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Exploring the Impact of Learning Technologies in Teaching Interaction Design: A Case Study at First Technical University, Nigeria

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Abstract
Teaching interaction design poses unique challenges as it requires discussing design principles for interactive products. Conventional methods like static slides and lectures often fail to effectively engage learners, leading to reduced satisfaction and limited active participation. To address this issue, an action research study was conducted at First Technical University, Nigeria, to investigate the impact of incorporating learning technologies in teaching interaction design. The study involved 21 purposively selected 200 level students from the Computer Science and Software Engineering departments who willingly participated to compare their previous instruction in interaction design.The study aimed to adapt the current learning approach by emphasizing technology-enhanced methods such as flipped classrooms and online teaching. By integrating technology-equipped pedagogy, the research aimed to enhance learners' engagement and interest in the subject.The findings reveal that the integration of learning technologies in teaching interaction design has a significant impact on student engagement and understanding. The gradual inclusion of various technologies transformed students from passive learners to active participants who freely expressed their ideas, engaged in critical discussions, and applied design principles in practical contexts. The results also highlight the importance of aligning pedagogy with learners' needs and cultural context. By creating a less formal learning environment that encourages open expression of ideas and active participation in discussions, the use of learning technologies not only enhances the application of design principles but also fosters the development of students' personalities and soft skills. Notably, communication skills, leadership abilities, teamwork, and project management skills exhibited significant improvement throughout the study cycles.
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1. Introduction

Interaction design involves the creation of user experiences and interfaces that facilitate effective interactions between users and digital products (see figure 1). It encompasses understanding user needs, designing intuitive interfaces, and ensuring seamless interactions (Smith, 2007). It is the exploration and application of design principles relevant to the development of interactive products. The field of interaction design has gained prominence in recent years due to the increasing reliance on digital technologies in various aspects of our lives (Saffer, 2010). As a result, there is a growing need for educational approaches that effectively equip students with the knowledge and skills required to excel in this domain.

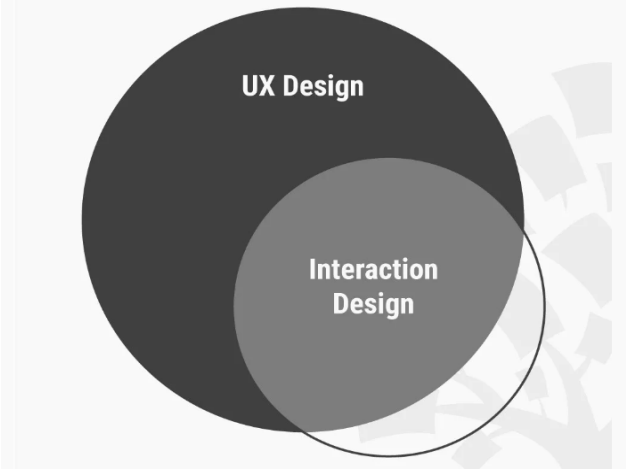

Figure 1. Interaction Design: A Part of UX Design (Source: https://www.interaction-design.org/literature/topics/interaction-design)

Effective teaching of interaction design requires innovative approaches that foster student engagement and facilitate a deep understanding of the subject matter. Traditional instructional methods, such as static slides and lectures, often fail to fully engage learners, resulting in passive consumption of information and limited comprehension. To overcome these challenges, this research aims to investigate the impact of incorporating learning technologies in teaching interaction design at First Technical University, Nigeria. By leveraging technology-enhanced pedagogies, we aim to create a more engaging and effective learning environment for students.

Learning technologies encompass a wide range of digital tools and resources that can enhance teaching and learning experiences (see figure 2). These technologies include multimedia resources, online platforms, interactive applications, and collaborative tools (Almara'beh et al., 2015; Olugbade et al., 2016; Outhwaite et al., 2019; Liu et al., 2020; Olugbade, & Olurinola, 2021; Tolorunleke et al., 2023; Durall et al., 2023). By incorporating these learning technologies into the instructional process, educators can create dynamic and interactive learning environments that promote active student engagement, critical thinking, and practical application of design principles.

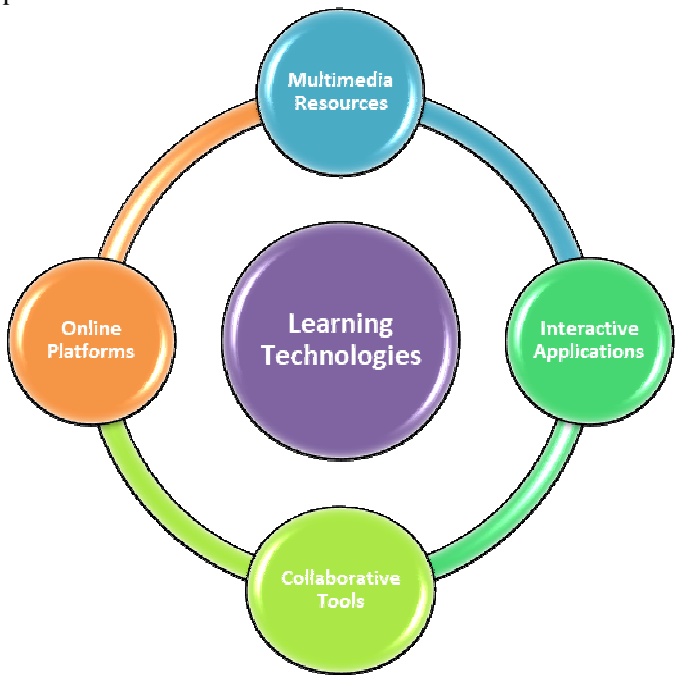

Figure 2. Learning Technologies

Recent research has emphasized the significance of adopting innovative approaches to teaching interaction design. In 2008, Hourcade et al. found that educational software was effective in teaching children about interaction design. Similarly, Dalle et al. (2018) concluded that learning technologies aided students in developing communication skills and soft skills such as leadership, teamwork, and project management. Lundgren et al. (2006) suggested that learning technologies would be necessary to teach designers programming skills in the context of interaction design.

In a more recent study, Liao et al. (2023) explored the role of Artificial Intelligence (AI) in facilitating interaction design. They demonstrated how multi-objective Bayesian optimization can assist designers in creating tactile displays for smart watches. This research highlights how AI can relieve designers of some of the complex decision-making processes involved in interaction design. Similarly, Battistoni et al. (2023) examined the evolving presence of AI in interactive systems and emphasized the need for designers to reconsider the interactions between AI and its users. They emphasized the importance of understanding users' emotions and focusing on the potential user experience when designing AI-driven interactions.

