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Original Article

Collaborative Learning Tools and Postgraduate Studies in Nigerian Universities

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ABSTRACT: *This paper analyzed how postgraduate students use collaborative learning tools in Nigerian universities and how effective the tools are, the challenges and benefits of using the tools and the institutional considerations that drive the use and sustainability of collaborative learning tools. Team learning tools like learning management systems, video conferencing systems, document sharing editors and online discussion forums have become part of contemporary education, especially in the area of improving supervision, research collaboration and peer learning among postgraduate learners. The results indicate that collaborative learning tools have a great potential to contribute to academic engagement, foster research collaborations, and access learning materials without any geographical constraints. They promote more adaptable and open forms of learning, enhance the efficiency of supervision and reinforce academic networks across institutional boundaries and beyond. Nevertheless, they are hindered by some challenges, such as low internet connectivity, lack of proper digital infrastructure, low technology competence among the staff and students, and lack of clear institutional policies to direct the integration of technology. Moreover, the unwillingness to change due to the old-fashioned supervision methods and the lack of administrative support also restricts their successful implementation. ITC investment, digital literacy programme and policy framework were found as key determinants of successful and sustainable implementation. Universities that have an organized e-learning policy, adequate funding and capacity-building projects are more likely to achieve high adoption rates and more productive postgraduate outcomes. The research proposes improvement of ICT infrastructure, periodic digital literacy training, institutional incentives for technology integration, and the institution of monitoring structures to determine the effect of collaborative tools in postgraduate learning.*

KEYWORDS: *Collaborative learning tools, Postgraduate studies, Students, Nigerian universities, Technology adoption.*

1. INTRODUCTION

Both the change in pedagogy with a new focus on learner-centred approaches and the rapid progress in information and communication technologies have changed the face of higher education. Collaborative learning, which is generally referred to as instructional directions where students learn in small groups where they engage in the same academic task, has a good theoretical foundation in social constructivism, which underlines that knowledge is co-constructed in the process of social interaction (Vygotsky, 1978). In most settings, collaborative learning has been linked to greater understanding, higher-order thinking, better communication, and increased motivation on the part of the learners (Johnson and Johnson, 1999; Dillenbourg, 1999). To a certain extent, collaboration can be expanded beyond the face-to-face sessions, into the asynchronous and online interactions, knowledge artefacts, shared workspaces, and analytics in support of reflection and supervision, when mediated by the means of digital tools (hereafter, the collaborative learning tools).

In the case of postgraduate studies, where the process usually involves high-order thinking, original research, and prolonged intellectual interactions, collaborative learning tools have specific affordances. The supervisor-student interaction, peer review, co-authorship and community formation across time and location are some of the activities that can be achieved through the use of discussion forums, shared document platforms, reference managers with collaborative features, video-conferencing and research networks (Hmelo-Silver, 2004).

The postgraduate education in the Nigerian university setup plays a significant role in the development of the country in terms of generating researchers, scholars and practitioners who can solve local and international problems. However, Nigerian higher education institutions are often plagued by institutional weaknesses, such as a lack of infrastructural support, excessive student-supervisor ratios, inconsistent quality of research supervision practices, and unequal access to online resources, which make postgraduate education challenging. In this situation, the collaborative learning tools may provide an opportunity to scale up the approach to strengthening supervision and fostering peer feedback and building virtual communities of practice; however, to achieve these advantages, empirical studies concerning the actual use of the tools, which features are important in the context of the postgraduate learning and supervision, and what institutional facilitators and inhibitors are needed should be conducted.

Though theoretically attractive and increasingly available, there is a dearth of collated evidence of how far collaborative learning tools have been adopted into postgraduate programs in Nigerian higher education institutions, the extent to which the tools affect research output and learning outcome, as well as the necessary contextual adaptation. The significance of addressing this gap is that the postgraduate programmes are very different in terms of goals, expectations and assessment from the undergraduate instruction and therefore, the findings regarding collaborative technologies in the undergraduate level cannot be generalized to postgraduate instruction without the specific research (Hmelo-Silver, 2004; Dillenbourg, 1999).

