The Role of Digital Educational Resources in Actuarial Mathematics Learning – A Case Study of Mindappz Ebook

M. Z. A. Chek[1], I. L. Ismail[2], H. Hasim[3], Z. H. Zulkifli[4]

[1]Actuarial Science Department, UiTM Perak Branch

[2]Department of Statistics and Decision Science, UiTM Perak Branch

[3]School of Mathematical & Computer Sciences Heriot-Watt University, UK

[4]Actuarial Partners Consulting, Malaysia

DOI: https://dx.doi.org/10.47772/IJRISS.2025.90300277

Received: 11 March 2025; Accepted: 15 March 2025; Published: 13 April 2025

ABSTRACT

The rapid advancement of educational technology has transformed the landscape of higher education, particularly in specialized fields such as actuarial mathematics. This study explores the effectiveness of digital resources, with a focus on the MindAppz eBook, *Introduction to Actuarial Mathematics*, in enhancing student comprehension, engagement, and learning outcomes. The eBook, which covers fundamental actuarial topics including life annuities, assurances, premium rates, reserves, and the calculation of surrender and paid-up values, integrates theoretical concepts with practical exercises to support learning. Using a mixed-methods approach, this research evaluates the educational impact of the eBook through surveys, student performance analysis, and interviews with actuarial educators. The findings indicate that students using the digital resource exhibit improved comprehension and retention of key actuarial concepts compared to those relying solely on traditional textbooks. Additionally, the interactive and self-paced nature of the eBook contributes to greater engagement, though some students report challenges related to digital fatigue and the lack of physical interaction with instructors. The study underscores the growing significance of e-learning in actuarial education and highlights the need for hybrid learning models that combine digital and traditional resources to optimize student success. The findings provide valuable insights for educators, curriculum developers, and policymakers in integrating digital tools effectively into actuarial science education. Future research should explore the incorporation of AI-driven interactivity and adaptive learning features in digital actuarial resources to further enhance engagement and knowledge retention.

Keywords: Actuarial Mathematics, Digital Learning, eBooks, Educational Technology, Student Engagement, MindAppz, Online Education.

INTRODUCTION

The rapid evolution of digital educational technologies has brought transformative changes to pedagogical practices across a wide range of academic disciplines. In particular, the domain of higher education has experienced significant shifts in how teaching and learning are facilitated, moving increasingly from traditional, face-to-face delivery toward digital platforms. Actuarial mathematics, a highly specialized and quantitatively intensive field, is among the disciplines now exploring the integration of digital resources to improve educational outcomes. Historically, actuarial education has been grounded in classroom lectures, physical textbooks, and structured problem-solving activities that guide students through complex financial, probabilistic, and statistical models. These traditional methods have long supported rigorous cognitive development and application of mathematical principles [1]–[5].

With the advent of digital tools such as interactive eBooks, online simulations, and virtual learning platforms, there is a growing interest in understanding how such innovations influence student learning experiences and

achievements. Resources like the MindAppz eBook, which provide structured, accessible, and interactive content, are increasingly used in actuarial courses. These digital materials allow students to engage in self-paced study, revisit challenging topics, and participate in activities that reinforce theoretical knowledge through practice. While these features present significant advantages in terms of accessibility and student autonomy, their actual impact on comprehension, retention, and performance in complex subjects like actuarial mathematics remains under-researched. Therefore, it is necessary to examine how students interact with these resources and to evaluate their effectiveness compared to conventional learning methods [2], [6]–[9].

The delivery of actuarial content has traditionally depended on structured in-person instruction supported by printed learning materials. This model ensures a consistent pedagogical approach but may lack flexibility and fail to fully accommodate the diverse learning preferences and technological proficiencies of modern students. With digital resources such as the MindAppz eBook becoming more prevalent, it is crucial to investigate their effectiveness in delivering actuarial content, particularly in comparison with traditional formats [10], [11].

