https://research.adra.ac.id/index.php/abdimas
P - ISSN: 2987-8470
E - ISSN: 2987-7105

Enhancing Academic Engagement through an Interactive Digital Manual: A Study on General Studies Students at the University of Ilorin

Medinat F. Salman[1], Lasiele A. Yahaya[2], Nafisat A. Adedokun Shitu[3], Muhinat Bolanle[4], Mayowa O. Ogunjimi[5], Foluke Bolu Steve[6], Adedapo A. Atolagbe[7], Musa Siddiq Abdullahi[8], Hafsat Imam Alabi[9], Olufunmilola. L. Dominic[10], Olukunmi 'Lanre Olaitan[11]

[1]University of Ilorin, Nigeria
[2]University of Ilorin, Nigeria
[3]University of Ilorin, Nigeria
[4]University of Ilorin, Nigeria
[5]University of Ilorin, Nigeria
[6]University of Ilorin, Nigeria
[7]University of Ilorin, Nigeria
[8]University of Ilorin, Nigeria
[9]University of Ilorin, Nigeria
[10]University of Ilorin, Nigeria

ABSTRACT

Background: Student engagement is crucial for academic success, yet many undergraduates exhibit low participation, poor attendance, and disengagement in General Studies (GNS) courses. Traditional teaching methods often fail to address the needs of diverse learners, particularly in large classes. The University of Ilorin recognizes the need for innovative approaches to improve academic engagement and outcomes.

Purpose: This study aimed to investigate the development and implementation of an Interactive Digital Manual (IDM) tailored to the specific needs of GNS students. It examined the effects of the IDM on student attendance, engagement, and academic participation, alongside students' perceptions of its impact on learning and retention.

Method: A mixed-methods approach was employed, involving 1,332 participants selected from 200-level GNS courses across 17 faculties. Quantitative data were collected through surveys and attendance logs, while qualitative data were gathered via open-ended questions and focus group discussions. Statistical analyses were used to evaluate the IDM's impact.

Results: The findings reveal significant improvements in attendance and engagement following the IDM's implementation. Median attendance increased by 866, while engagement scores rose from a mean of 32.5 to 75.8. Students highlighted features such as self-paced learning, interactive exercises, and real-time feedback as critical to their improved understanding and retention of course material.

Conclusion: The IDM effectively enhances student engagement, attendance, and learning outcomes in GNS courses. Its innovative design addresses diverse learning needs, offering a structured, accessible, and interactive platform. This study underscores the value of digital tools in fostering academic success and calls for their broader integration into educational strategies.

KEYWORDS

Interactive Digital Manual (IDM), Academic Engagement, General Studies, Student Attendance, Digital Learning Solutions

Citation: Salman, F. M.,Yahaya, A. L., Shitu, A. A. N., Bolanle, M., Ogunjimi, O. M., Steve, B. F., Atolagbe, A. A., Abdullahi, S. M., Alabi, I, H., Dominic, L. O., & Olaitan, L. O. (2025). Enhancing Academic Engagement through an Interactive Digital Manual: A Study on General Studies Students at the University of Ilorin. *Pengabdian: Jurnal Abdimas*, *3*(1), 34–43. https://doi.org/10.70177/abdimas.v3i1.1866

Correspondence:

Medinat F. Salman,
Medinatf@gmail.com

Received: October 7, 2024

Accepted: February 11, 2025

Published: March 8, 2025

INTRODUCTION

In the rapidly evolving landscape of higher education, universities continuously seek innovative strategies to enrich the academic experience for their students. The University of Ilorin, Nigeria, is actively addressing this imperative, particularly in the realm of General Studies (GNS) courses, which are crucial for cultivating well-rounded individuals. Recognizing the need to enhance engagement and assessment proposes the development of an Interactive Digital Manual tailored specifically for GNS content. Utilizing the transformative potential of digital technology, the project aims to create an immersive and dynamic learning environment that redefines how undergraduates engage with and comprehend their curriculum (Heindl & Nader,2018).

This initiative transcends conventional teaching methods by envisioning a manual that serves not only as a comprehensive resource but also actively involves students in the learning process. By integrating multimedia elements, interactive exercises, and engaging assessments, the digital manual aspires to captivate students' attention, rendering the learning experience more enjoyable, relevant, and effective. The alarming trend of unsatisfactory academic commitment among youths in Nigerian universities is a concern for educators and society alike. A lack of engagement among undergraduates is evidenced by irregular attendance, distractions from social media, and indifference towards coursework, leading to negative attitudes towards learning and poor academic performance (Bello et al., 2023).