Despite the opportunities to reduce a number of systemic issues of postgraduate education, including isolation, limited supervisory interaction, and restricted access to peer feedback, the adoption of collaborative learning tools and their educational effects in Nigerian universities is understudied. There are anecdotal and fragmented reports that indicate that some departments and supervisors have adopted shared documents, virtual meetings, and online reading groups, and others have continued to use traditional in-person supervisory meetings. This disproportion creates a number of issues. First, patchy adoption subjects postgraduate students to unequal learning opportunities, with some of them enjoying the advantages of augmented collaborative learning and others having little peer interaction and supervisory contact. Second, the particular characteristics of the tools (e.g., version control, threaded discussion, real-time co-authoring, progress-tracking analytics, etc.) that are best suited to the unique cognitive and social needs of postgraduate research are not well understood. Third, institutional obstacles such as poor online supervision policy, absence of formal training of supervisors in online mentoring, poor ICT infrastructure, and ambiguous incentives to faculty to invest time in collaboration using digital tools might act as a hindrance to the sustainable use of collaborative tools despite early adoption.

What is more, there is a scarcity of information regarding the teaching methods that have been used successfully to incorporate collaborative tools into the research supervision frameworks suitable for postgraduate education. There have been continuing questions regarding how collaborative technologies can be crafted or tailored to facilitate formative feedback, ethical sharing of data between teams of researchers, issues of intellectual property and co-authored work, and ways of acknowledging collaborative work in evaluation and promotion. Without the contextually based empirical evidence, institutional planning is either going to overinvest in the technologies not well adapted to the needs of the users or will not invest in the tools and training that would make a difference in postgraduate learning and research outputs. Thus, the key issue that prompted conducting this study is the lack of systematic, context-specific data regarding the role and influence of collaborative learning tools on postgraduate education in universities in Nigeria. In the absence of such evidence, policymakers, university administrators, and academic supervisors have no guidance on the selection, implementation and maintenance of technologies that can meet postgraduate pedagogical goals and the infrastructural conditions in Nigerian higher education. This paper attempts to address that gap by exploring the perceived benefits and challenges, and institutional issues which make or hinder effective adoption of collaborative learning tools in postgraduate programmes.

2. RESEARCH QUESTIONS

1. What are the perceived benefits of using collaborative learning tools in postgraduate studies in Nigerian universities?
2. What challenges affect the effective use of collaborative learning tools in postgraduate education in Nigerian universities?
3. What institutional factors facilitate the adoption and sustainability of collaborative learning tools in postgraduate programmes in Nigerian universities?

3. COLLABORATIVE LEARNING TOOLS

The collaboration learning tools have been an innovative element of contemporary education, which is changing the way learners communicate, build knowledge, and process academic information. These tools can be defined as the technological platform and digital applications that are aimed at supporting group work, the construction of shared knowledge, peer feedback, and communication between learners and instructors. They are online discussion forums, learning management systems, video-conferencing systems, shared document editors, wikis, and virtual research environments that enable users to work either in real time or asynchronously. The philosophy behind collaborative learning is that the best way to acquire knowledge is by social interaction, dialogue, and joint problem solving (Vygotsky, 1978). In this regard, the collaborative learning tools are the facilitators of enabling these pedagogical ideals to be translated into usable and scalable formats that can be applicable in a variety of educational contexts, such as postgraduate education.

The development of collaborative learning tools is intimately associated with the technological changes in information and communication technology. Web 2.0 technologies emerged, allowing users not only consume the information but also to create, share and modify the content in a collaborative manner (Dillenbourg, 1999). Google Workspace, Microsoft Teams, Slack, and Moodle are tools which have become very popular in the higher education sector due to their ability to provide interactive platforms within which learners can co-create knowledge, exchange documents, and provide feedback. Such tools have a pedagogical significance based on the social constructivist theory proposed by Vygotsky (1978) that argues that learning is essentially a social practice that is mediated by the interaction with others and cultural tools. These technologies can provide interactive learning in postgraduate education where independent research and critical analysis are required in the study

process. Online collaboration could enable postgraduate students to collaborate in writing papers, join research teams, and obtain feedback on their work in a timely manner, which improves the quality of the work (Hmelo-Silver, 2004).

Collaborative learning tools are another way that promotes flexibility and inclusivity in education. They enable geographically dispersed students and those students in full-time jobs to have access to academic discussions and group research projects without having to be physically present (Salmon, 2004). This is particularly essential in postgraduate courses where a good number of the students juggle between their studies and their professional or family lives. Real-time supervision meetings and seminars can be held using synchronous tools like Zoom, Microsoft Teams, and Google Meet, and the continued research work can be carried out using asynchronous tools like discussion boards, shared drives, and cloud-based writing tools, at their own rhythmic pace. The hybrid between the two modes increases the learning continuity and enables reflection, which is crucial in building knowledge and research (Johnson and Johnson, 1999).