Building upon this existing research, our study aims to specifically investigate the impact of learning technologies on teaching interaction design at First Technical University, Nigeria.

The primary objectives of this research are as follows:

1. To examine the effectiveness of learning technologies in fostering learner engagement during interaction design courses.
2. To assess the impact of technology-enhanced pedagogies on students' comprehension and application of design principles in interactive product development.
3. To explore the role of different learning technologies, such as static slides, videos featuring external experts, locally developed digital storytelling products, and interactive tools, in facilitating the learning

of interaction design concepts.
4. To evaluate the development of students' soft skills, including communication, leadership, teamwork, and project management, through the integration of learning technologies.
5. To provide valuable insights and recommendations for educators and institutions seeking to optimize the teaching and learning of interaction design through the integration of technology-enhanced pedagogies.

This research will contribute to the existing body of knowledge on effective instructional approaches for teaching interaction design, particularly within a technology-driven learning environment. The findings of this study will have practical implications for educators and curriculum designers, enabling them to create dynamic and engaging learning experiences that promote active student participation, deep understanding, and proficient application of design principles in interactive product development.

2. Literature Review

The effectiveness of traditional instructional methods in higher education has come into question, as they often fail to promote active learning and student engagement. As a result, there has been a growing recognition of the importance of creating interactive and engaging learning environments. Interactive learning experiences, facilitated by the integration of learning technologies, have shown promise in fostering critical thinking, knowledge construction, and student engagement. This literature review explores the significance of interactive and engaging learning environments in higher education and examines the application of learning technologies, such as videos, digital storytelling, and interactive products, in the field of interaction design education. By leveraging technology-enhanced pedagogies, educators can create immersive and dynamic learning experiences that better prepare students for real-world challenges in design. The review highlights the potential of these approaches in improving learning outcomes and equipping students with essential skills for their future careers.

2.1 Importance of Interactive and Engaging Learning Environments

The significance of creating interactive and engaging learning environments in higher education has been widely recognized in educational research. The traditional methods of instruction, such as static slides and lectures, often fail to promote active learning and student engagement (Harrison, & Stennett, 2022; Ndihokubwayo et al., 2022). Students tend to passively consume information without actively participating in the learning process, leading to limited understanding and retention of the subject matter (Lin et al., 2022).

In contrast, interactive learning environments foster student engagement, critical thinking, and knowledge construction (Berry, & Kowal, 2022; Reid et al., 2022). Interactive learning experiences provide students with opportunities to explore concepts, collaborate with peers, and apply their knowledge in practical contexts. By incorporating learning technologies into the teaching process, educators can create dynamic and interactive learning environments that align with the needs and preferences of today's digitally connected learners (Bahari, 2022; Muñoz et al., 2022).

2.2 Integration of Learning Technologies in Higher Education

The integration of learning technologies in higher education has gained considerable attention due to its potential to enhance teaching and learning outcomes. Various forms of learning technologies, such as videos, digital storytelling, and interactive products, have been utilized to engage students and facilitate their understanding of complex concepts (Dalle et al., 2018; Salas-Pilco et al., 2022; Jdaitawi & Kan'an, 2022; Muñoz et al., 2022).

Videos have been widely used as a supplementary instructional resource in higher education (Liu, & Luo, 2022). They provide students with visual and auditory stimuli, making the learning process more engaging and accessible. Digital storytelling, on the other hand, offers a creative and interactive way of presenting information, enabling students to construct their understanding through narrative-based experiences (Anastasiou, 2022; Petousi et al., 2022). Interactive products, such as simulations and virtual environments, provide students with hands-on experiences and opportunities to apply their knowledge in realistic contexts (Knowles, Mills, Shen, & Jur, (2022).

2.3 Application of Learning Technologies in Interaction Design Education

The integration of learning technologies in the field of interaction design education holds significant potential for improving learning outcomes and preparing students for real-world design challenges. By leveraging technology-enhanced pedagogies, educators can create immersive and interactive learning experiences that closely mirror industry practices (Wu et al., 2023; Cowan, & Farrell, (2023).

Previous studies have explored the use of videos in teaching interaction design, demonstrating their effectiveness in providing students with access to experts, real-world design examples, and diverse perspectives (Boling et al., 2012; Dalle et al., 2018; Rogers et al., 2023). Digital storytelling has also been employed to engage students in the design process, fostering creativity, problem-solving skills, and critical thinking (Yang, &

Wu, 2012; Istenic et al., 2016; Niemi, & Multisilta, 2016).

Moreover, interactive products, such as prototyping tools and virtual environments, offer students opportunities to experiment, iterate, and receive immediate feedback on their design solutions (Roberts et al., 2021; Neroni et al., 2021; Gong, 2021). These technologies not only enhance students' technical skills but also promote their collaboration, communication, and project management abilities (Hernandez-de-Menendez et al., 2020).

In conclusion the literature review emphasizes the significance of interactive and engaging learning environments in higher education. Traditional instructional methods often lack active learning and student engagement, but the integration of learning technologies, such as videos, digital storytelling, and interactive products, has shown promise in promoting critical thinking, knowledge construction, and student engagement. In the field of interaction design education, these technologies have been utilized to provide students with access to experts, real-world examples, and hands-on experiences, enhancing learning outcomes and equipping students with essential skills for their future careers. By leveraging technology-enhanced pedagogies, educators can create dynamic and immersive learning experiences that better prepare students for real-world design challenges.

3. Methodology

This study employed an action research approach to examine the impact of integrating learning technologies in teaching interaction design at First Technical University, Nigeria. Action research was chosen as the methodology due to its ability to facilitate iterative cycles of planning, implementation, observation, and reflection, allowing for continuous improvement and informing pedagogical practices (see figure 3). It has been used by other previous studies (Hine, 2013; Hine, & Lavery, 2014; Ivankova, & Wingo, 2018; Thompson, 2022)

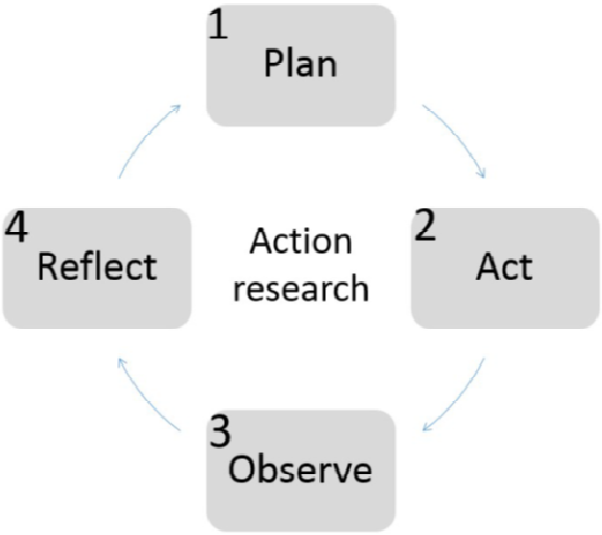

Figure 3. Method: Four-Cycle Process

The research focused on 21 purposively selected 200 level students from the Computer Science and Software Engineering departments who willingly participated in the study to compare their previous instruction in interaction design.