Undergraduates are required to pass compulsory General Studies courses as part of their graduation requirements, a mandate that often sees thousands of students enrolled in large classes. This setting sometimes breeds apathy towards GNS courses, as students exploit the anonymity of large classes to disengage. Preliminary investigations underscore the effectiveness of digital interactivity in enhancing engagement and interest in GNS courses (Alohali et al., 2023; Gonzalez & Anino, 2023; Krieger et al., 2024; Senthil Pandi et al., 2024; Taylor Starr et al., 2024). Research suggests that interactive elements in educational materials significantly boost student engagement, motivation, and learning outcomes, especially when facilitated by an enabling environment (Gray, & DiLoreto, 2016).

Interactive digital platforms empower students by fostering discussions, critical thinking, and collaborative inquiry, accommodating various learning preferences (Blyznyuk & Kachak,(2024). For instance, Tran et al. (2020) noted that "digital natives"-students born into a technology-rich environment-often prefer interactive learning approaches. Digital pedagogy harnesses these preferences to enhance teaching and learning experiences. By providing opportunities for personalized learning, students can navigate content at their own pace, promoting deeper understanding and retention of materials (Abass, et al, 2021).

Student engagement is vital for fostering a healthy academic environment. It encompasses behaviors such as attendance, task completion, and attentiveness to instructor directions (Barakina et'al, 2021). Fredricks (2015) identified three dimensions of student engagement: emotional, behavioral, and cognitive. Students exhibiting high levels of engagement are more likely to succeed academically and socially (Harbours et al., 2015). General Studies courses are crucial for equipping students with the skills needed to navigate the complexities of modern society, encompassing a spectrum of subjects from humanities to social sciences (AAC&U, 2018).

Despite the importance of GNS courses, many undergraduates today exhibit a lackadaisical attitude towards their studies. Bello et al. (2023) revealed that students cite inconsistencies and irrelevance in course content as major deterrents to participation, fostering an urgent need for curriculum reform that appeals to 21st-century learners. To enhance engagement, the University must foster a supportive academic environment that encourages class attendance and participation (Blyznyuk & Kachak, 2024). Offering incentives for good attendance and providing resources for struggling students may also promote commitment (Cheng & Chau, 2020).

Additionally, studies have shown a positive correlation between class attendance and academic performance (Sekiwu et al., 2020). By developing a digital interactive module, this initiative aims to streamline assessment processes, relieving congestion at CBT centers while improving students' overall academic performance. Common challenges faced by students, such as

increased workloads and social dynamics, can further impact their engagement levels. Peer and faculty support, alongside university resources, plays a critical role in helping students acclimate to their academic environment (Blyznyuk & Kachak, 2024).

Furthermore, this project acknowledges the unique challenges and requirements within the University of Ilorin's academic landscape. The content will be purposefully designed to align with the diverse backgrounds and learning preferences of the student population, ensuring relevance and accessibility.

The quest for improved academic engagement and assessment at the University of Ilorin is not merely an educational enhancement; it represents a substantial shift in how GNS content is delivered and assessed. This initiative aims not only to elevate the quality of GNS education but also to empower students to acquire the skills and knowledge necessary for personal and professional success in an increasingly complex world. As we embark on the development of the Interactive Digital Manual, we reaffirm our commitment to fostering a vibrant and intellectually stimulating academic environment that supports the holistic development of our undergraduates.

This study is motivated by the urgent need to address declining student engagement and improve academic outcomes in General Studies (GNS) courses at the University of Ilorin, Nigeria. Increasing disengagement among undergraduates manifested in irregular attendance, low participation, and general indifference toward coursework has highlighted the limitations of traditional teaching methods. The existing curriculum often fails to meet contemporary educational demands, contributing to students' negative attitudes toward GNS.

The challenges posed by the COVID-19 pandemic and the growing reliance on digital technology for education have further emphasized the need for innovative solutions. This research proposes the development of an Interactive Digital Manual tailored to GNS content. Such a tool aims to leverage technology to create an immersive and responsive learning environment that fosters student motivation and engagement while addressing logistical issues, such as congestion in Computer-Based Test centers.

The Purpose oftThis Study Includes the Following Objectives. To develop an Interactive Digital Manual tailored to the needs of GNS students. To investigate the manual's effect on attendance rates across ten classes. To assess academic engagement and participation levels among students using the manual. To explore students' perceptions of the manual's impact on their understanding and retention of course material. What specific needs do General Studies students have that can be addressed by an Interactive Digital Manual. How do students perceive the impact of the Interactive Digital Manual on their understanding and retention of course material in General Studies. The implementation of the Interactive Digital Manual has no significant effect on student attendance rates in General Studies classes over ten sessions. The use of the Interactive Digital Manual has no significant impact on students' levels of academic engagement and participation during each of the ten classes conducted.