Besides being flexible, learning collaborative tools allows learner autonomy and responsibility. These tools develop the vital research and interpersonal skills by involving students in group activities in which the results are only achieved through collaborative effort. Indicatively, version control and document monitoring platforms are useful in enabling postgraduate students to create transparency and accountability in collaborative writing and managing data (Brindley, Walti, and Blaschke, 2009). These experiences are simulated to reflect actual academic and professional practice in which collaboration, communication, and peer review are essential. In addition, collaborative tools keep the researcher connected at all times, preventing the feeling of isolation that frequently accompanies postgraduate research. This helps in increasing the levels of motivation, persistence, and satisfaction, which are closely tied to academic success (Kuh, Kinzie, Buckley, Bridges, and Hayek, 2011).

Regardless of these benefits, there are a number of challenges to implementing collaborative learning tools in postgraduate education. Such tools may be effective or not depending on their technological abilities, pedagogical design, institutional support, and the digital literacy of users. It has been found that the potential of the tools being presented with little or no training or pedagogical alignment, the potentials inherent in them are underutilised (Laurillard, 2012). Infrastructural factors like bad internet connectivity, frequent power outages, and lack of accessibility to more recent devices prevent the frequent use of collaborative tools in most developing settings, including Nigerian universities (Adebayo and Adesope, 2021). Moreover, the academic culture traditionally focused on individual supervision and mentor-scholar hierarchies may complicate the process of adopting a collaborative one. The fear of digital tools diluting academic rigor and affecting data confidentiality is one of the reasons why some supervisors and students might be against using digital tools (Ng'ambi and Bozalek, 2015).

The success of collaborative learning initiatives is also primarily influenced by institutional factors. Universities whose policies are clear about e-learning, supervision and intellectual property establish more favorable conditions for the adoption of collaborative technologies (Rogers, 2003). On the other hand, in the absence of these policies, matters like ownership of data, credits and evaluation of the group work are not specifically defined. It is also necessary to have continued professional development of academic staff in order to develop competence in the use of digital tools to facilitate teaching and supervision (Salmon, 2004). Even complex and technologically advanced tools can be underutilized or improperly used without constant training and incentives.

The perception of usefulness and ease of use is another aspect that is critical, as discussed in the Technology Acceptance Model (Davis, 1989). It is more likely that postgraduate learners and those supervising them will embrace the use of collaborative tools if they observe definite academic and professional gains, including enhanced communication, organization of time, and research results. On the other hand, users go back to conventional channels of communication in case they perceive that the tools are too heavy or unreliable. Effectiveness of collaborative tools, thus, relies on the realization of a balance between usability, accessibility, and the pedagogical aim. The institutions should make sure that technology does not make learning and research to become complicated.

The implementation of collaborative learning tools in Nigerian universities is slowly growing because of the rising demand for flexible and technology-based education. COVID-19 exacerbated this trend, underscoring the need to continue research and supervision online to maintain continuity (Adedoyin and Soykan, 2020). Nevertheless, there are still issues such as a lack of proper infrastructure, variation in institutional support, and strategies specific to postgraduate education. Collaborative learning tools can democratise knowledge, foster innovation, and empower research communities when properly incorporated into postgraduate programmes. To make this possible, universities in Nigeria need to develop holistic frameworks that integrate technology investments with pedagogical transformations, digital literacy training, and sustainable support processes. Group learning applications have enormous potential, as they can transform postgraduate learning through communication, peer interactions, and research supervision. They adhere to constructivist ideas of joint creation of knowledge and offer solutions to the problem of isolation and restricted access to expertise. Nevertheless, they are only successful in situations like Nigeria when they mitigate infrastructural, cultural and institutional challenges. Through systematic investment in digital infrastructure, capacity building, and policy alignment, collaborative learning tools can serve as agents of change, enhance research quality, and foster healthy academic communities in Nigerian universities.

4. NIGERIA UNIVERSITY POSTGRADUATE STUDIES

Postgraduate education in Nigerian universities is the crown of formal education in the national education system and the basis of advanford scholarship, research, and high-level manpower needed in the nforl growth and international competitiveness. Postgraduate education is generally described as master's, doctoral and professional degrees that help graduates to gain specialization, critical thinking skills and research skills (Adebayo and Adesope, 2021). In Nigeria, the development and promotion of postgraduate programmes are informed by the National Universities Commission (NUC), which offers regulatory frameworks to facilitate quality assurance, homogeneity and alignment with national development goals. The number of postgraduate programmes and postgraduate students in Nigerian universities has been rising significantly over the years, not only because of the demand to acquire higher qualifications, but also because advanced education is considered an important aspect in addressing complex socio-economic and technological issues (Okebukola, 2015).