The primary objective of the study was to adapt the existing learning approach by emphasizing technology-enhanced methods, such as flipped classrooms and online teaching. By incorporating technology-equipped pedagogy, the research aimed to enhance learner engagement and interest in the subject matter.

To investigate the impact of learning technologies, the study implemented four cycles, each introducing different technological interventions to explore their effects on student engagement and understanding of design principles. These cycles were guided by the iterative process of planning, acting, observing, and reflecting (Ivankova, 2015).

Cycle 1: The first cycle served as a baseline and utilized traditional methods of instruction, including static slides and lectures, to introduce the course (see figure 4).

Figure 4. Traditional Delivery of Instruction (Static slides and Lectures)

Cycle 2: The second cycle introduced YouTube videos featuring experts from various universities discussing interaction design principles and showcasing real-world examples (see figure 5). The purpose was to enhance student engagement and bridge the gap between theoretical concepts and practical applications.

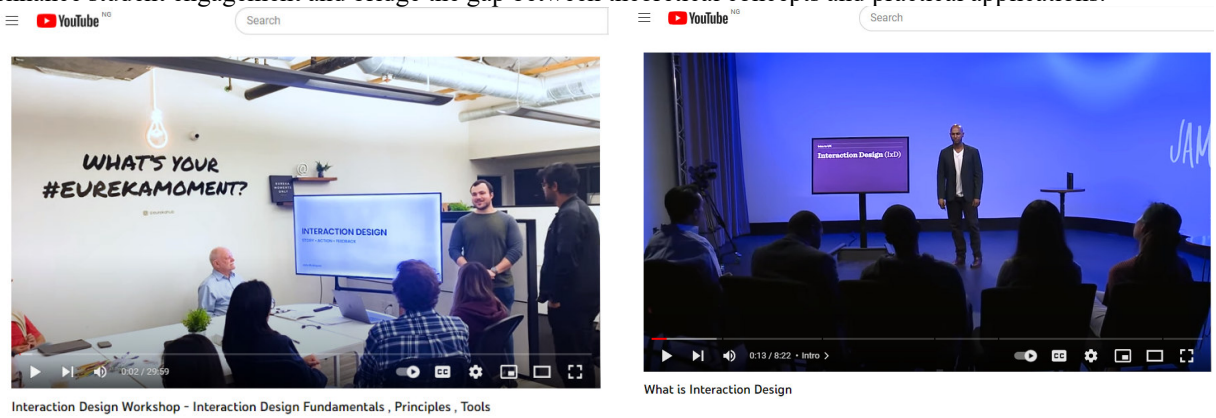

Figure 5. Samples of YouTube videos used

Cycle 3: The third cycle incorporated locally developed digital storytelling products, which were interactive and narrative-based. These materials aimed to promote active engagement, creativity, and self-directed class discussions, providing a context for applying design principles and fostering critical thinking skills (see figure 6).

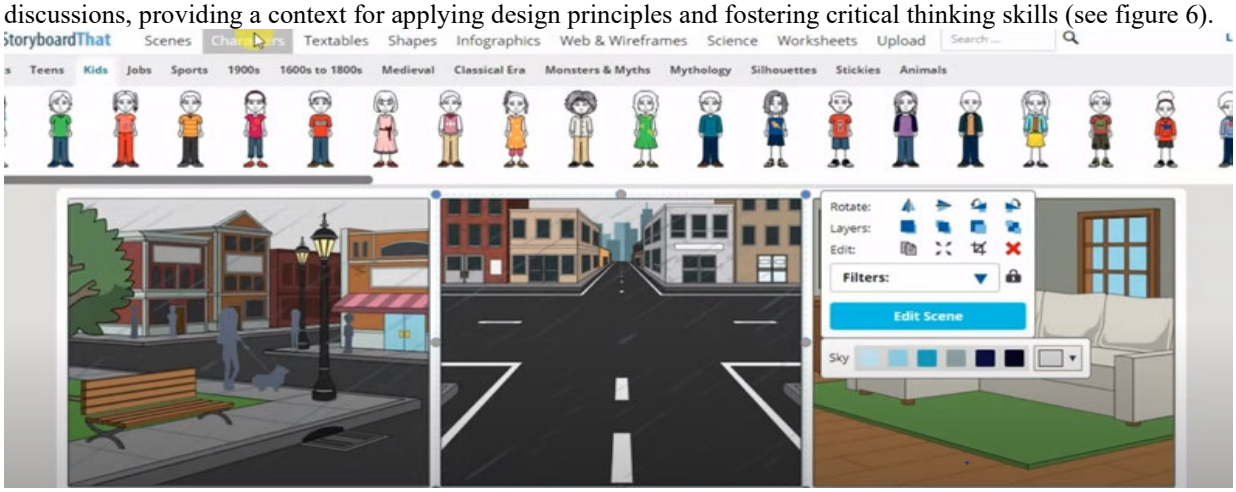

Figure 6. Storyboard for Digital Storytelling Products

Cycle 4: The fourth cycle integrated interactive tools, such as prototyping tools and virtual environments, enabling hands-on design activities, exploration of different design solutions, and immediate feedback (see figure 7 and 8). The focus was on sustaining learner engagement and facilitating productive discussions.