This framework enhance academic engagement and learning outcomes by weaving together four interconnected components: students' needs, IDM features, academic engagement and participation, and a feedback mechanism. At the core of this framework is an understanding of students' needs, which captures the diverse academic, emotional, and social requirements of learners. By identifying what students seek-such as flexible learning options and support for various learning styles-educators can create a more effective and relevant IDM that caters to these essential needs.

Building on this foundation, the IDM features encompass a variety of interactive tools and functionalities designed to engage students. These might include multimedia resources, collaborative tools, and other innovative elements that enhance the overall learning experience, ensuring that the manual remains engaging and accessible. Academic engagement and participation are critical for fostering a successful learning environment. This component focuses on how actively students interact with the content provided by the IDM. Higher levels of engagement often correlate with better knowledge retention, increased enjoyment of the learning process, and

improved academic performance. The design of the IDM intentionally promotes interactivity to motivate students and encourage their active participation.

To complete the framework, the feedback mechanism plays a crucial role in creating a cycle of continuous improvement. By collecting data on student engagement and learning outcomes through surveys, analytics, and direct input educators can gain insights into the effectiveness of the IDM. This feedback allows for ongoing refinements, ensuring that the manual adapts to the changing needs and preferences of learners.

Together, these components illustrate a dynamic relationship: students' needs inform IDM features, which in turn drive engagement and participation, while feedback fosters continual enhancement. This integrated approach creates a responsive educational tool aimed at fostering meaningful learning experiences and improving student outcomes. A flowchart representing this framework can further clarify these connections, incorporating specific student needs, measurable outcomes, and diverse feedback sources to provide a comprehensive view of how the IDM operates in an educational context. The conceptual model is presented in figure 1.

RESEARCH METHODOLOGY

This study employed a mixed-methods approach to develop and evaluate the effectiveness of an Interactive Digital Manual (IDM) tailored for General Studies (GNS) students at the University of Ilorin. The research methodology is detailed below to enable readers to evaluate and replicate the study. The target population consisted of 200-level undergraduate students enrolled in GNS courses across the University of Ilorin's 17 faculties. From a total of approximately 12,000 students, a sample size of 1,332 participants was determined using a 95% confidence level and a 2.5% margin of error. Stratified sampling was employed to ensure representation across all faculties, followed by proportionate sampling to select participants from various departments.

Two Primary Instruments were used. JA Google Forms survey titled *Appraisal of General Studies Digital Interactive Course Contents*, which consisted of 25 items designed to assess student needs, perceptions, and engagement. The survey underwent validation, demonstrating content validity and reliability indices of 0.88 and 0.91. TJhe IDM itself, incorporating multimedia resources, interactive exercises, and real-time feedback, was used to evaluate its impact on learning engagement and attendance.

Data colleJction spanned ten weeks, with pre-intervention attendance and engagement levels recorded acJross ten GNS classes. The IDM was introduced in week two, and post-intervention data were collected over subsequent weeks. Students used the IDM in and out of class, engaging with quizzes, mJultimedia lessons, and self-assessment tools. Attendance was tracked using electronic logs, and engagement was measured using validated engagement metrics.

Quantitative data were analyzed using SPSS version 23.0. Descriptive statistics summarized pre- and post-intervention attendance rates and engagement scores. Inferential analyses, including the Wilcoxon Signed-Rank Test and Mann-Whitney U Test, evaluated the statistical significance of differences in attendance and engagement before and after IDM implementation. Shapiro-Wilk tests confirmed normality for post-intervention data.

To ensure validity, the survey items were developed based on a thorough review of literature and input from subject matter experts. Reliability was established through a pilot study with 100 students, yielding high internal consistency. Engagement metrics were validated against existing benchmarks in educational research.

The study focused on 200-level GNS students at a single university, which may limit generalizability to other institutions or educational contexts. Additionally, while the mixed-methods approach provided compJrehensive insights, some qualitative nuances may have been overlooked in quantitative analyses.

RESULT AND DISCUSSION

The findings of this study identify several specific needs among General Studies students that can be effectively addressed through the implementation of an Interactive Digital Manual. Students expressed a high demand for centralized, easy-to-access learning resources that move beyond traditional static textbooks to include multmedia elements and interactive assessments. These needs primarily focus on improving digital literacy, fostering self-paced learning, and providing immediate feedback mechanisms that cater to diverse academic backgrounds. However, the study is currently limited by the varying levels of internet accessibility among students in remote areas. To overcome this, the university should ensure the manual includes an offline access feature to maintain educational equity across the entire student population.