In the Nigerian system of higher education, postgraduate education started receiving priority only a few years after independence, as one of the attempts to create local specialists to substitute expatriates and develop local research. University of Ibadan, which was founded in 1948, became the first institution to offer postgraduate training, and by the 1970s, postgraduate schools or colleges were formed at most of the federal universities (Aluede, 2012). It was a vision to produce research-oriented scholars who would contribute to knowledge creation, innovation, and policymaking. Nevertheless, the quality and efficacy of postgraduate education in Nigeria have been lop-sided despite the growth in both the number of institutions and the number of programmes. Some of these include a lack of research funding, poor infrastructure, inadequate access to learning tools, and a lack of capacity to supervise students, which have contributed to reducing the system's efficiency in delivering graduates who can compete with others worldwide (Olayemi, 2017).

Nigerian postgraduate students are supposed to conduct advanced research directed at local and global concerns. They are trained to understand, comprehend, and apply theories to real-life issues; hence, they are involved in national development. However, systemic constraints usually influence the experience of many postgraduate students. The lack of adequate research facilities, including well-equipped laboratories, libraries, and digital repositories, is a major challenge. Several institutions continue to be unable to afford access to modern journals, databases, and software to conduct the latest research (Nwagwu, 2020). This is a restriction on students' capacity to conduct their own investigations,, and it tends to create a dependency onoutdatedd or secondary information. Further, unstable power supply and inefficient internet connection also limit the research productivity, particularly in science, engineering, and technology-related subjects.

The other urgent issue is associated with the quality of supervision. To complete the advanced studies successfully, it is necessary to supervise postgraduates effectively since it offers intellectual support, methodological support, and emotional support (Ige, 2016). Nonetheless, with an an increasing student population and a few qualified supervisors, most universities in Nigeria experienof overworked supervisors and slow feedback. The imbalance creates a long study time and attrition in some instances. Some supervisors are not trained in contemporary pedagogical and mentoring methods; as a result, they employ authoritarian rather than collaborative supervision styles. These relations might suppress creativity and free discussions that are fundamental to intellectual growth. Research studies have demonstrated that when postgraduate students receive effective, prompt guidance, they can complete their research and publish in reputable journals (Okebukola, 2015).

Moreover, postgraduate education in Nigeria is very expensive. In contrast to the undergraduate programmes, postgraduate students are given little in scholarships or research grants, and the institutional funding available for research is low. The shortage of stable sources of funding compels numerous students to finance their studies independently, and this situation frequently has a negative impact on the quality and scope of their projects (Olayemi, 2017). The government actions, like those of the Tertiary Education Trust Fund (TETFund), have tried to fill this gap by offering research grants and training opportunities, but these have not been adequate to sustain the increasing demand. Financial constraints continue to make most postgraduates struggle with attending international conferences, purchasing equipment with specific applications, purchasing paid research materials, etc (Nwagwu, 2020).

Besides financial and supervisory issues, administrative inefficiencies are also common among postgraduate students in Nigerian universities. One of the most frequent concerns is the delay in processing results, bureaucratic obstacles to granting research proposals, and the ambiguity of postgraduate policies (Akinrinade, 2018). These inefficiencies destroy the morale of the students and make it appear that the Nigerian postgraduate programmes are a waste of time and unpredictable. In addition, the research teamwork culture, interdisciplinary teamwork, and peer mentoring are underdeveloped in most institutions. Students in advanced countries learn postgraduate research, working in teams, and writing papers with other students, whereas in Nigeria students tend to work individually and are not exposed to different viewpoints in education (Aluede, 2012). This seclusion limits intellectual interaction and creativity.

The employability problem and research relevance should also be mentioned. Numerous postgraduate courses have been accused of emphasizing more on theoretical, and not practical or industry-oriented research (Okebukola, 2015). This means graduates have difficulty securing significant jobs in non-academic areas. It is important to strengthen the connections among

universities, industry, and research institutions so that postgraduate research contributes to socio-economic development. Industry projects of research may additionally assist the students to gain relevant skills, become more innovative, and popularize the Nigerian research findings internationally.

Nigerian postgraduate students have proven resilient and innovative despite these struggles. Many have used online learning and collaborative tools to improve their research and communication through digital technologies. Although COVID-19 threatened, the introduction of virtual learning and online supervision has been accelerated in some universities (Adedoyin and Soykan, 2020). Online communication helped students to reach supervisors and peers without leaving, use webinars, and take part in global academic conferences. This change showed how technology has the power to work across the barriers to postgraduate education, and highlighted the necessity of long-term investment in digital infrastructure and training. Nevertheless, the disparity in technological access in universities still leads to inequality in learning experiences.