Figure 7. Samples of Interactive Tools

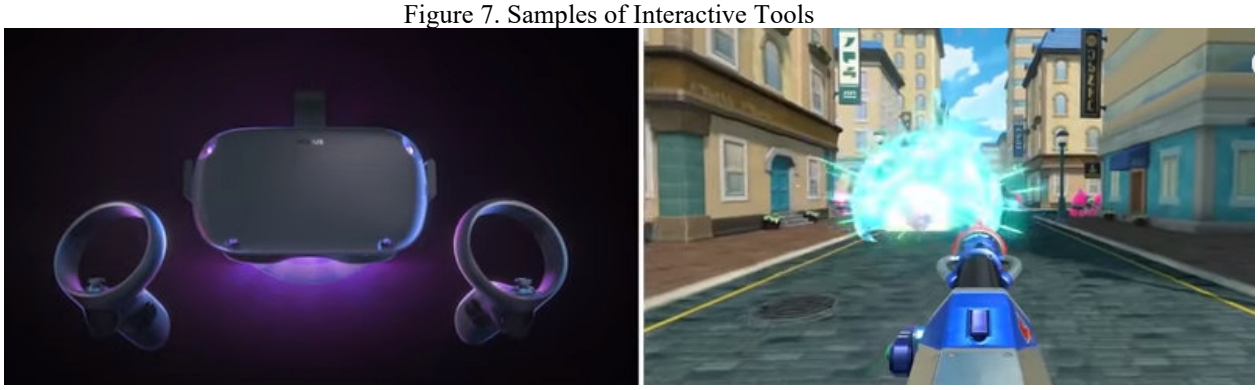

Figure 8. Virtual Reality Environment

Data collection during each cycle included various methods such as observation, student surveys, interviews, and artifact analysis. Observations documented student engagement levels, participation patterns, and overall classroom dynamics. Surveys and interviews gathered students' perceptions, attitudes, and experiences regarding the effectiveness of the learning technologies employed. Artifact analysis involved assessing students' design outputs, prototypes, and project deliverables.

Data analysis encompassed both qualitative and quantitative approaches. Qualitative analysis, including thematic analysis, identified emerging themes, patterns, and insights from observations, interviews, and artifact analysis. Quantitative analysis involved statistical examination of survey responses to identify trends and correlations.

The findings from each cycle informed subsequent cycles, enabling continuous refinement of the pedagogical approach and selection of appropriate learning technologies. Through this iterative process, the study aimed to identify best practices and develop guidelines for effectively integrating learning technologies in the teaching of interaction design.

4. Results

The results obtained from each cycle of the study shed light on the impact of incorporating learning technologies in teaching interaction design. The findings reveal valuable insights into student engagement and understanding of design principles within the context of the First Technical University, Nigeria.

Table 1: Qualitative Data Analysis

Cycle	Learning Technology	Key Findings
1	Static slides and lectures	• Limited student engagement • Passive participation
2	YouTube videos featuring experts	• Increased student engagement • Bridge between theory and practice
3	Locally developed digital storytelling	• Enhanced student engagement and creativity • Encouraged critical thinking
4	Interactive tools (prototyping, virtual environments)	• Sustained learner engagement • Productive discussions

Table 1 provides an overview of different learning technologies and their key findings in relation to student engagement and participation. The table lists four different learning technologies in the left column: static slides and lectures, YouTube videos featuring experts, locally developed digital storytelling, and interactive tools such as prototyping and virtual environments.

For each learning technology, the table presents the key findings or observations in the right column.

1. Static slides and lectures: The key findings associated with this traditional approach include limited student engagement and passive participation. This implies that students may not be actively involved in the learning process and may have a relatively passive role in receiving information.
2. YouTube videos featuring experts: This learning technology has shown to increase student engagement compared to static slides and lectures. It serves as a bridge between theory and practice, possibly by providing real-world examples or expert perspectives, which can enhance student interest and understanding.
3. Locally developed digital storytelling: This learning technology has been found to enhance student engagement and creativity. By incorporating digital storytelling methods, students are encouraged to actively participate in constructing narratives, which can foster critical thinking skills.
4. Interactive tools (prototyping, virtual environments): The use of interactive tools, such as prototyping and virtual environments, sustains learner engagement. Additionally, these tools facilitate productive discussions among students, potentially enabling collaboration and deeper understanding of the subject matter.

In conclusion, the table highlights the varying levels of student engagement associated with different learning technologies, with more interactive and creative approaches generally resulting in higher levels of engagement and active participation.

Table 2: Quantitative Data Analysis

Cycle	Learning Technology	Mean	S.D	T-Test
1	Static slides and lectures	2.8	0.5	-0.67
2	YouTube videos featuring experts	4.2	0.7	1.23
3	Locally developed digital storytelling	4.6	0.6	2.14
4	Interactive tools (prototyping, virtual environments)	4.3	0.8	1.98

Table 2 presents statistical results for different learning technologies in terms of student engagement. It includes mean scores, standard deviations (S.D.), and t-test values. The mean scores are as follows: static slides and lectures (2.8), YouTube videos featuring experts (4.2), locally developed digital storytelling (4.6), and interactive tools (prototyping, virtual environments) (4.3). The corresponding standard deviations are 0.5, 0.7, 0.6, and 0.8, respectively. The t-test values indicate the significance of differences in student engagement: static slides and lectures (-0.67), YouTube videos featuring experts (1.23), locally developed digital storytelling (2.14), and interactive tools (prototyping, virtual environments) (1.98).

In conclusion, Table 2 presents quantitative data and statistical analysis to compare the levels of student engagement associated with different learning technologies, providing insights into their relative effectiveness.

Table 3: Summary of Results (Qualitative and Quantitative Data)

Cycle	Learning Technology	Qualitative Findings	Quantitative Findings
1	Static slides and lectures	Limited student engagement	Low satisfaction scores
		Passive participation	Minimal student interaction
2	YouTube videos featuring experts	Increased student engagement	Improved satisfaction scores
		Bridge between theory and practice	Higher participation rates
3	Locally developed digital storytelling	Enhanced student engagement and creativity	Positive feedback on learning experience
		Encouraged critical thinking	Higher levels of student-led discussions
4	Interactive tools (prototyping, virtual environments)	Sustained learner engagement	Further improvement in satisfaction scores
		Productive discussions	Enhanced collaboration and active participation

Table 3 summarizes qualitative and quantitative findings for different learning technologies. The technologies evaluated are static slides and lectures, YouTube videos featuring experts, locally developed digital storytelling, and interactive tools (prototyping, virtual environments). The qualitative findings suggest limited student engagement and passive participation for static slides and lectures, increased engagement and bridging of theory and practice for YouTube videos, enhanced engagement and creativity with digital storytelling, and sustained engagement and productive discussions for interactive tools. The quantitative findings show low satisfaction scores and minimal interaction for static slides and lectures, improved satisfaction scores and higher participation rates for YouTube videos, positive feedback and higher levels of student-led discussions for digital storytelling, and further improvement in satisfaction scores with interactive tools.