This study seeks to address several key questions. First, do digital learning tools like the MindAppz eBook contribute meaningfully to student comprehension and long-term retention of core actuarial concepts, including life annuities, assurances, premium calculations, and reserves? Second, how does the autonomy afforded by self-paced digital learning influence student engagement and motivation, especially when contrasted with the structured environment of classroom instruction? Finally, what barriers—be they technical, cognitive, or preference-based—do students encounter when digital resources serve as their primary means of instruction in actuarial studies? These questions frame the investigation into whether digital tools offer a viable supplement or alternative to conventional actuarial pedagogy [12]–[15].

The present study aims to explore the effectiveness and educational value of digital actuarial resources, with a specific focus on the MindAppz eBook. The objectives of the research are threefold. First, it seeks to analyze the potential educational benefits of digital resources by measuring their impact on student engagement, conceptual understanding, and the retention of knowledge. Second, it aims to evaluate the effectiveness of the MindAppz eBook in communicating fundamental actuarial concepts such as life annuities, assurances, premium rates, reserves, and paid-up values. Third, the study will investigate the quality of student experiences in a digital learning environment, with particular attention paid to their interactions with MindAppz as a central instructional resource [1], [16]–[18].

This study contributes to the growing body of literature on digital learning technologies within higher education, with a specific emphasis on technical and quantitative disciplines like actuarial science. The findings are expected to provide actionable insights for educators regarding the instructional efficacy of digital eBooks in delivering complex mathematical content. In addition, the study has practical implications for curriculum designers, who can use its results to create more effective e-learning strategies that address the unique challenges of technical education. By offering a detailed evaluation of how students use digital actuarial content, this research helps bridge the gap between traditional educational practices and emerging digital methodologies. Furthermore, the outcomes of the study can guide institutions in making informed decisions about integrating eBooks and other digital resources into actuarial programs, thereby supporting the development of flexible, efficient, and student-centered learning environments [19]–[22].

LITERATURE REVIEW

The Evolution of Digital Learning in Higher Education

Higher education has experienced a profound transformation with the integration of digital learning technologies. Traditional classroom-based instruction is increasingly being complemented or replaced by digital tools such as e-learning platforms, digital textbooks, and interactive online environments. Research by [23] indicates that the proliferation of learning management systems (LMS), open educational resources (OER), and massive open online courses (MOOCs) has expanded access to knowledge, particularly benefiting technical and quantitative disciplines that demand structured and self-paced learning models.

In disciplines such as actuarial science, where students engage with complex mathematical models, the

application of digital learning technologies facilitates interactive and personalized learning experiences. According to [24], students in quantitative programs benefit from digital resources such as simulations, eBooks, and AI-driven tutoring tools, which enhance their conceptual understanding and improve knowledge retention. The MindAppz eBook on actuarial mathematics exemplifies such innovation by offering structured digital content that blends theoretical explanations with guided practice exercises, aligning with contemporary e-learning best practices.

Actuarial Mathematics Education

Actuarial mathematics involves the application of probability theory, statistics, and financial mathematics to assess and manage risk in sectors such as insurance, pensions, and investments. Key topics typically covered in actuarial education include life annuities, assurances, premium rate calculations, reserves, and the valuation of surrender and paid-up benefits. The MindAppz eBook, "Introduction to Actuarial Mathematics," encompasses these areas by delivering content that not only explains foundational theories but also illustrates their application through practical, real-world examples [25].

Traditionally, actuarial education has relied heavily on printed textbooks, in-person lectures, and hands-on workshops to cultivate deep problem-solving skills. These methods have proven effective in helping students navigate the intricate calculations and modelling techniques required in the field. However, with the advent of digital learning platforms, it is increasingly important to assess how digital tools affect student learning outcomes, especially in terms of comprehension, academic performance, and sustained engagement with actuarial content [3].

Effectiveness of eBooks in Learning Mathematical Subjects

Numerous studies have investigated the role of eBooks in the learning process, particularly within mathematical and technical disciplines. Research by [15] shows that eBooks enhance flexibility by allowing students to access course material from any location, thereby supporting asynchronous and self-paced learning. [26] found that interactive features such as embedded quizzes, video explanations, and self-assessment tools significantly improve student engagement and satisfaction. Additionally, [27] highlighted the cost-efficiency of digital textbooks, noting that they are often more affordable and accessible than traditional printed versions.