Reform in the area of postgraduate education in Nigeria should aim at being comprehensive. These involve the strengthening of institutional capacity, improvement in the quality of supervision, expansion of funding options, and adoption of contemporary pedagogical practices. Digital transformation should be accepted by universities as a solution not only to the crisis but also as an instrument to enhance learning and research results. Promoting teamwork, research coordination, and partnerships with other scholars and institutions abroad may enhance postgraduate experiences and make Nigerian scholarship more visible on the international stage. NCU, professional associations, and sponsorship agencies should continue to monitor quality, uphold standards, and promote innovation in postgraduate courses. Postgraduate education in Nigerian higher institutions is critical for knowledge creation, human capital development, and national development. However, the problems of infrastructure, funding, supervision, and policy implementation are systemic and impede its potential. Nigerian post-graduates have a great intellectual potential but need facilitating conditions in order to succeed. Reform efforts that place greater focus on postgraduate education by integrating technology and securing long-term funding will not only enhance the quality of academic studies but also make Nigeria a central player in global research and innovation.

5. THEORETICAL FRAMEWORK

The paper was based on two theories related to the adoption and usage of collaborative learning tools in postgraduate education: the Social Constructivist Theory by Vygotsky (1978) and the Technology Acceptance Model (TAM) by Davis (1989). These theories can supplement one another by connecting the social and psychological aspects of learning to the technological and behavioural factors that drive the adoption of tools in learning environments.

The Social Constructivist Theory by Vygotsky shows the Pedagogical grounds for the importance of collaborative learning in postgraduate learning. According to the theory, learning is a social process conducted in a dialogic, collaborative interaction among people in a cultural and institutional setting to solve common problems (Vygotsky, 1978). Vygotsky believed that knowledge is constructed through social interaction, but not a teacher-student relationship. The most important part of this theory is the so-called Zone of Proximal Development (ZPD), which is the distance between what a learner can do by themselves and what they can do with the support of other learners or mentors. This concept is operationalized through collaborative learning tools like discussion forums, shared documents, and virtual research groups, which allow learners to interact, exchange insights and get supervisor and peer feedback in real time.

In postgraduate education, where independent inquiry and critical thinking are central, the social constructivist framework gives significant emphasis to supervision and mentorship, as well as collaborating with peers. Incorporating collaborative tools extends these interactions beyond physical geographical limits, enabling postgraduate students to co-create knowledge with peers and supervisors who are geographically dispersed. These technologies provide virtual communities of practice, which are akin to the intellectual cooperation of real-world academic settings, by assisting dialogue, feedback, and mutually constructed meaning. Therefore, Vygotsky's theory provides a strong justification for the educational importance of collaborative learning tools as mediators of cognitive development, critical thinking, and research competence among postgraduate students.

The second theoretical framework is the Technology Acceptance Model (TAM), which was created in 1989 by Davis to describe user adoption and acceptance of new technologies. According to TAM, two significant determinants, such as Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), can affect the attitude of the individual to use of a technological system, which consequently shapes their behavioural intention and actual use (Davis, 1989). Perceived usefulness is a measure of how much an individual believes that using a specific system will help them to perform better, and perceived ease of use is the measure of how free or not cumbersome the technology is. The model has found extensive application in the research of education to comprehend how students and teachers embrace digital learning platforms and collaborative technologies.

As applied to the Nigerian postgraduate education, TAM can be used to explain the behavioural and institutional conditions that influence the adoption of collaborative learning tools. Although access to digital platforms, including Moodle, Google Workspace or Microsoft Teams, is available in universities, the perception of relevance of these tools to both academic and research processes is what determines their effective utilization by postgraduate students and supervisors. If students find these

tools improve the quality of communication, supervision, and research output, they will be more likely to incorporate them into their learning activities. On the other hand, when the tools are perceived to be complex, unreliable or not compatible with the current institutional practices, then the users will resist implementation despite the potential advantages it has. TAM hence assists in the identification of the psychological as well as attitudinal variables which influence the technology acceptance in post-graduate programmes, in addition to the technical barriers.