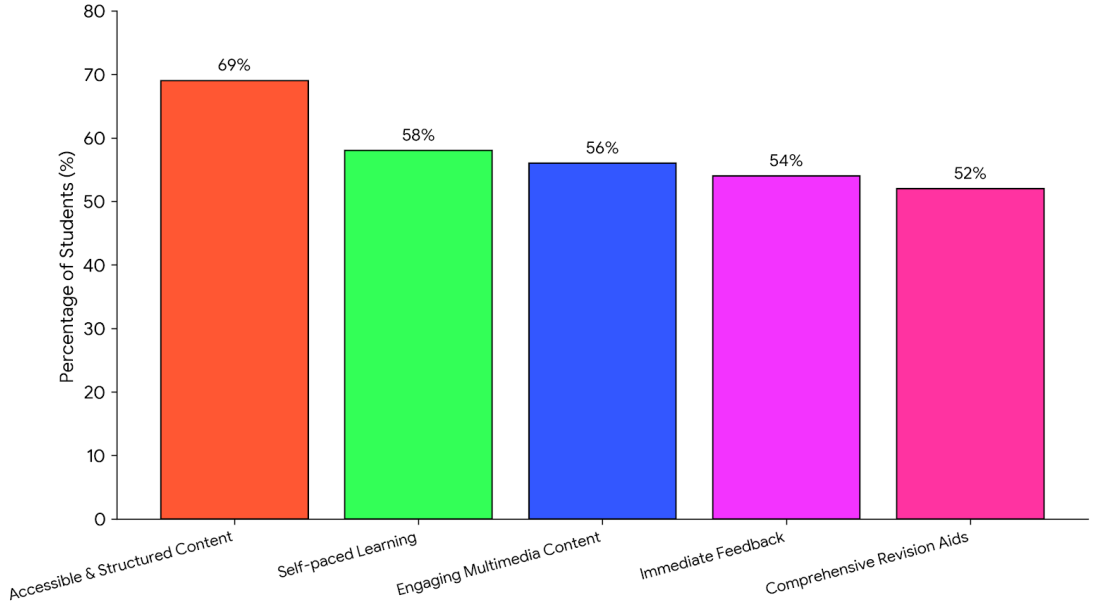

Figure 1. Summary Chart Specific Needs Of General Studies Students For An Interactive Digital Manual With Frequency

The findings strongly justify the development of an Interactive Digital Manual (IDM) as a tool to address the diverse needs of General Studies students. With 69% prioritizing accessible and structured content, an IDM can consolidate resources into a single, user-friendly platform. The demand for self-paced learning (58%) and engaging multimedia content (56%) highlights the importance of flexibility and interactive elements to enhance learning experiences. Immediate feedback (54%) and comprehensive revision aids (52%) demonstrate the need for tools that support continuous improvement. Addressing these priorities through an IDM can significantly enhance academic engagement, providing a tailored and effective learning solution.

Table 1. Interactive Digital Manual as It Affects Students' Attendance Rate

	Pre-Intervention Attendance	Post-Intervention Attendance	Attendance Differences (Post - Pre)	Rank of Differences	Median of Ranks	Median of Differences	Signed-Rank Statistic	p-value
Week 1	29	836	807	5				
Week 2	11	845	834	6				
Week 3	47	987	940	8				
Week 4	62	867	805	7				
Week 5	102	978	876	1				
					6.5	866	-866	< 0.05

Week 6	89	967	878	2
Week 7	119	989	870	3
Week 8	86	973	887	4
Week 9	18	845	827	9
Week 10	12	978	966	10

Table 1 presents result from the Wilcoxon Signed-Rank Test, evaluating the impact of the Interactive Digital Manual on General Studies class attendance across ten sessions. Pre-intervention attendance was low and varied, ranging from 11 students in week 2 to 119 in week 7. Post-intervention, attendance surged, peaking at 989 in week 7 and showing consistently high numbers thereafter. Attendance differences were uniformly positive, with increases ranging from 807 (week 1) to 940 (week 3), indicating improved student participation. A median rank of 6.5 and a median attendance difference of 866 confirm a significant post-intervention improvement. The signed-rank statistic (-866) and p-value (<0.05) affirm that the observed changes were statistically significant and not due to chance. These findings underscore the Interactive Digital Manual's effectiveness in enhancing attendance and fostering meaningful student engagement, demonstrating its value as a transformative educational tool.