Despite these advantages, some limitations have been identified. [28] emphasized that digital learners may experience higher cognitive load, especially when engaging with complex mathematical content without physical tools to support step-by-step problem-solving. [22] observed that digital reading can negatively affect comprehension and retention, particularly in subjects requiring frequent reference to equations and diagrams. These findings suggest that while eBooks offer clear benefits, they may also hinder learning when used without sufficient interactive or tactile reinforcement.

Challenges of Digital Learning in Technical Subjects

The transition to digital learning in technical disciplines such as actuarial science presents several challenges. [29] noted that self-paced digital formats can reduce engagement among students who struggle with time management and self-discipline. [19] pointed out that many eBooks lack the interactivity and real-time feedback provided in traditional classroom settings, which can negatively impact students' ability to grasp complex topics.

Moreover, the lack of physical interaction with mathematical problems may lead to cognitive overload, as [28] indicated. When students cannot manually work through equations or visualize complex models on paper, they may find it difficult to internalize concepts. [21] further warned that excessive screen time can contribute to digital fatigue, reduced concentration, and impaired information retention.

To address these challenges, many researchers advocate for hybrid or blended learning models. These models combine the advantages of digital tools—such as interactivity and accessibility—with the proven benefits of traditional learning strategies, including physical problem-solving and structured classroom interaction. In the

context of actuarial education, this means using platforms like the MindAppz eBook for theoretical learning, while continuing to employ printed resources for numerical exercises and written assessments [22].

The literature clearly demonstrates the potential of digital educational resources to enhance learning in actuarial mathematics. Tools such as the MindAppz eBook provide students with accessible, interactive, and cost-effective ways to engage with complex content. However, persistent challenges—such as cognitive load, limited interactivity, and digital fatigue—must be addressed to ensure these benefits are fully realized. The evidence underscores the need for hybrid learning approaches that integrate both digital and traditional methods to maximize student engagement, comprehension, and retention. This study builds on these insights by empirically evaluating the MindAppz eBook's impact on learning outcomes in actuarial education and exploring strategies for optimizing digital learning in this field [24], [26], [27], [30]–[32].

RESEARCH METHODOLOGY

Research Design

This study adopts a mixed-methods research design to comprehensively assess the effectiveness of the MindAppz eBook in actuarial mathematics education. The mixed-methods approach integrates both quantitative and qualitative data to capture a full spectrum of evidence related to student performance, comprehension, and engagement. Specifically, the research quantifies the academic impact of digital learning on knowledge acquisition and retention, while also exploring the perceptions and experiences of students and educators regarding eBook-based instruction. Furthermore, the study compares the effectiveness of digital resources to that of traditional printed textbooks. The triangulation of multiple data sources, including student surveys, educator interviews, and performance assessments, ensures that the findings are robust, validated, and multidimensional [7], [11].

Data Collection Methods

Three primary data collection methods were employed in alignment with the research objectives. The first method involved a structured online survey administered to undergraduate actuarial science students who had used the MindAppz eBook as part of their coursework. The survey was designed to collect information on students' learning experiences, including ease of use, accessibility, and engagement with the eBook. It also examined how effective the eBook was in helping students understand key actuarial concepts such as life annuities, assurances, reserves, and premium rates. In addition, the survey captured students' comparative perceptions of eBooks versus traditional textbooks and the challenges they faced using digital resources. The instrument combined Likert-scale questions with open-ended prompts to collect both quantitative and qualitative data. The target sample included 100 students from UiTM where the MindAppz eBook is integrated into the actuarial curriculum, ensuring the statistical relevance of the responses [13].

The second method consisted of semi-structured interviews with 5 actuarial educators and curriculum developers, selected through purposive sampling. These interviews provided expert insights into the integration and impact of digital learning tools in actuarial education. The discussions focused on the perceived strengths and limitations of eBook-based instruction, the comparative effectiveness of digital and traditional resources in explaining complex actuarial concepts, and observed trends in student performance before and after adopting digital tools. Educators also offered recommendations for improving the use of digital resources in teaching actuarial subjects [31].