In conclusion, Table 3 provides a comprehensive overview of the qualitative and quantitative findings for each learning technology, offering insights into the levels of student engagement, participation, satisfaction, and the impact of different approaches on learning outcomes.

Cycle 1: The use of static slides for the course introduction showed that students initially exhibited a serious and focused demeanor, reflecting their familiarity with traditional teaching methods (see figure 9). However, there was a noticeable lack of active participation and in-depth understanding among the learners. This suggests that static slides alone may not effectively engage students in the learning process.

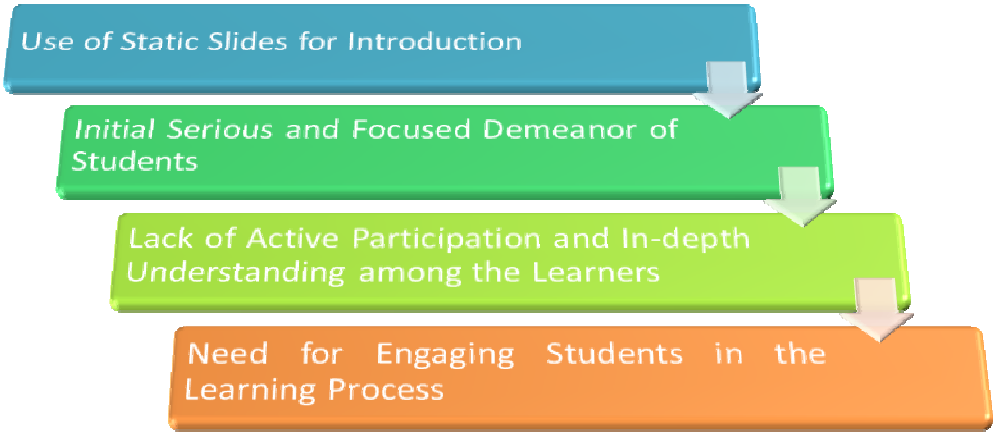

Figure 9. Pictorial Breakdown of Cycle 1

Cycle 2: The introduction of YouTube videos featuring experts discussing interaction design principles and showcasing real-world examples gradually enhanced student participation and narrowed the gap between instructors and learners. The incorporation of video content provided a more dynamic and visually engaging learning experience. However, it was observed that the reliance on external experts in the videos sometimes led to variations in terminologies and accents, which affected learner engagement to some extent (see figure 10).

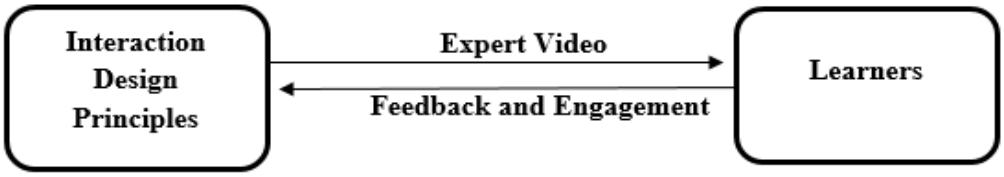

Figure 10. Flowchart of Cycle 2

Cycle 3: The utilization of locally developed digital storytelling products introduced an element of surprise and novelty for the students. These interactive and narrative-based materials fostered complete engagement and self-directed class discussions. The use of digital storytelling encouraged students to think critically, apply design principles within a context, and express their ideas creatively (see figure 11). However, it was also noted that these products had certain limitations in illustrating certain aspects of interaction design, requiring further refinement.

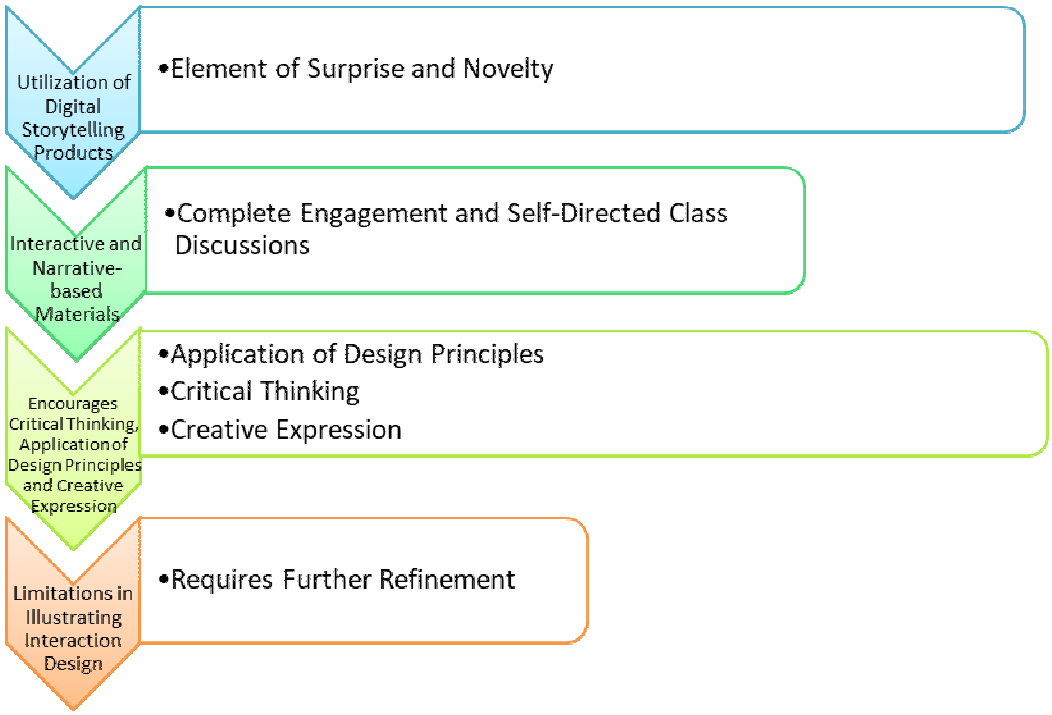

Figure 11. Diagram chart of Cycle 3

Cycle 4: The incorporation of interactive products, such as prototyping tools and virtual environments, in Cycle 4 resulted in sustained learner engagement and productive discussions. The hands-on nature of these tools allowed students to actively explore different design solutions, receive immediate feedback, and iterate on their ideas. This cycle demonstrated the potential of interactive products to enhance students' practical skills and problem-solving abilities in interaction design (see figure 12).