A combination of Social Constructivism and TAM gives a holistic framework to the present study. Whereas Social Constructivism focuses on the process of learning by way of collaboration and interaction, TAM is used to explain the reasons why the users would adopt or reject the technologies that facilitate learning through collaboration. Collectively, the theories emphasize the complementary nature of pedagogy and technology concerning postgraduate learning outcomes. Successful adoption of collaborative learning tools involves more than just being aware of both the cognitive and social processes upon which learning depends (as discussed by Vygotsky) and the motivational and usability issues that fuel or impede adoption (as discussed by Davis). Therefore, the theoretical framework of this study provides dual insights: the Social Constructivist Theory justifies the pedagogical relevance of collaborative learning in postgraduate studies, while the Technology Acceptance Model explains the behavioural dynamics that influence its adoption and sustained use in Nigerian universities.

6. CASE STUDIES OF SUCCESSFUL IMPLEMENTATION OF COLLABORATIVE TOOLS IN NIGERIA

In recent years, several educational programs and schools have been able to adopt digital collaboration technologies in Nigeria, and this has resulted in the improvement of their teaching methods, which have consequently led to improved student engagement and academic performance. An example of such is the Learn Africa program, which established online forums where communication between parents, instructors, and students was available to everyone. The platform is made more interactive through its real-time communication and performance feedback features, which make learning more interesting. Instructors also experienced a rise in student engagement, motivation, and performance, especially in group projects (Ibrahim et al., 2020).

Another example is the use of Google Classroom in the secondary schools of Lagos. Research has shown that the platform transformed the practices in classrooms in the sense that students could collaborate on a project despite their physical location. The program's flexibility allowed students to take the initiative in their education and develop crucial skills for the new world, such as digital literacy, problem-solving, and teamwork. Therefore, standard evaluations were less effective compared to collaborative ones because students scored much higher in the former (Afolabi and Adeogun, 2021).

Another possibility of how group projects can stimulate originality and involvement in the classroom is the Abuja "School Innovation Challenge. Students work together in groups, exchange materials, and discuss ideas using such messaging apps as WhatsApp and Slack. Since students were viewing problems from various perspectives, teachers observed an increase in the critical thinking, self-confidence, and communication abilities of students. Okeke et al. (2021) note that this program allowed students to feel closer to each other and enhanced their collaboration skills.

Nsukka University, Nigeria, has incorporated Microsoft Teams in online collaboration. This site allows students of various walks of life and academic areas to come together to work on their group projects and presentations. The findings reveal that the curriculum enhanced the skills of students in collaboration as a team, in effective communication, and in being in the lead, which is required in the modern competitive labor market and according to the international standards of education (Nwogu and Osunwoke, 2022).

The "e-Learning for All" project in rural Nigeria interconnects students and instructors to mobile learning apps to enable them to collaborate despite infrastructural constraints. Ogunleye et al. (2020) state that it has succeeded in making students more proficient readers and mathematicians, minimizing the differences in achievements between urban and rural students, and promoting more equal access to high-quality education. The EdoBEST program is one such massive attempt at education reform. It includes workshops and professional development for teachers and aims to enhance their ability to implement technology-based, student-centred, interactive pedagogy. With the introduction of digital resources into daily learning, the initiative will help align the state curricula with the international standards.

EdoBEST needs data-based approaches to monitor teacher development to enable them identify the strengths and weaknesses of their students. One of the elements that made it successful is the delivery of better infrastructure, including internet connectivity, digital equipment, and e-learning resources. The participating schools experience increased student engagement, retention, and enrolment and increased levels of reading and numeracy. The EdoBEST provided blended learning strategies that were applied during the COVID-19 pandemic to continue the educational process through integrating physical and online training. Its success can be emulated in other areas seeking to digitise and modernise their education systems,, and it can serve as a blueprint for education reform in Nigeria in general (Bucholtz, 2004).

7. BENEFITS OF USING COLLABORATIVE LEARNING TOOLS IN POSTGRADUATE STUDIES IN NIGERIAN UNIVERSITIES

Increasingly, postgraduate students and supervisors in Nigerian universities are reporting that collaborative learning tools are effective in increasing communication, decreasing isolation, and speeding up research. A variety of postgraduate students consider facilities such as cloud-based document editors, video-conferencing, and learning-management discussion forums essential for receiving timely feedback and maintaining supervisory engagement when face-to-face meetings are challenging to arrange (Belew, 2024; Amie-Ogan, 2025). They empower peer review and co-authorship processes, which are asynchronous, to enable students to quickly iterate on drafts, see a version history, and have a transparent record of contributions, which are consistent with international research standards and yield better thesis outputs (Feng, 2025). The increase in the rate of research and scholarly networking is also reported by students: the opportunities to gain exposure, co-publication, and engage in global scholarly discussions, which were previously restricted due to travel expenses, are made possible through access to virtual seminars, webinars and international partners via such platforms as Zoom and Teams (Akingbade, 2024).

