USING TECHNOLOGY FOR COLLABORATIVE LEARNING: AN INNOVATIVE APPROACH TO ONLINE PEDAGOGICAL PRACTICE IN THE NIGERIAN CONTEXT

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Abstract

This study examines the potential of leveraging technology to enhance collaborative learning in online pedagogical practice within the Nigerian educational context. Through a comprehensive review of literature and case studies, the paper explores innovative approaches to technology-enhanced collaborative learning being implemented in Nigerian institutions. Key findings highlight that when properly designed and implemented, technology-supported collaborative learning can expand access to education, improve learning outcomes, and develop critical 21st century skills among Nigerian students. However, successful implementation requires careful adaptation to local realities, including infrastructure limitations, varying levels of digital literacy, and cultural factors. The paper identifies best practices such as utilizing affordable and accessible technologies, employing culturally-responsive pedagogical designs, providing sustained faculty development, and fostering supportive institutional ecosystems. Challenges including inadequate ICT infrastructure, socioeconomic barriers, and low digital literacy levels are also discussed. The study concludes that technology-enhanced collaborative learning represents a paradigm shift in Nigerian education, aligning with both modern educational goals and traditional Nigerian principles of community knowledge-building. Recommendations are provided for educators, institutions and policymakers to effectively leverage technology for collaborative learning in the Nigerian context.

Keywords: Collaborative learning, Pedagogical practices, Nigerian Online Education, Technology

Introduction

Education in Nigeria is in the middle of a revolution that is being brought about by technological innovations and evolving pedagogical paradigms. One of the most effective instructional strategies that have been identified to meet the modern educational objectives is collaborative learning, an educational strategy that focuses on student interaction, joint knowledge building, and collective problem solving. This is a change of the teacher-centered models to more dynamic learning environments where knowledge is co-constructed by engaging in meaningful interactions among learners.

The last few years have seen a major increase in the use of technology in educational institutions in Nigeria, and the COVID-19 pandemic has only served to increase the pace of the switch to online and hybrid learning. The integration of technology has opened up new opportunities in collaborative learning experiences that have never been experienced before in terms of geographical location and time. In fact, as Aliyu (2017) found in his research of Nigerian tertiary institutions, collaborative learning enabled by technology is one of the potential avenues through which the longstanding issues of the Nigerian educational system, such as the lack of

access to quality education, overcrowded classes, and the necessity to acquire essential 21st-century skills, can be resolved.

In this paper, it is argued that technology can be effectively used to promote collaborative learning in online pedagogical practice in the Nigerian context of education, leading to higher levels of engagement, better learning, and the acquisition of 21 st century skills. This study adds to the discourse of educational innovation in the developing economies by looking at the theoretical basis, practical implications and the situational factors of technology-enhanced collaborative learning in Nigeria.

The theoretical basis of collaborative learning and the analysis of the potential of different technologies to facilitate collaborative learning experiences will be discussed in the following sections, as well as the case studies of successful implementations in Nigerian institutions, best practices of educators, and challenges peculiar to the Nigerian environment, and recommendations to future research and practice. The analysis will be based on the global research, as well as the research carried out in Nigeria and other African countries, which will give a full picture of how the technology-enhanced collaborative learning can be modified to address the needs and limitations peculiar to the Nigerian educational context.

Literature Review

Conceptualizing Collaborative Learning: Theoretical Foundations

Collaborative learning is a result of social constructivist theories of knowledge acquisition and is mostly based on the idea of a zone of proximal development introduced by Vygotsky (1987) that focuses on the social aspect of learning and the significance of peer interaction in cognitive development.

Collaborative learning is a formal process that enables team members to interact with each other in order to build collective meanings. It is based on the constructivist theory, especially social constructivism, which focuses on the significance of reciprocal interaction in the process of knowledge construction (Madzimure, 2020). This is in line with collaborative learning that emphasizes active engagement and sharing of knowledge in group work. The sociocultural perspective of collaborative learning has been developed as the theoretical basis over the cognitive one, particularly in the setting of second language learning (Wen, 2019). Computer-supported collaborative learning (CSCL) and computer-supported cooperative work (CSCW) are based on collaborative cognition theories, which conceptualize group activities as the individual participants in the group processes within the larger community settings. The theoretical approaches emphasize the possibility of collaborative learning to improve academic, social, and psychological dimensions of learning due to peer interactions and knowledge co-construction (Madzimure, 2020).