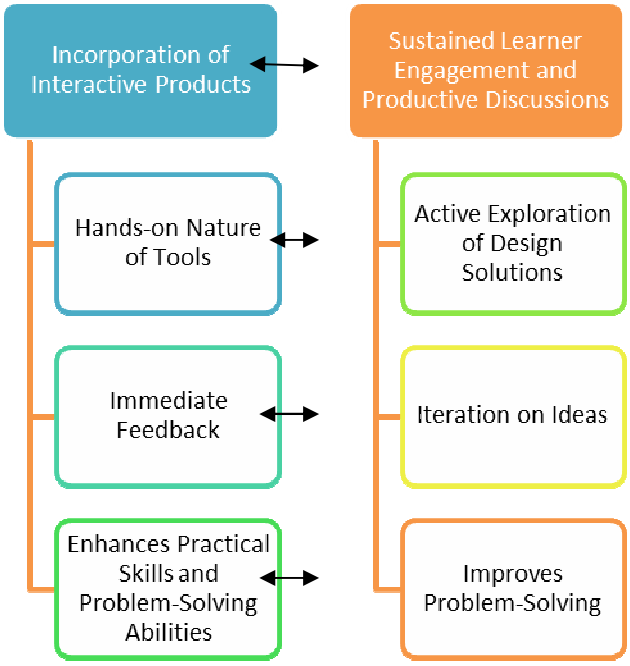

Figure 12. Flowchart of Cycle 4

In conclusion, the findings suggest that the integration of learning technologies in teaching interaction design can significantly impact student engagement and understanding. The progressive inclusion of various technologies led to a transformation from passive learners to active participants who expressed their ideas, engaged in critical discussions, and applied design principles in practical contexts.

The study results also highlight the importance of aligning pedagogy with learners' needs and cultural context. By creating a less formal learning environment that encourages students to freely express their ideas and actively participate in discussions, the utilization of learning technologies not only enhances the application of

design principles but also fosters the development of students' personalities and soft skills. Communication skills, leadership abilities, teamwork, and project management skills were observed to be significantly improved throughout the cycles.

These results provide valuable insights for educators and institutions seeking to optimize the teaching and learning of interaction design. By leveraging technology-enhanced pedagogies, educators can create more engaging and effective learning environments that promote active student participation, deeper understanding of design principles, and the development of essential skills for future professionals in the field of interaction design.

5. Discussion

The findings of this study highlight the significance of incorporating learning technologies in the teaching of interaction design. The utilization of conversation-based materials, expert videos, digital storytelling, and interactive products created a dynamic and engaging learning environment that fostered active student participation and deepened their understanding of design principles. This section discusses the implications of these results and explores the broader implications for pedagogical practices in interaction design education.

First and foremost, the integration of learning technologies addressed the challenge of disengaged learners commonly associated with traditional instructional methods. The use of static slides and lectures often leads to passive learning experiences, where students focus solely on the presented material without actively engaging with the subject matter. However, by leveraging technology-enhanced pedagogies, students were encouraged to interact with the content, express their ideas, and engage in discussions. This shift from a passive to an active learning approach has significant implications for promoting student-centered learning experiences. This conclusion is consistent with the findings of Dada, Laseinde, and Tartibu's 2023 research, which indicated that transitioning from a passive to an active learning method had an influence on student-centered learning.

Furthermore, the incorporation of expert videos from various universities in Cycle 2 provided students with diverse perspectives and real-world examples. Exposure to different experts and their unique insights expanded students' understanding of interaction design principles and showcased the relevance of these principles in professional practice. This validates Dumitrica and Jarmula's 2022 research result on educating using video experts. However, it is essential to consider the variations in terminologies and accents among the experts, as this can impact learner engagement and comprehension. Future iterations of the curriculum could focus on carefully selecting videos that align with the students' linguistic and cultural context.

The introduction of locally developed digital storytelling products in Cycle 3 brought a sense of novelty and creativity to the learning process. Digital storytelling allowed students to explore design principles within a narrative framework, stimulating critical thinking and problem-solving skills. The findings complement Poonsawad, A., Srisomphan, and Sanrach, (2022) research, which showed that the usage of interactive digital storytelling approaches can assist learners build critical thinking abilities. Furthermore, Meletiadou's 2022 research found that learners enhanced their writing skills and critical thinking with the usage of interactive digital storytelling. The engagement observed during this cycle suggests that incorporating interactive and narrative-based materials can effectively enhance student motivation, curiosity, and self-directed learning. However, the limitations identified in illustrating certain aspects of interaction design call for further refinement and development of these digital storytelling tools to ensure comprehensive coverage of the subject matter.

Cycle 4 demonstrated the value of hands-on experiences with interactive products in promoting student engagement and practical skill development. The use of prototyping tools and virtual environments enabled students to actively explore design solutions, iterate on their ideas, and receive immediate feedback. This finding is in line with Halabi, 2020 research work submission on the effectiveness of immersive virtual reality to enforce teaching in engineering education. By engaging in practical exercises, students developed problem-solving abilities and gained confidence in applying design principles in real-world scenarios. The integration of interactive products in the curriculum not only enhanced students' technical skills but also fostered their ability to work collaboratively, communicate effectively, and manage design projects.

The transformation observed in learners' communication skills, leadership abilities, teamwork, and project management skills throughout the study underscores the broader impact of learning technologies on the development of students' professional and interpersonal competencies. These skills are essential for success in the field of interaction design, where collaboration, effective communication, and project management play crucial roles. By providing an interactive and collaborative learning environment, the integration of learning technologies prepares students for the challenges they will encounter in their future careers.

It is important to note that the success of integrating learning technologies in teaching interaction design is highly dependent on the alignment of pedagogy with learners' needs and cultural context. The observed transformation from passivity to active engagement suggests that an adaptable and context-specific approach to pedagogy is essential. Educators should consider the cultural backgrounds, learning preferences, and prior knowledge of their students when designing and implementing technology-enhanced instructional strategies.

This ensures that the learning experiences are meaningful, relevant, and inclusive for all learners.

In conclusion, the findings of this study provide valuable insights into the impact of incorporating learning technologies in teaching interaction design. By creating an engaging and dynamic learning environment, students' interest, understanding, and confidence in applying design principles were enhanced. The integration of conversation-based materials, expert videos, digital storytelling, and interactive products fostered active student participation, critical thinking, and the development of essential professional and interpersonal skills. These findings contribute to the ongoing discourse on effective pedagogical practices in interaction design education and offer practical implications for educators and institutions seeking to optimize the teaching and learning of this discipline.