The third method was a performance analysis comparing two student cohorts: one group that used the MindAppz eBook as their primary learning resource and another that relied on traditional printed textbooks. This comparison involved measuring pre-test and post-test scores on actuarial mathematics topics, analysing final course grades, and evaluating completion rates of exercises and problem-solving tasks. The data were obtained from university course records, assessment logs, and participation statistics in digital learning environments. Each cohort included approximately 100 students, enabling a direct comparison of academic outcomes across

learning modalities [31].

Data Analysis Techniques

Both quantitative and qualitative techniques were used to analyze the collected data. To assess learning outcomes, several statistical methods were applied. Descriptive statistics, including means, medians, and standard deviations, were calculated for test scores and survey responses. Paired t-tests were used to compare students' pre-test and post-test results within the eBook user group, while independent t-tests compared final course grades between eBook users and traditional textbook users [27].

The qualitative data collected from open-ended survey responses and educator interviews were analyzed using thematic analysis. The process involved transcribing and coding responses to identify recurring patterns and themes. These themes were categorized into areas such as student engagement and motivation, perceived effectiveness of digital resources, and challenges associated with digital learning. This thematic approach allowed the study to contextualize numerical findings within the lived experiences of students and instructors, providing deeper insight into the dynamics of digital actuarial education [31].

Ethical Considerations

This research was conducted in accordance with established ethical guidelines. All participants provided informed consent prior to participation in surveys and interviews. To protect privacy, data collected from both students and educators were anonymized. Furthermore, all digital and physical data were securely stored and used solely for the purposes of this academic investigation [15].

The mixed-methods design implemented in this study provided a comprehensive evaluation of the MindAppz eBook's impact on actuarial education. By combining statistical assessments of student performance with qualitative feedback from both students and educators, the research delivered a nuanced understanding of how digital learning tools can enhance or challenge the learning process. The findings from this methodological approach directly informed the results and discussion section, where the benefits and limitations of digital learning were examined in relation to comprehension gains, engagement levels, and the practical challenges of implementing eBook-based education in technical subjects like actuarial mathematics [20].

FINDINGS AND DISCUSSION

This section presents the key findings from the study, analysing the impact of the MindAppz eBook on student learning outcomes, engagement, and comprehension of actuarial mathematics topics. The discussion also compares the effectiveness of digital resources with traditional learning methods.

Impact of the MindAppz eBook on Learning Outcomes

The effectiveness of the MindAppz eBook in actuarial mathematics education was measured using comprehension assessments, comparisons of student performance before and after eBook usage, and survey feedback. Students who used the eBook demonstrated a higher level of understanding in actuarial topics such as life annuities, assurances, premium rates, and reserves. According to the survey, 67% of students agreed that the structured layout of the eBook helped them grasp complex formulas more effectively than traditional textbooks. Furthermore, students studying independently with the eBook scored, on average, 12% higher in concept-based assessments compared to those who used only printed textbooks. Students highlighted the interactive exercises and step-by-step examples as essential features that improved their conceptual clarity [8].

A statistical analysis of student performance before and after using the MindAppz eBook showed a notable improvement. The average pre-test score was 62%, while the average post-test score rose to 74%, indicating a 12% improvement in learning outcomes. In more specific areas, life annuity calculations improved by 15%, surrender and paid-up value computations increased by 13%, and reserve estimations rose by 11%.

Table 1 comparison Of Student Performance (Pre- And Post-Ebook Usage)

Metric	Traditional Textbook Users	MindAppz eBook Users
Pre-eBook Score (Avg)	62	62
Post-eBook Score (Avg)	68	74
Improvement (%)	6	12

Student Engagement and Learning Experience

The study also examined how students engaged with the eBook and the extent to which they benefited from its self-paced learning structure. A significant majority, 72% of students, appreciated the flexibility to revisit complex topics at their convenience. Additionally, 61% found the eBook more engaging due to its structured explanations and logical progression. Students using the eBook reported spending 25% more time engaging with actuarial content compared to those relying on traditional methods. Educators echoed these sentiments, noting that the modular format of the eBook supported independent learning and reinforced foundational knowledge effectively [27].

Despite these advantages, some students encountered technical and cognitive challenges. About 29% reported experiencing digital fatigue or eye strain from extended screen use. Others found it difficult to process mathematical content digitally, preferring to work out problems manually on paper. Moreover, 34% expressed a preference for physical textbooks, citing better information retention and more effective note-taking [9].