Benefits of Collaborative Learning

The studies have always shown complex advantages of cooperative learning methods.

The collaborative learning model has been proven to be very helpful in the Nigerian education system. It improves the problem solving, communication and collaboration of students in the teaching of chemistry. This method also enhances academic performance and lowers the level of anxiety through balancing chemical equations. Collaboration learning supports improved understanding and complete involvement of students in tertiary learning.

Also, it builds oral communication skills that are essential to academic and professional success (Aliyu, 2017). Collaborative learning demands a change in the teaching strategies whereby the educators abandon the traditional lectures and become facilitators of student interaction. These studies indicate that the introduction of collaborative learning in the Nigerian schools can result in the better learning outcomes, critical thinking, and the overall student engagement at different educational levels and subjects.

Technology in Education: Evolution and Impact

The use of technology in education has changed significantly over the past decades, and it has advanced to the use of complex digital learning environments. This has changed the potential of collaborative learning by eliminating time and space constraints to collaboration, and offering new means of knowledge co-construction and representation.

The use of technology in the Nigerian education sector has not been without challenges as well as prospects. Although Information and Communication Technology (ICT) has greatly influenced the delivery of curriculums in tertiary institutions, which has resulted in the transformation of teaching strategies and learning environments (Salako & Sodeinde, 2024), its complete adoption is hindered by challenges, including power shortages, technical expertise, and the cost of hardware. The COVID-19 pandemic revealed the poor use of technology in the education sector in Nigeria, where many children have poor access to the internet, which limits high-quality education. More so, the gradual incorporation of Information Technologies (ITs) and Information Systems (ISs) in teacher education programs has caused stakeholder dissatisfaction (Ololube, 2015). Nevertheless, e-learning has become an important learning and teaching tool in the 21st century, where it is recommended that governments invest more in ICT infrastructure and its adoption by tertiary institutions (Salako & Sodeinde, 2024).

Online Collaborative Learning: Effectiveness and Challenges

Online collaborative learning has been effectively documented in the world literature. The extensive survey of the literature on online collaborative learning conducted by Ikwunne et al., (2021) revealed that there are positive results in all educational settings, with enhanced content mastery, higher-order thinking skills, and learner satisfaction being the most common ones.

Collaborative learning online in Nigeria is a major challenge even though it can improve the educational outcomes. Research has indicated that this is capable of enhancing postgraduate performance in science education (Ajayi & Ajayi, 2020). Ikwunne et al., (2021) offer alternatives in case of interruptions, including the COVID-19 pandemic. Nevertheless, such challenges as unstable Internet connection, power cuts, and technological resource scarcity are major barriers (Akaeze & Akaeze, 2024). Adoption is also impeded by socioeconomic, sociocultural and IT infrastructure factors (Abdulmajeed et al., 2020). To resolve these problems, researchers proposed to introduce strong learning management systems (Ikwunne et al., 2021) and enhance the Internet and power infrastructure. Also, it is important to improve training and institutional support of lecturers (Akaeze & Akaeze, 2024). Notwithstanding these challenges, online collaborative learning has a potential of scaling up education and enhancing accessibility in the higher education system of Nigeria.

Technology-Enhanced Collaborative Learning Strategies

Technologies Supporting Collaborative Learning in the Nigerian Context

The environment of collaborative learning technologies in Nigeria is a combination of the global trends and local responses to the infrastructural difficulties and the lack of resources. There are a number of types of technology that have been found to be especially useful in facilitating collaborative learning in Nigerian learning institutions.

Learning Management Systems (LMS)

LMS is a system that offers a formal framework of delivering a course, sharing content, and collaborating.

Learning Management Systems (LMS) have a lot of challenges in adoption in the Nigerian tertiary institutions though they have a lot to offer in teaching and learning. The use and issues of Learning Management Systems (LMS) in the tertiary institutions in Nigeria have been studied recently. The studies have shown low to zero adoption rates in most institutions (Chioma et al., 2018). Using the Technology Acceptance Model, factors affecting the acceptance of LMS in the context of Nigerian instructors have been explored, where the perceived usefulness and ease of use have been found to be substantial (Yakubu & Kah, 2020). An extensive literature review on the period between 2008 and 2024 indicated that although the implementation of LMS has had positive effects on teaching and learning, a significant number of institutions are yet to adopt it (Austine et al., 2024). Most of the research has been conducted on universities and the main data collection tool has been questionnaires. Although the use of LMS can be beneficial to the teaching process due to its flexibility and positive influence on the interactions between students and instructors, the adoption of LMS in most Nigerian tertiary institutions remains a challenge (Chioma et al., 2018; Austine et al., 2024).