6. Conclusion

This research aimed to address the challenges associated with teaching interaction design by investigating the impact of incorporating learning technologies in the instructional process. The findings of this study have demonstrated the potential of technology-enhanced pedagogies in creating a more engaging and effective learning environment for students at First Technical University, Nigeria.

By integrating conversation-based materials, expert videos, digital storytelling, and interactive products into the curriculum, students were able to actively engage with the content, express their ideas, and participate in meaningful discussions. This shift from passive to active learning experiences has proven to enhance student motivation, curiosity, and self-directed learning. Moreover, the integration of diverse perspectives and real-world examples through expert videos expanded students' understanding of design principles and their practical application.

The incorporation of digital storytelling products brought creativity and narrative-driven learning into the classroom, stimulating critical thinking and problem-solving skills. While these products showed promise in engaging students, further development and refinement are necessary to address the limitations encountered in illustrating certain aspects of interaction design.

The inclusion of hands-on experiences with interactive products, such as prototyping tools and virtual environments, has been instrumental in developing students' technical skills, problem-solving abilities, and collaborative competencies. Through practical exercises, students gained confidence in applying design principles and acquired important professional skills, including effective communication, teamwork, and project management.

The transformation observed in learners' personalities and soft skills highlights the broader impact of integrating learning technologies in teaching interaction design. By providing an adaptable and context-specific approach to pedagogy, educators can foster the development of students' communication skills, leadership abilities, and teamwork, preparing them for successful careers in the field.

The findings of this study contribute to the body of knowledge on effective pedagogical practices in interaction design education. Educators and institutions can use these insights to optimize their teaching strategies and create engaging learning environments that promote active student participation, critical thinking, and the acquisition of essential skills.

In conclusion, the integration of learning technologies in teaching interaction design at First Technical University, Nigeria, has proven to be a valuable approach for enhancing student engagement, understanding, and practical skills. By leveraging technology-enhanced pedagogies and IoT-Based cloud integrated classroom (Olugbade et al., 2023), educators can create a dynamic and inclusive learning environment that prepares students for the challenges and opportunities in the field of interaction design. The insights gained from this study have significant implications for educators, institutions, and policymakers aiming to improve the quality of interaction design education. By adapting pedagogical approaches and embracing learning technologies, we can foster a new generation of skilled and innovative interaction designers who can create meaningful and impactful interactive products for the benefit of society. Future research can build on previous findings by investigating various learning technologies other than educational software and investigating the function of Artificial Intelligence (AI) in teaching interface design. Longitudinal studies can examine these instructional techniques' long-term impacts, while examinations into their transferability to different educational situations can give broader insights.

References

Almara'beh, H., Amer, E. F., & Sulieman, A. (2015). The effectiveness of multimedia learning tools in education. *International Journal*, *5*(12), 761-764.

Anastasiou, P. (2022). Digital stories in science. *Open World Learning*, 29.

Bahari, A. (2022). Affordances and challenges of technology-assisted language learning for motivation: A systematic review. *Interactive Learning Environments*, 1-21.

Battistoni, P., Di Gregorio, M., Romano, M., Sebillo, M., & Vitiello, G. (2023). Can AI-Oriented Requirements

Enhance Human-Centered Design of Intelligent Interactive Systems? Results from a Workshop with Young HCI Designers. *Multimodal Technologies and Interaction*, *7*(3), 24.

Berry, L. A., & Kowal, K. B. (2022). Effect of Role-Play in Online Discussions on Student Engagement and Critical Thinking. *Online Learning*, *26*(3).

Boling, E. C., Hough, M., Krinsky, H., Saleem, H., & Stevens, M. (2012). Cutting the distance in distance education: Perspectives on what promotes positive, online learning experiences. *The Internet and Higher Education*, *15*(2), 118-126.

Cowan, P., & Farrell, R. (2023). Virtual Reality as the Catalyst for a Novel Partnership Model in Initial Teacher Education: ITE Subject Methods Tutors' Perspectives on the Island of Ireland. *Education Sciences*, *13*(3), 228.

Dada, D., Laseinde, O. T., & Tartibu, L. (2023). Student-Centered Learning Tool for Cognitive Enhancement in the Learning Environment. *Procedia Computer Science*, *217*, 507-512.

Dalle, J., & Abdul Mutalib, A. (2018). The Impact of Technologies in Teaching Interaction Design. *The Impact of Technologies in Teaching Interaction Design*. http://eprints.ulm.ac.id/7760/

Damola, O., Adebayo, T. E., & Olayinka, O. Examining the Potential of IoT-Based Cloud-Integrated Smart Classroom for Efficient Learning and Institutional Sustainability. *International Research Journal of Modernization in Engineering Technology and Science, 5(5), 2436-2444.*

Dumitrica, D., & Jarmula, P. (2022). Teaching Qualitative Research Methods in Media and Communication: The Benefits and Limitations of Digital Learning Objects. *The Qualitative Report*, *27*(9), 1934-1951.

Durall Gazulla, E., Martins, L., & Fernández-Ferrer, M. (2023). Designing learning technology collaboratively: Analysis of a chatbot co-design. *Education and Information Technologies*, *28*(1), 109-134.

Gong, Y. (2021). Application of virtual reality teaching method and artificial intelligence technology in digital media art creation. *Ecological Informatics*, *63*, 101304.

Halabi, O. (2020). Immersive virtual reality to enforce teaching in engineering education. *Multimedia Tools and Applications*, *79*(3-4), 2987-3004.

Harrison, C. R., & Stennett, E. M. (2022). Flipped Learning in the Analytical Chemistry Classroom. In *Active Learning in the Analytical Chemistry Curriculum* (pp. 37-49). American Chemical Society.

Hernandez-de-Menendez, M., Escobar Díaz, C. A., & Morales-Menendez, R. (2020). Educational experiences with Generation Z. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *14*, 847-859.

Hine, G. S. (2013). The importance of action research in teacher education programs. *Issues in Educational research*, *23*(2), 151-163.

Hine, G. S., & Lavery, S. D. (2014). Action research: Informing professional practice within schools. *Issues in Educational Research*, *24*(2), 162-173.

Hourcade, J. P. (2008). Interaction design and children. *Foundations and Trends® in Human–Computer Interaction*, *1*(4), 277-392.