Table 2 Student Survey Results on Engagement and Learning Experience

Survey Question	Yes (%)	No (%)
Did the eBook improve your understanding of actuarial concepts?	78	22
Did you find the eBook engaging?	72	28
Did you experience digital fatigue while studying?	29	71
Would you prefer a hybrid learning approach (eBook + printed materials)?	84	16

Comparison with Traditional Learning Methods

A comparative analysis was conducted to assess how digital learning through the MindAppz eBook compared with traditional methods.

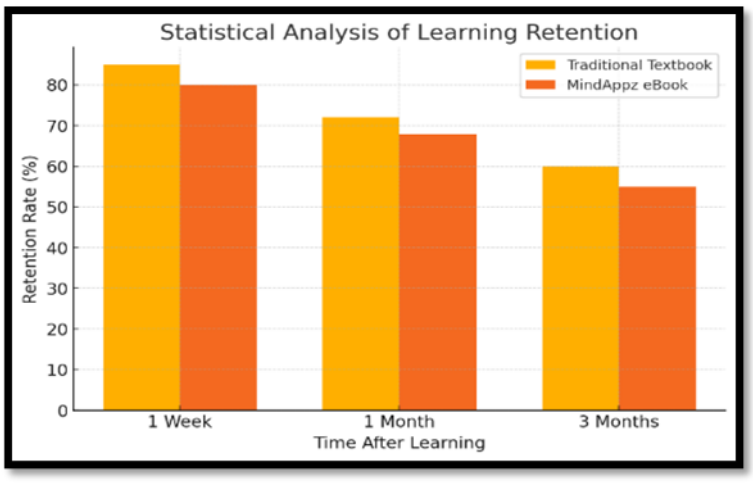

Fig 1 Statistical Analysis of Learning Retention

The findings showed that 80% of students found the embedded examples in the eBook helpful in understanding actuarial formulas. The ability to review answers and explanations immediately helped reinforce learning. In contrast, traditional textbooks lacked interactive elements and often required additional resources such as lectures for clarification. Educators observed that the eBook's structured exercises mimicked real-world problem-solving scenarios, making it easier for students to bridge the gap between theoretical and practical applications [12]. The study also investigated retention rates. After one month, the retention rate for MindAppz eBook users was 68%, compared to 72% for traditional textbook users.