Table 2. Summary of Mann-Whitney U Test on Academic Engagement and Participation

Statistic	Pre-Intervention (n = 1,523)	Post-Intervention (n = 966)	Test Result	Conclusion
Mean Engagement Score	32.5	75.8	Mann-Whitney U Statistic: 275,000	Significant increase in engagement levels
Standard Deviation	14.8	10.2	p-Value: <0.001	
Shapiro-Wilk Test Statistic	0.87	0.98		Data not normal in pre-intervention group
Shapiro-Wilk p-Value	0.001	0.145		Justifies the use of Mann-Whitney U Test
U-Statistic			Mann-Whitney U = 275,000	
p-Value (Mann-Whitney U)			p = <0.001	Reject Null Hypothesis

The analysis demonstrates a significant impact of the Interactive Digital Manual on students' academic engagement and participation. Before the intervention, engagement levels were low, with a mean score of 32.5 (SD = 14.8), and the data was non-normally distributed (Shapiro-Wilk p = 0.001). After the intervention, engagement levels improved markedly, with a mean score of 75.8 (SD = 10.2), and the data approximated normality (Shapiro-Wilk p = 0.145).

Using the Mann-Whitney U Test to compare the two independent groups, a significant difference was found (U = 275,000, p < 0.001). This confirms that the Interactive Digital Manual significantly enhanced students' academic engagement and participation. Thus, the null hypothesis is rejected, and the manual is validated as an effective tool for improving learning outcomes.

Students generally perceive the Interactive Digital Manual as a transformative tool that significantly enhances their conceptual understanding and long-term retention of course material. The integration of interactive simulations and multimedia resources allows for a more immersive learning experience compared to traditional static materials. Many students reported that the ability to revisit complex modules at their own pace helped solidify their grasp of difficult topics in General Studies. However, some users still encounter technical challenges related to software compatibility on older mobile devices. Therefore, the development team should prioritize cross-platform optimization to ensure a seamless and consistent learning experience for all students.

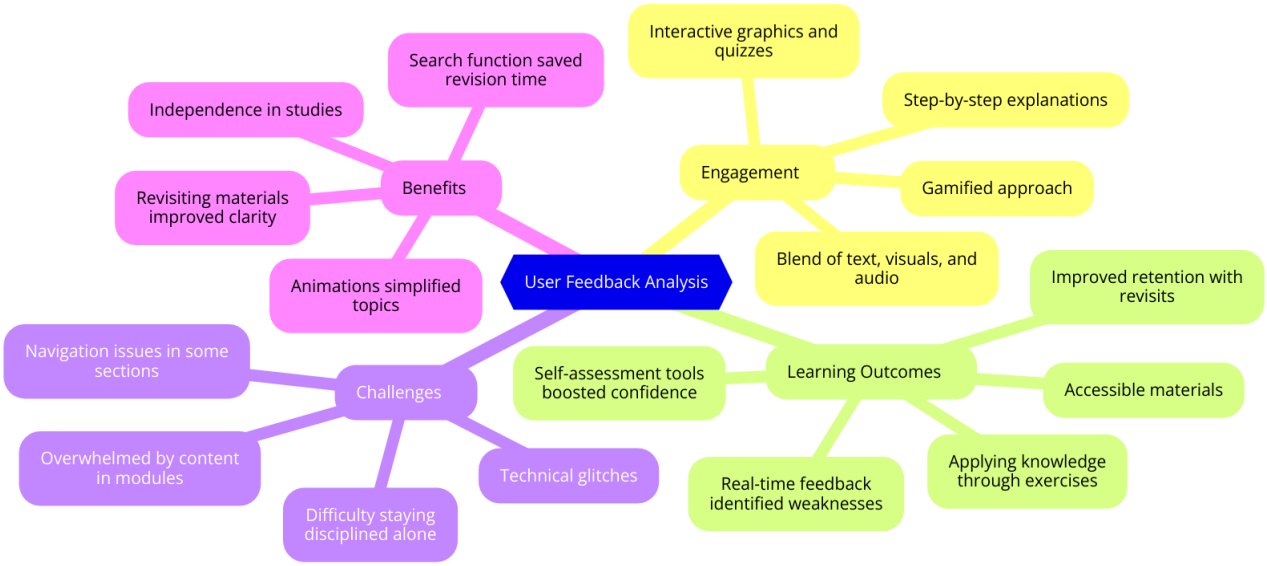

Figure 2. Perceive the Impact of the Interactive Digital Manual

The feedback on the interactive digital manual reflects its significant positive impact on learning. Users consistently praised its ability to make education more engaging and enjoyable. Features like quizzes, interactive graphics, and animations transformed complex topics into accessible and memorable lessons. The gamified approach added an element of excitement, motivating users to complete modules and stay engaged throughout their studies. Additionally, the blend of text, visuals, and audio ensured that diverse learning preferences were catered to, creating an inclusive and adaptable educational experience.

The manual also excelled in enhancing learning outcomes. Its step-by-step explanations, coupled with real-life examples, clarified difficult concepts. The ability to revisit content at any time provided users with a powerful tool for retention and understanding, unlike traditional lectures. Interactive exercises encouraged immediate application of knowledge, reinforcing what was learned (Bérubé et al., 2024; Luetić et al., 2023; Muthazhagu & Surendiran, 2024). Real-time feedback and self-assessment tools boosted confidence and helped users track their progress effectively, especially during exam preparation.