Mobile-Based Collaboration Tools

Since Nigeria has a mobile-first digital environment, where mobile Internet penetration is much higher than fixed broadband, mobile-based tools of collaboration have been particularly successful.

Collaboration tools that are mobile are becoming relevant in Nigerian environments, especially in academic and professional environments. Nigerian university postgraduate students view e-collaboration as a positive tool in terms of projects and research and use email, social media, and Google Documents (Tella, 2023). The positive perception of mobile technologies by university lecturers is also related to research collaboration as they are useful and easy to use (Samuel et al., 2018). Building Information Modelling (BIM) is an emerging collaborative tool in the construction business, but its application has been struggling against a number of challenges, including insufficient infrastructure and skilled labour. The example of mobile collaboration tools (MP-Collaborator) shows that it is possible to enhance communication within organizations through the use of context-aware and location-based technologies. In spite of the identified advantages, there are still challenges, such as power outages, inefficient Internet connection, and low understanding of ethics of collaboration (Tella, 2023).

Social Media Platforms

Most institutions in Nigeria have re-engineered social media platforms as collaborative learning platforms.

The use of social media has become more common in Nigeria, especially among the 16-25 age group, where 99 percent of the population has a social media account and 95.2 percent of them use their

smartphones to access it (Mbanaso et al., 2015). The most used platforms to do so are Facebook and WhatsApp (Mbanaso et al., 2015). Nevertheless, the use of social media by Nigerian universities is low (19 percent) despite the high usage by the students (Amali et al., 2018). Social media is a useful instrument of political engagement, particularly among young adults aged 25-34, which allows the spread of information and mobilization (Ofei et al., 2024). It also has the possibility of social mobilization and development, which offers new forms of engagement. The issues are the proliferation of fake news, hate speech and privacy (Ofei et al., 2024). In order to resolve these problems, it is suggested to introduce media literacy programs and strong regulations (Ofei et al. 2024).

Pedagogical Strategies for Technology Integration

Pedagogical approaches to technology-enhanced collaborative learning must be well-considered and take advantage of the technological affordances, as well as overcome the possible drawbacks. A number of pedagogical approaches have been promising in the Nigerian schooling environment.

Project-Based Learning

Project-based learning (PBL) is a competent student-centered method that improves critical thinking, collaboration, and communication (Isa & Kamin, 2019). PBL has been promising in a number of educational settings in Nigeria. It has been discovered to enhance the development of entrepreneurial skills, creative thinking and problem solving skills in higher education (Kristiawan et al., 2021). PBL has also influenced the performance of students in secondary schools in subjects like descriptive geometry positively (Abubakar et al., 2020). The combination of PBL and design thinking approaches and visual programming, including Scratch, has proved a potentially effective way to promote STEM-related education and decrease the educational gap in developing countries, including Nigeria (Sakpere, 2024). Although effective, PBL is yet to gain popularity in Nigerian tertiary institutions. Among the effective implementation strategies, one can mention the redesign of curricula to emphasize learner-centered strategies and workshops with educators to introduce them to PBL practices (Isa & Kamin, 2019).

Inquiry-Based Learning

Inquiry-based methods place students as researchers who work together in finding answers to meaningful questions. Inquiry-based learning (IBL) is becoming popular in Nigeria in science education but its application is challenged. The pedagogy of IBL is not understood by teachers, and they have difficulties with its implementation (Bako, 2020). Nevertheless, it has been demonstrated that IBL may dramatically enhance oral and written communication skills of students, foster learner autonomy, and increase content knowledge (Iwe et al. 2022). The use of IBL in the form of digital technologies like Go-Lab has been promising in African secondary schools, but it needs the training of teachers and sufficient infrastructure (Coenders et al., 2020). The majority of Nigerian teachers are convinced that IBL could help address learning challenges in Basic Science, yet they have to deal with the absence of resources, large classes, and inadequate time. Nevertheless, IBL methods are deemed to be positive to students, as they enable them to think over their thoughts and construct knowledge on their own.