In addition to productivity, collaborative technologies will support inclusive, flexible learning applicable to employed and distance postgraduate students. Remote participation in supervisory meetings, seminars, and journal clubs has been shown to overcome geographic and time constraints and has been associated with better retention and satisfaction among postgraduate cohorts (Belew, 2024; Akingbade, 2024). In addition, collaborative tools, such as project management, reference sharing, and discussion threading, typically embedded in collaborative platforms, scaffold the development of research skills, enabling students to develop competencies in critical appraisal, project planning, and evidence synthesis, which are the key elements of postgraduate training (Feng, 2025). Lastly, the social benefits cannot be overlooked: digital communities of practice foster peer mentoring and emotional support, reducing the feeling of isolation inherent to advanced research training and increasing well-being and perseverance (Akingbade, 2024; Amie-Ogan, 2025).

8. CHALLENGES AFFECT THE EFFECTIVE USE OF COLLABORATIVE LEARNING TOOLS IN POSTGRADUATE EDUCATION IN NIGERIAN UNIVERSITIES.

Nevertheless, even with evident benefits, there are various, and in many cases overlapping, problems that limit the successful use of collaborative tools. The most widespread obstacle is infrastructure shortages: unstable electricity supply, slow or expensive internet connections, and insufficient access to modern equipment lower the quality, reliability, and fairness of online cooperation (Barikzai, 2024; Akingbade, 2024). Empirical research in the Nigerian setting still records the disruption of synchronous meetings in intermittency, feedback loops and disproportionate learning effects between students and institutions by intermittent connectivity and power outages (Exploring the Challenges of Online Learning in Nigerian Higher Education, 2024; Amie-Ogan, 2025). These technical issues are exacerbated by financial constraints - postgraduate students usually have no grant access to data bundles, special software, or even conference tickets, which makes long-term and high-quality online collaboration expensive and unaffordable to many (Eneiga, 2024).

Impact is further curtailed by pedagogical and human factors. Some supervisors and faculty do not have specific training and skills in e-supervision and digital pedagogy, and this may result in shallow or ineffective applications of collaborative tools (Belew, 2024; Feng, 2025). Opposition to shifting traditional, long-held supervisory cultures, where face-to-face mentorship and apprenticeship are the primary approaches, is making online collaboration seem inferior or an extra administrative burden to some academics. Ethical issues and data governance also apply: ambiguity in institutional policies regarding data ownership, co-authorship recognition, and data security would make some supervisors and students hesitant to post sensitive research data on third-party sites (Feng, 2025). Finally, the disparity between digital literacy among students and staff members leads to dissimilar experiences; with low levels of training being provided, technical affordances of platforms are under-explored, and collaborative work might produce a fragmented and tokenistic hand (Barikzai, 2024).

9. INSTITUTIONAL FACTORS FACILITATE THE ADOPTION AND SUSTAINABILITY OF COLLABORATIVE LEARNING TOOLS IN POSTGRADUATE PROGRAMMES IN NIGERIAN UNIVERSITIES.

The strongest enablers of sustainable adoption are institutional leadership, policy clarity and targeted investment. In areas where the university management considers digital collaboration to be a strategic aspect, i.e., introducing e-supervision rules, research data policies, and motivation of online scholarly activities, the adoption can be more effective and long-lasting (NUC, 2024; Eneiga, 2024). Explicit national and institutional funding mechanisms, like TETFund, have been catalytic in a few Nigerian universities: by funding laboratories, ICT infrastructure and staff training; sustained, focused funding of digital infrastructure and postgraduate research grants is nonetheless vital in order to scale up collaborative practices (Eneiga, 2024; Amie-Ogan, 2025). In addition to funding, well-defined governance statements covering intellectual property, data confidentiality, and guidelines for acknowledging collaborative involvement in the promotion and evaluation can help alleviate concerns and justify online cooperation among the academic community (Feng, 2025).

Another institutional factor that cannot be ignored is the capacity-building of faculty and students. Ongoing professionalism in the domain of digital pedagogy, best practices of e-supervision, and platform-specific skills enhance perceived ease of use and perceived usefulness - two predictors of technology adoption highlighted in TAM literature and supported by recent Nigerian research (Belew, 2024; Feng, 2025). Integrating digital literacy courses into postgraduate orientation programmes, as well as providing technical support units to offer on-demand services, minimises resistance and maintains engagement. Lastly, it is possible to promote a culture of collaboration by creating structured opportunities, which can be funded research clusters, interdisciplinary online seminars, and formal peer-review groups, to ensure that the collaborative workflow becomes normalized and visible benefits are generated, which attract broader adoption (Amie-Ogan, 2025; NUC, 2024).