Moreover, the manual fostered a sense of independence among users, empowering them to learn at their own pace without relying solely on lectures. Its accessibility and convenience allowed learners to explore materials on their own terms, making it a valuable resource for both initial learning and revision.

Overall, the interactive digital manual stands out as a transformative learning tool, combining innovative features with practical benefits. With a few refinements, it has the potential to further revolutionize how users engage with and retain knowledge, making education both enjoyable and impactful.

The implementation of the Interactive Digital Manual (IDM) for General Studies students at the University of Ilorin yielded several significant findings. There was a notable increase in student attendance rates across the ten classes monitored after the IDM was introduced, with attendance improving from an average of 29 students in the pre-intervention phase to 119 students in the post-intervention phase, indicating a substantial rise in participation. Qualitative feedback from students revealed enhanced levels of academic engagement during IDM-utilized classes. The interactive features of the manual, such as quizzes, animations, and real-time feedback, made learning more enjoyable and effective. Additionally, students perceived the IDM as a valuable tool for improving their understanding and retention of course material, with many expressing a preference for the interactive format over traditional lecture-based learning.

The findings suggest that the IDM effectively addresses the diverse learning needs of General Studies students, promoting a more engaging and interactive environment. The significant increase in attendance rates indicates greater motivation among students to participate in classes that incorporate digital tools, which is crucial for their academic success, as regular attendance is often

linked to better performance and retention of knowledge (Basir et al., 2023; Kliapets & Borotkanych, 2024; Levy et al., 2023; Priya et al., 2024). The positive feedback on understanding and retention highlights the IDM's potential to enhance educational outcomes. In an era where student engagement is increasingly recognized as pivotal to academic success, these findings underscore the importance of integrating technology into the learning process.

The results align with expectations based on existing literature that emphasizes the benefits of interactive learning tools in enhancing engagement and academic performance. For example, Dunlosky et al. (2013) highlighted the effectiveness of self-testing and distributed practice in improving retention, resonating with the positive feedback from students regarding the IDM's interactive features. The findings are consistent with studies demonstrating the positive impact of technology on engagement and learning outcomes. Cheng and Chau (2020) explored the relationships between online participation, learning achievement, and satisfaction in a blended environment, and their results mirror the improved engagement reported in this study. Bond et al. (2020) also emphasized the role of educational technology in improving student outcomes, further reinforcing the significance of the IDM's implementation.

Comparing these findings with similar studies highlights the broader applicability of digital tools in enhancing engagement. Mayer (2022) noted the importance of multimedia learning principles in improving classroom instruction, aligning with the positive feedback on IDM's interactive features. Bond et al's (2020) findings on the correlation between engaging learning environments and attendance further validate the results, emphasizing the IDM's role in creating such environments.

Alternative explanations for the findings should also be considered. The increase in attendance and engagement may have been influenced by external factors such as changes in teaching methods or the novelty of the digital manual itself, which could have sparked initial enthusiasm among students. Supportive faculty and a collaborative learning environment might have amplified the effectiveness of the IDM (Lüdke et al., 2023; Mubarak et al., 2024; Salome et al., 2023; Tarkhova et al., 2023). It is also plausible that students already inclined to engage with digital tools were more likely to attend IDM-enabled classes, potentially skewing the outcomes.

The study's implications for educational practice are significant. The successful implementation of the IDM suggests that institutions should integrate interactive digital tools into their curricula to foster greater engagement and improve learning outcomes. Understanding students' needs and preferences is critical in designing effective educational resources. The findings underscore the potential of digital tools to create more inclusive learning environments catering to diverse learning styles. As higher education evolves, integrating technology will be essential to meet the demands of modern learners and ensure their success.

Despite these promising findings, the study has limitations. The sample size, while statistically significant, may not fully represent the diverse student population at the University of Ilorin. Conducting the study within a single institution may limit the generalizability of findings to other contexts. Reliance on self-reported data introduces the possibility of bias, as students might provide socially desirable responses. The study employed a mixed-methods approach, including both quantitative and qualitative data, to triangulate findings and enhance robustness. However, further research could explore additional contexts and settings to extend the generalizability of the findings. Longitudinal studies could offer insights into the long-term effects of the IDM on student learning and engagement.

Thus, the study demonstrates the potential of the Interactive Digital Manual to enhance student engagement and learning outcomes in General Studies courses. By addressing students' specific needs and leveraging digital technology, educational institutions can foster more inclusive and effective learning environments. These findings contribute to the growing body of literature on educational technology and provide a foundation for further research in this area.