Online Discussions and Forums

Online discussions made easier allow collaborative knowledge building in the form of structured discussions. E-learning and social interaction in Nigeria

has become significant through online discussion forums (ODFs). Researchers have established that ODFs improve knowledge-building and communication between students (Adetimirin 2015). Computer self-efficacy and anxiety are the factors that have a significant impact on ODF usage among postgraduate students (Adetimirin 2015). Despite ODFs offering avenues to read news and exchange opinions, they have been criticized over the rampant use of abusive language and divisive arguments on religion, politics, and ethnicity (Omotosho, 2020). Socratic questioning, personal opinion sharing, and brainstorming are the common patterns of participation among undergraduates. Intellectual support and knowledge sharing are the advantages of ODFs, but the participation is hindered by challenges, including power outages and time constraints. In order to enhance ODF use, universities are recommended to offer free Internet services, and one should strive to overcome the drawbacks of online discussions (Omotosho, 2020).

Exemplary Collaborative Learning Activities

Several institutions have developed innovative technology-enhanced collaborative learning activities that are adapted to Nigerian realities.

Virtual Field Research

Collaborative learning strategies online have been revealed to improve the learning outcomes and retention of postgraduate students in science education (Ajayi & Ajayi, 2020). Collaborative virtual laboratories have proven to have positive impacts on the achievement levels of secondary school chemistry students without any significant gender differences. The joint learning experience has also been identified to have a positive impact on learning engagement and e-satisfaction among the Nigerian university students in the COVID-19 pandemic (Saputra et al. 2022). To overcome the problem of overcrowding in classrooms and scarcity of resources, a synchronous virtual learning system has been suggested in the Nigerian universities that combines the e-learning portals with video conferencing to enable virtual classrooms. The findings indicate the possibility of collaborative and virtual learning methodologies on enhancing educational outcomes in Nigeria.

Cross-Institutional Knowledge Exchange

Northern and southern Nigerian Universities (University of Maiduguri and University of Calabar) developed a collaborative learning program that bridged the gap between students in different regions by organizing online debates and other problem-solving tasks aimed at developing solutions to national development issues. This program did not only improve academic knowledge, but also helped in national unity, creating a sense of understanding among the different regions of Nigeria.

The recent research has been done on knowledge sharing among academics in the Nigerian universities. Research has revealed the existence of cooperation in the form of workshops, seminars, conferences, and professional associations (Abbas, 2017). Different technologies are applied by academics to share information, and they include computers, mobile phones, and Internet facilities, but the use differs depending on the country. The reasons that challenge knowledge sharing in Nigerian universities are insufficient resources, research support, and negative attitudes. The support systems in universities are important in encouraging knowledge sharing and innovation by students, and some of the suggestions include technology patenting, seed funding, and business incubators (Olokundun et al., 2017). Examples of academic collaboration among

Nigerian academics are co-publication, co-data collection and analysis, and co-presentation of workshops. The tools of communication in the dissemination of research are phones, emails, web forums, and social networking sites (Abbas, 2016).

Case Studies: Innovative Approaches in Nigerian Online Pedagogical Practice

Case Study 1: Federal University of Technology, Minna - Hybrid Collaborative

The Federal University of Technology, Minna, has ventured into the use of hybrid and e-learning in order to improve engineering education. Although the university has tried to adopt the ICT infrastructure, mainly on administrative basis, there exist difficulties in its accessibility and use in teaching and learning. The lecture halls as physical learning spaces have problems with thermal comfort and furniture layouts that do not support student-teacher interactions (Alfa et al., 2019). In order to solve these problems and meet the Education 4.0, universities are implementing hybrid teaching models, which introduce digital technologies, including Digital Twins. The effective application of a Hybrid Teaching Factory model showed that it could expand the pedagogical aspects, enhance teamwork, and guarantee cyber security in engineering education (Mourtzis et al., 2022). These reports indicate that more investment in ICT infrastructure, flexible learning classrooms and new methods of teaching need to be invested in order to improve the quality of university engineering education.

Case Study 2: National Teachers' Institute - Rural Teacher Professional Development

In Nigeria, the National Teachers Institute (NTI) is at the centre of promoting teacher quality using professional development programmes (Shuaibu et al., 2022). The institute addresses the issues that rural educators face, such as physical isolation, the lack of resources, and various duties (Glover et al., 2016). However, the effectiveness of the programmes is still debatable. The results show that NTI has a positive effect on the quality of education in Nigeria (Shuaibu et al., 2022), and some findings show that it does not have a significant impact on student outcomes or teaching practice. The literature defines effective professional development as one that focuses on a particular teaching practice, provides graduate experiences, and promotes inter-teacher collaboration (Glover et al., 2016). Although the programmes are associated with significant financial investment, their role in reducing the achievement gap between rural and urban students does not seem to be significant. A lifelong learning is still vital in improving the Nigerian education system and nurturing future leaders.