Istenic Starčič, A., Cotic, M., Solomonides, I., & Volk, M. (2016). Engaging preservice primary and preprimary school teachers in digital storytelling for the teaching and learning of mathematics. *British Journal of Educational Technology*, *47*(1), 29-50.

Ivankova, N. V. (2015). *Mixed methods applications in action research*. Sage.

Ivankova, N., & Wingo, N. (2018). Applying mixed methods in action research: Methodological potentials and advantages. *American Behavioral Scientist*, *62*(7), 978-997.

Jdaitawi, M. T., & Kan'an, A. F. (2022). A Decade of Research on the Effectiveness of Augmented Reality on Students with Special Disability in Higher Education. *Contemporary Educational Technology*, *14*(1).

Knowles, C., Mills, A., Shen, Y., & Jur, J. (2022, August). Virtual Hands-on Learning–The development of an online engineering design course with a virtual product inspection portal. In *2022 ASEE Annual Conference & Exposition*.

Lin, C., Han, C., Huang, Y., Chen, L., & Su, C. C. (2022). Effectiveness of the use of concept maps and simulated cases as a teaching-learning strategy in enhancing the learning confidence of baccalaureate nursing students: A qualitative approach. *Nurse Education Today*, *115*, 105418.

Liu, D., & Luo, J. (2022). College Learning from Classrooms to the Internet: Adoption of the YouTube as Supplementary Tool in COVID-19 Pandemic Environment. *Education and Urban Society*, *54*(7), 848-870.

Liu, Z. Y., Lomovtseva, N., & Korobeynikova, E. (2020). Online learning platforms: Reconstructing modern higher education. *International Journal of Emerging Technologies in Learning (iJET)*, *15*(13), 4-21.

Liao, Y. C., Dudley, J. J., Mo, G. B., Cheng, C. L., Chan, L., Oulasvirta, A., & Kristensson, P. O. (2023). Interaction Design With Multi-objective Bayesian Optimization. *IEEE Pervasive Computing*, *22*(1), 29-38.

Lundgren, S., Torgersson, O., Hallnäs, L., Ljungstrand, P., & Eriksson, E. (2006). Teaching interaction design: Matters, materials and means.

Meletiadou, E. (2022). Using educational digital storytelling to enhance multilingual students' writing skills in higher education. *IAFOR Journal of Education*, *10*(2), 111-130.

Muñoz, J. L. R., Ojeda, F. M., Jurado, D. L. A., Peña, P. F. P., Carranza, C. P. M., Berríos, H. Q., ... & Vasquez-Pauca, M. J. (2022). Systematic Review of Adaptive Learning Technology for Learning in Higher Education. *Eurasian Journal of Educational Research*, *98*(98), 221-233.

Ndihokubwayo, K., Uwamahoro, J., & Ndayambaje, I. (2022). Assessment of Rwandan physics students' active learning environments: classroom observations. *Physics Education*, *57*(4), 045027.

Neroni, M. A., Oti, A., & Crilly, N. (2021). Virtual Reality design-build-test games with physics simulation: opportunities for researching design cognition. *International Journal of Design Creativity and Innovation*, *9*(3), 139-173.

Niemi, H., & Multisilta, J. (2016). Digital storytelling promoting twenty-first century skills and student engagement. *Technology, Pedagogy and Education*, *25*(4), 451-468.

Olugbade, D., & Olurinola, O. (2021). Teachers' perception of the use of Microsoft Teams for remote learning in Southwestern Nigerian schools. *African Journal of Teacher Education*, *10*(1), 265-281.

Olugbade, D., Adekomi, A., & Sofowora, O. A. (2016). Enhancing Students' performance in Basic science and Technology in Nigeria using Moodle LMS. *International Journal of Educational and Pedagogical Sciences*, *10*(5), 1657-1660.

Outhwaite, L. A., Faulder, M., Gulliford, A., & Pitchford, N. J. (2019). Raising early achievement in math with interactive apps: A randomized control trial. *Journal of educational psychology*, *111*(2), 284.

Petousi, D., Katifori, A., Servi, K., Roussou, M., & Ioannidis, Y. (2022, August). History education done different: A collaborative interactive digital storytelling approach for remote learners. In *Frontiers in Education* (Vol. 7, p. 942834). Frontiers Media SA.

Poonsawad, A., Srisomphan, J., & Sanrach, C. (2022). Synthesis of problem-based interactive digital storytelling learning model under gamification environment promotes students' problem-solving skills. *International Journal of Emerging Technologies in Learning*, *17*(5).

Reid, J. W., Gunes, Z. D. K., Fateh, S., Fatima, A., Macrie-Shuck, M., Nennig, H. T., ... & Talanquer, V. (2022). Investigating patterns of student engagement during collaborative activities in undergraduate chemistry courses. *Chemistry Education Research and Practice*, *23*(1), 173-188.

Roberts, S., Page, R., & Richardson, M. (2020). Designing in virtual environments: The integration of virtual reality tools into industrial design research and education.

Rogers, Y., Sharp, H., & Preece, J. (2023). *Interaction design: beyond human-computer interaction*. John Wiley & Sons.

Saffer, D. (2010). *Designing for interaction: creating innovative applications and devices*. New Riders.

Salas-Pilco, S. Z., Yang, Y., & Zhang, Z. (2022). Student engagement in online learning in Latin American higher education during the COVID-19 pandemic: A systematic review. *British Journal of Educational Technology*, *53*(3), 593-619.

Smith, G. C. (2007). What is interaction design. *Designing interactions*, 8-19.

Thompson, I. (2022). Peer Reflection in a Healthcare Program: Implications for Practice. In *Inted2022 Proceedings* (Pp. 4215-4222). Iated.

Tolorunleke, E. A., Haruna, M. M., & Olugbade, D. (2023). Influence of Tertiary Students' Usage of Online Collaborative Tools For Learning and Improving Students' Academic Performance in Kogi State, Nigeria. *Journal of Science, Technology and Mathematics Pedagogy*, *1*(1), 59-68.

Wu, J. G., Zhang, D., & Lee, S. M. (2023). Into the Brave New Metaverse: Envisaging Future Language Teaching and Learning. *IEEE Transactions on Learning Technologies*.

Yang, Y. T. C., & Wu, W. C. I. (2012). Digital storytelling for enhancing student academic achievement, critical thinking, and learning motivation: A year-long experimental study. *Computers & education*, *59*(2), 339-352.