descriptive evidence that may inform decisions concerning technology-supported entrepreneurship education. Educational institutions should consider the development of entrepreneurial competencies, the suitability of digital technologies and pedagogical approaches, and the availability of resources when planning instructional activities. However, the findings do not establish the comparative effectiveness of particular technologies or pedagogies. Further research using appropriate evaluation methods is needed to determine their effects on students' entrepreneurial knowledge, skills, and learning outcomes.

7. Recommendation

Based on the findings, the following recommendations are proposed:

i. Teachers should incorporate learning activities that develop critical thinking, creativity, and problem-solving skills in entrepreneurship education.

ii. Educational institutions should assess the suitability, affordability, and accessibility of emerging technologies before integrating them into instructional activities.

iii. Project-based and problem-based learning should be considered for activities involving business planning, problem-solving, and the development of entrepreneurial solutions.

iv. Educational stakeholders should assess resource requirements and instructional time when planning technology-supported entrepreneurship programmes.

v. Further research should evaluate the learning outcomes associated with different technologies and pedagogical approaches using appropriate research designs.

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