Challenges and Future Directions

Challenges in Technology-Enhanced Collaborative Learning in Nigeria

Collaborative learning with the use of technology has a significant potential in the education system of Nigeria, but there are still several barriers that need to be addressed on the long-term basis.

The systematic use of technology-enhanced collaborative learning models is still limited by the lack of ICT infrastructure, especially the availability of Internet access and unreliable power supply (Ugwu & Ugwuanyi, 2024). In addition, issues of socioeconomic disadvantage and low ICT literacy levels among students and teachers also limit the advancement (Abdulmajeed et al. 2020). However, technology-mediated learning has not lost its major advantages, such as increased access, lower costs, and higher safety of learners. Researchers recommend that such constraints should be resolved by

collaborative effort of government agencies, business entities, and international agencies to enhance ICT infrastructure and integrate ICT literacy in educational programs (Ugwu & Ugwuanyi, 2024). Moreover, it is claimed that the implementation of authentic learning in science and technical education will lead to the creation of better technologies and to the more appropriate alignment of teaching practices with the needs of the labour market in Nigeria (Kola & Kehinde, 2019).

Conclusion

Collaborative learning, which is technology-enhanced, has a lot of prospects in addressing persistent problems in Nigerian education. As empirical evidence in existing case studies shows, when well-designed, these approaches have the potential to expand access to education, enhance learning, develop the 21 st - century skills that students need, and sustain interest regardless of the inadequate infrastructure. Whether in engineering projects at the Federal University of Technology, Minna, in the development of rural teachers programmes provided by the National Teachers Institute, Nigerian institutions are developing context-sensitive approaches that turn structural constraints into opportunities to demonstrate pedagogical creativity.

The successful implementation, however, depends on the conscious adjustment to the uniquely Nigerian realities as opposed to the blind transplantation of the global models. The effective projects combine the technologies that are both affordable and physically available, pedagogical architectures sensitive to different degrees of digital literacy, and collaborative frameworks that resonate with the Nigerian cultural realities. This adaptive process is an innovative project on its own, providing models that can be applied to similar situations in education.

Another requirement of sustainable impact is the development of an overall ecosystem that will combine technological support, pedagogical change, faculty preparation, and policy facilitation. The review of the best practices confirms that technological interventions, which are considered individually, without the parallel focus on pedagogical design, faculty capacity and institutional scaffolding, are unlikely to last. On the other hand, comprehensive programs that involve all these aspects have recorded positive outcomes in diverse Nigerian learning environments.

Recommendations

Pedagogical design must be the priority of educational practitioners over the technological complexity with the focus on clear learning goals and purposeful collaborative frameworks. Multi-modal pedagogies should be adaptable to the unequal accessibility of technology and should be inclusive to participation so that different learners can make valuable contributions. Evaluation must take context-sensitive standards that consider the collaborative processes, as well as the products that result out of the process, and consider the peculiarities of the Nigerian educational environment.

The institutional leadership should coordinate holistic plans that deal with technological infrastructure, faculty professional growth, student support, and pedagogical change simultaneously. These strategies need to be anchored on equity-based policies that make technology-enhanced collaborative learning to the advantage of all learners regardless of their socioeconomic situation, geographical location, or previous exposure to technology. Collaborations with other institutions, industry organizations and governmental bodies should be encouraged to ensure maximum allocation of resources and sharing of expertise.

The policymakers can contribute by developing national structures that can provide general guidance but allow contextual modifications in the diverse educational environment in Nigeria. Basic infrastructure shortages, especially in the areas of connectivity, device penetration and power reliability, need to be addressed by specific investments in the industry. Funding of the creation of open educational resources that are collaborative-learning centered, and sensitive to both Nigerian curricula and contexts is also crucial.

In order to develop the research, it is necessary to go beyond the superficial accounts of implementation to the rigorous analysis of learning outcomes, particularly in the underrepresented Nigerian educational settings. There is a need to explore the cultural responsive theoretical frameworks in terms of their relevance to the technology-enhanced collaborative learning environments in Nigeria. Moreover, design principles should be described on collaborative technologies that work efficiently under the constraints of the Nigerian infrastructure. There is also a need to examine long-term implications of the skill building, employability, and educational equity among the various Nigerian groups. Interdisciplinary cooperation and inter-institutional collaboration is a key to building a full picture of effective approaches.

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