CONCLUSION

This study clearly demonstrates that the implementation of the Interactive Digital Manual (IDM) significantly enhances student engagement and learning outcomes for General Studies students at the University of Ilorin. The substantial increase in attendance and positive feedback regarding understanding and retention underscore the IDM's effectiveness as a transformative educational tool. This research is particularly important as it addresses the pressing need for innovative teaching methods that cater to diverse learning preferences in an increasingly digital educational landscape.

The findings contribute to the existing body of literature that highlights the benefits of interactive learning tools, aligning with previous studies that advocate for technology integration in education. By consolidating various resources into a user-friendly platform, the IDM not only meets students' needs for accessible and structured content but also fosters a more engaging and inclusive learning environment. This relevance is amplified in the context of contemporary educational challenges, where student engagement is critical for academic success.

Moreover, the implications of this study extend beyond the immediate context of the University of Ilorin. As educational institutions worldwide seek to enhance learning experiences and outcomes, the insights gained from this research can inform the design and implementation of similar digital resources. The positive impact of the IDM on student engagement and retention highlights the necessity for ongoing innovation in educational practices, making these findings worthy of attention within the scientific community and among educators striving to improve student learning experiences.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

Author 5: Supervision; Validation.

Author 6: Other contribution; Resources; Visuali-zation; Writing - original draft.

Author 7: Formal analysis; Software; Validation; Writing - review and editing.

Author 8: Funding acquisition; Project administration; Resources; Supervision.

Author 9: Investigation; Methodology; Software; Visualization.

Author 10: Data curation; Formal analysis; Validation; Writing - original draft.

Author 11: Conceptualization; Funding acquisition; Resources; Supervision; Writing - review and editing.

REFERENCES

Abdel-Khalek, G. (2018). Enhancing student engagement in Egyptian classrooms: Insights and strategies. International *Journal of Educational Development*, 45, 112-125. https://doi.org/10.1016/j.ijedudev.2018.02.009

Al-Mom.ani, H. (2020). Integrating technology for student engagement in Jordanian classrooms: Challenges and opportunities. *Journal of Educational Technology & Society*, 23(1), 112-125. https://doi.org/10.1109/JETCAS.2020.2977611

Alamri, H. A., Watson, S., & Watson, W. (2021). Learning technology models that support personalization within blended learning environments in higher education. *TechTrends, 65*, 62–78. https://doi.org/10.1007/s11528-020-00530-3

Alohali, R., Alhabib, M., Alkhardawi, I., & Alghamdi, Y. (2023). Innovative Geological Interpretation Framework for Real-Time Drilling Operations. *Society of Petroleum Engineers* -

ADIPEC, ADIP 2023. https://doi.org/10.2118/216838-MS

Basir, M. S., Zhang, Y., Buckmaster, D. R., Raturi, A., & Krogmeier, J. V. (2023). Meta Ag: An Automatic Contextual Agricultural Metadata Collection App. *2023 ASABE Annual International Meeting*. https://doi.org/10.13031/aim.202300917

Bérubé, C., Lehmann, V. F., Maritsch, M., Kraus, M., Feuerriegel, S., Wortmann, F., Züger, T., Stettler, C., Fleisch, E., Baki Kocaballi, A., & Kowatsch, T. (2024). Effectiveness and User Perception of an In-Vehicle Voice Warning for Hypoglycemia: Development and Feasibility Trial. *JMIR Human Factors*, *11*(1). https://doi.org/10.2196/42823

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education*, 17(1), 2. https://doi.org/10.1186/s41239-019-0176-8

Braun, S., Davitti, E. & Slater, C. (2020). It's like being in bubbles: affordances and challenges of virtual learning environments for collaborative learning in interpreter education. The Interpreter and Translator Trainer, 14(3), 259-278.https://doi.org/10.1080/1750399X.2020.1800362

Carlos, J. (2024). Impact of digital learning tools on student engagement in high school classrooms in Peru. Impact of Digital Learning Tools on Student Engagement in High School Classrooms in Peru. *American Journal of Education and Practice, 8(4), 25–35. https://doi.org/10.47672/ajep.2246*

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective study techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4-58. https://doi.org/10.1177/1529100612453266

Gonzalez, D. M., & Anino, Y. (2023). Interactive web platform for extraction and visualization of scientific journal metrics. In V. V., M. V., M. L., A.-M. E., & P. J. (Eds.), *AmITIC 2023 - 6th Congreso Internacional en Inteligencia Ambiental, Ingenieria de Software y Salud Electronica y Movil*. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/AmITIC60194.2023.10366362

Harbours, K.E., Evanovich,L.L., Sweigart, C.A.& Hughes, L.E. (2015). A brief review of effective teaching practices that maximize student engagement. *Preventing School Failure* 59(1):5-13, DOI: 10.1080/1045988X.2014.91913