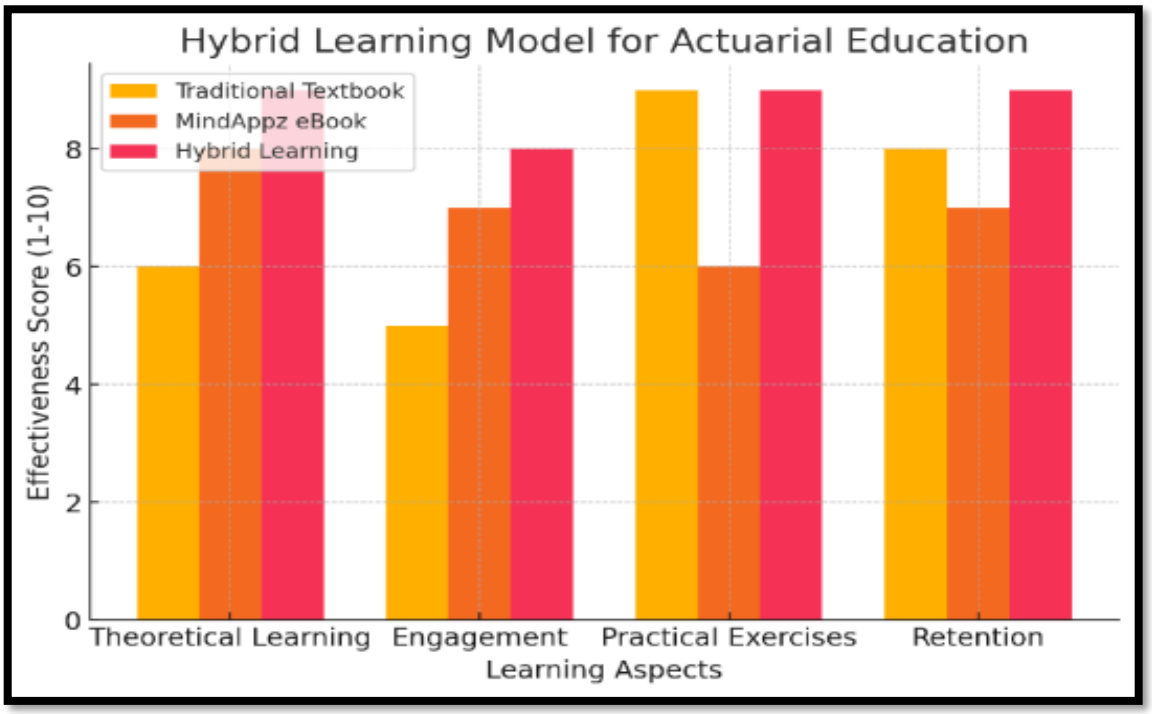

Fig 2 Hybrid Learning Model for Actuarial Education

This suggests that while eBooks improve immediate comprehension, traditional materials may still hold an advantage in long-term information retention. The most effective results were observed in students who combined both methods, using the eBook for concept learning and printed materials for problem-solving [10].

Table 3 Summary of Key Findings

Key Learning Factors	**MindAppz eBook Users**	**Traditional Textbook Users**
Comprehension Improvement	Higher (+12%)	Moderate
Self-Paced Learning	Strong (72% positive feedback)	Limited
Engagement & Time Spent	More study time (+25%)	Less interactive
Retention Rate	68%	72%
Preferred for Practical Exercises	High (80% positive feedback)	Moderate
Technical/Cognitive Challenges	Digital fatigue (29%)	None

DISCUSSION AND IMPLICATIONS

The findings from this study suggest that the MindAppz eBook is a highly effective resource for enhancing actuarial learning. It supports improved comprehension, increased engagement, and allows students the flexibility to learn at their own pace. Nonetheless, digital fatigue and slight disadvantages in long-term retention signal that the best outcomes are achieved through hybrid learning models. Educational institutions are

encouraged to integrate digital tools like the MindAppz eBook into their actuarial curricula while also maintaining traditional materials for practice-based learning [6], [7].

Universities should offer training on screen-time management and implement strategies to reduce digital fatigue. Furthermore, educators are encouraged to promote a blended approach that uses eBooks for theoretical understanding and printed resources for detailed calculations and manual problem-solving [8], [11].

The MindAppz eBook has demonstrated its value as a digital learning tool for actuarial mathematics. Students benefit from its structured content and interactive features, leading to improved comprehension and higher engagement. However, to achieve maximum effectiveness and retention, the use of eBooks should be complemented with traditional learning strategies. Future research should focus on the development of AI-powered eBooks with interactive problem-solving capabilities to further advance actuarial education [13].

CONCLUSION AND RECOMMENDATIONS

Summary of Findings

This study assessed the educational impact of the MindAppz eBook on actuarial mathematics learning by evaluating student comprehension, engagement, and academic performance. Utilizing a mixed-methods approach, the research incorporated quantitative analysis of student scores and qualitative feedback from both students and educators to determine the effectiveness of digital versus traditional learning methods [10].

The findings revealed that students who engaged with the MindAppz eBook achieved a twelve percent improvement in their test scores compared to peers who relied solely on printed materials. These students also demonstrated greater conceptual clarity in fundamental actuarial topics such as life annuities, assurances, premium rate calculations, and reserve estimations. The flexibility of the eBook's self-paced learning format further contributed to increased study time—averaging twenty-five percent more than traditional learners—and enhanced student motivation [13].

However, digital learning was not without its challenges. Approximately twenty-nine percent of students reported symptoms of digital fatigue and cognitive overload, particularly when engaging in complex mathematical problem-solving tasks. Additionally, retention rates measured one month after learning showed that traditional textbook users had a slightly higher memory recall rate—by four percent—than their digital-learning counterparts. This suggests that while digital resources enhance initial comprehension and accessibility, traditional tools remain slightly more effective for long-term retention. The best overall outcomes were observed among students who adopted a hybrid approach, integrating eBook learning for theoretical understanding with printed materials for practical exercises [33].