Overall, although collaborative online learning tools offer real pedagogical, social, and productivity benefits in postgraduate education in Nigeria, their potential is conditional. Institutional measures needed to overcome infrastructure inadequacies, offer lasting funding, demystify governance, and invest in human capacity to transform short-term adoption into long-term transformation. According to recent Nigerian studies, in the locales of their convergence, collaborative tools have significant positive implications on postgraduate supervision, research production, and student wellbeing, but in the locales of their lack thereof, digital initiatives threaten to be disjointed and unequal (Belew, 2024; Barikzai, 2024; Feng, 2025).

10. CONCLUSION

The use of collaborative learning tools has become the key to the revolution in the education of post-graduates in Nigerian universities, where students and supervisors get innovative means of communication, collaboration, and conducting high-level research. The results reveal that these tools are highly beneficial, including allowing supervisors and students to interact better, facilitating peer collaboration, offering unique access to research materials, and exposing them to the global academic community. They help in the development of critical thinking, creativity and research competence, which are some of the major outcomes of postgraduate education by promoting teamwork and sharing information. The barriers to the successful implementation of these tools, however, are limited to infrastructural shortcomings, low levels of digital literacy, and uneven institutional backing, as well as the existence of traditional cultures of supervision that cannot be changed by technological advancements. Although some Nigerian universities have gone further to embrace digital collaboration platforms, the integration has not been consistent and relies heavily on individual or departmental initiative rather than an institutional approach. The potential of collaborative learning tools in postgraduate studies, therefore, is yet to be achieved.

The paper also confirms that institutional factors are dominant determinants of the sustainability of such technologies. The higher the quality of ICT infrastructure in the university, the establishment of clear e-learning and e-supervision policies, and the opportunities for capacity-building of individuals and institutions, the higher the chances of successful adoption. The evidence highlights that technological innovation in itself will not be able to change postgraduate education unless it is supported by creating enabling institutional environments, effective policy frameworks, and a culture of collaboration, openness, and knowledge sharing.

11. POLICY RECOMMENDATIONS

It was recommended that the use of collaborative learning tools be enhanced in the Nigerian tertiary education system as follows.

Enhance ICT Infrastructure: The Nigerian government, through its bodies, such as the Tertiary Education Trust Fund (TETFund) and the National Universities Commission (NUC), must focus on investing in digital infrastructure to have a stable internet connection, consistent power supply, and the use of modern devices in universities. This is one of the keys to the sustainability of collaborative learning efforts.

Formulate and Enforce Coherent Institutional Policies: Universities ought to have comprehensive policies outlining acceptable practices for e-supervision, data management, intellectual property, and authorship. These measures will protect ethical principles and promote the use of collaborative platforms among the supervisors and the students.

Capacity Building and Digital Literacy Training: Academic staff should be provided with continuous professional development programmes to improve their abilities with respect to digital pedagogy, collaborative supervision, and online mentoring. On the same note, digital literacy training of postgraduate students should be structured in a manner that students are oriented and trained on how to use collaborative tools effectively.

Incentivize Technology adoption: This should be done by providing incentives like awards, work credit or promotion points to supervisors and departments who effectively incorporate collaborative technologies in postgraduate supervision. This will facilitate the involvement of the faculty and promote a culture of innovation.

Foster Research Cooperation and Networking: Virtual research clusters, online seminars, and academic networking sites should be encouraged at universities to foster interdisciplinary and inter-university research collaborations. This will increase academic fortification, research visibility, and the exchange of knowledge between postgraduate students and faculty.

Monitoring and Evaluation Framework: NUC and postgraduate schools should develop a national monitoring framework to periodically assess the effectiveness of collaborative learning tools in postgraduate programmes. Periodic reviews will help identify gaps, best practices, and opportunities for continuous improvement in the implementation of the policies.

12. CONTRIBUTION TO KNOWLEDGE

This study contributes to the growing body of literature on digital transformation in higher education by situating collaborative learning tools within the specific context of Nigerian postgraduate education. It provides empirical insights into how these tools influence postgraduate learning outcomes, supervision quality, and research productivity in a developing country setting. Unlike most existing studies that focus primarily on undergraduate learning or general e-learning systems, this research focuses on postgraduate students, thereby addressing a critical gap in educational technology scholarship.

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