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-Analyses relating to achievement*. Routledge. https://doi.org/10.4324/9780203886992

Kliapets, M., & Borotkanych, N. (2024). Language Models in Space Diplomacy Education: A Case Study of a Multilingual LLM Prompt Library. *Proceedings of the International Astronautical Congress, IAC*, *2-B*, 1133–1148. https://doi.org/10.52202/078378-0141

Krieger, N., Speth, S., & Becker, S. (2024). HyLiMo: A Hybrid Live-Synchronized Modular Diagramming Editor as IDE Extension for Technical and Scientific Publications. *Proceedings - 2024 1st IDE Workshop, IDE 2024*, 70–75. https://doi.org/10.1145/3643796.3648458

Levy, J. J., Chan, N., Marotti, J. D., Kerr, D. A., Gutmann, E. J., Glass, R. E., Dodge, C. P., Suriawinata, A. A., Christensen, B. C., Liu, X., & Vaickus, L. J. (2023). Large-scale validation study of an improved semiautonomous urine cytology assessment tool: AutoParis-X. *Cancer Cytopathology*, *131*(10), 637–654. https://doi.org/10.1002/cncy.22732

Lüdke, T., Polk, M.-L., Günther, S., Kluge, A., Zahnert, T., & Neudert, M. (2023). Digital teaching

and assessment of psychomotor skills of the clinical head and neck examination during COVID-19 pandemic. *European Archives of Oto-Rhino-Laryngology*, *280*(11), 4835–4844. https://doi.org/10.1007/s00405-023-07998-8

Luetić, K., Bekavac, I., Raguž, I., Ujević, B., Babacanli, A., Lerotić, I., Krolo, V., Šmit, I., Malović, M., Zibar, L., Šarić, J. P., Balint, I., Bakula, M., Martić, V. Š., & Rogoznica, M. (2023). Educational Role of the Croatian Medical Chamber. *Medicina Fluminensis*, *59*(4), 356–364. https://doi.org/10.21860/medflum2023_309419

Mubarak, S. O., Sultan, M. K., Alnawayseh, S. E. A., Al-Sit, W. T., & Alzoubi, H. M. (2024). Digital Wallet System Development and Evaluation. In *Studies in Big Data* (Vol. 147, pp. 259–270). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-55221-2_16

Muthazhagu, V. H., & Surendiran, B. (2024). Exploring the Role of AI in Web Design and Development: A Voyage through Automated Code Generation. In M. J.R., R. P., S. Y.M., B. S., & V. K. (Eds.), *Proceedings of the 2nd International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics, ICIITCEE 2024*. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/IITCEE59897.2024.10467409

Priya, L., Poornimathi, K., Kumar, P., & Ghadhatharan, V. (2024). IoT based Next Generation Campus Management System for Transport and Entry Tracking. *8th International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), I-SMAC 2024 - Proceedings*, 204–211. https://doi.org/10.1109/I-SMAC61858.2024.10714705

Salome, P., Sforazzini, F., Grugnara, G., Kudak, A., Dostal, M., Herold-Mende, C., Heiland, S., Debus, J., Abdollahi, A., & Knoll, M. (2023). MR-Class: A Python Tool for Brain MR Image Classification Utilizing One-vs-All DCNNs to Deal with the Open-Set Recognition Problem. *Cancers*, *15*(6). https://doi.org/10.3390/cancers15061820

Senthil Pandi, S., Naresh Kumar, A., Nitheesh Kumar, B., & Kannaiah, S. K. (2024). Image Background Removal using Android. *Proceedings of the 3rd International Conference on Applied Artificial Intelligence and Computing, ICAAIC 2024*, 1801–1806. https://doi.org/10.1109/ICAAIC60222.2024.10575782

Tarkhova, L., Tarkhov, S., Gusev, D., Akhmarov, R., Talypov, M., & Urmanov, V. (2023). Digital technologies in the training of engineering personnel for the agro-industrial complex. In G. A., U. G.N., & C. I. (Eds.), *AIP Conference Proceedings* (Vol. 3011, Issue 1). American Institute of Physics Inc. https://doi.org/10.1063/5.0161587

Taylor Starr, L., Shorts, K., & Vans, M. (2024). Interactive Aviation Maintenance Classroom. *IS and T International Symposium on Electronic Imaging Science and Technology*, *36*(13). https://doi.org/10.2352/EI.2024.36.13.ERVR-182

Zimmerman, B. J. (2002). *Becoming a self-regulated learner: An overview*. *theory into practice*, *41*(2), 64-70. https://doi.org/10.1207/s15430421tip4102_2