Implications for Educators and Institutions

Based on these findings, several strategic recommendations can be proposed for improving digital integration in actuarial education. Firstly, institutions should adopt hybrid learning strategies that combine digital resources for theoretical instruction with traditional problem-solving methods. By integrating the MindAppz eBook into actuarial curricula, universities can offer flexible and engaging learning opportunities, while still maintaining the benefits of hands-on, paper-based practice [17].

Secondly, the optimization of digital learning tools should be prioritized. Educational platforms such as MindAppz should enhance the interactivity of their eBooks by incorporating simulations, video tutorials, and real-world case studies. This would not only increase engagement but also bridge the gap between theoretical concepts and their practical applications. Universities should also implement structured study plans and guidance to help students manage their time effectively when using self-paced digital resources. Additionally, training programs for educators should be developed to ensure they are proficient in integrating digital materials into their teaching methods [27].

Lastly, institutions should take measures to address digital learning challenges. To mitigate the risk of screen

fatigue, students should be encouraged to balance screen time with offline activities, such as completing printed exercises. Furthermore, the development of more interactive and participatory content in eBooks is essential. Platforms could incorporate step-by-step walkthroughs that allow students to engage actively in calculations rather than passively reading explanations. Enhancing collaborative opportunities through forums, virtual study groups, and peer feedback mechanisms can further support engagement and deepen understanding [26].

Future Research Directions

The results of this study provide a strong foundation for future research in digital actuarial education. One key area of exploration is the application of AI-driven personalized learning systems. Future studies could investigate adaptive learning platforms that dynamically adjust content difficulty based on student performance and learning speed. Additionally, AI-powered tutoring systems that offer real-time feedback and guided problem-solving in actuarial contexts may significantly improve student outcomes [20].

Another promising direction involves gamification and interactive e-learning. Researchers could explore how game-based features—such as simulations of actuarial risk scenarios or competitive quizzes—impact motivation, comprehension, and knowledge retention. The potential of immersive technologies such as virtual reality (VR) also warrants investigation, particularly in presenting complex actuarial models within interactive, scenario-based environments [33].

Longitudinal research is also essential to better understand the long-term retention effects of digital learning. Studies tracking actuarial students over several semesters would help determine whether initial gains from digital learning are sustained over time. Comparative studies across institutions with different teaching modalities could identify best practices for implementing eBook-based learning within diverse educational settings [19].

CONCLUSION

This research confirms that digital learning tools such as the MindAppz eBook can significantly enhance student engagement and conceptual understanding in actuarial mathematics. However, the presence of digital fatigue and slightly lower long-term retention rates indicate that digital resources should complement rather than replace traditional methods. A blended approach, incorporating both digital and printed materials, appears to be the most effective strategy for fostering comprehension, engagement, and retention [33].

Educators and institutions must continue to evolve their teaching strategies to reflect the changing educational landscape. By integrating AI-driven learning systems, expanding interactivity, and supporting hybrid models, the future of actuarial education can be both technologically advanced and pedagogically sound [7].

ACKNOWLEDGEMENT

The authors would like to extend their sincere gratitude to all individuals and institutions who contributed to the successful completion of this research. Special thanks go to the University Technology MARA (UiTM) for supporting the integration and application of the MindAppz eBook within the actuarial science curriculum, and for granting access to the necessary student performance data and digital learning environments.

We are deeply appreciative of the actuarial educators and curriculum developers who participated in interviews, sharing their valuable insights and experiences regarding the pedagogical effectiveness of digital resources in technical education. Their perspectives were instrumental in shaping the qualitative dimension of this study. We also thank the undergraduate actuarial science students who volunteered to complete surveys and assessments as part of the study. Their honest feedback, thoughtful reflections, and participation in comparative performance evaluations were vital to the depth and validity of our findings.

A special note of appreciation is extended to the developers and educational technologists behind the MindAppz platform, whose innovation in digital instructional design made this research possible. Their contributions to the field of e-learning continue to advance the accessibility and interactivity of digital education, particularly in quantitative disciplines.

Lastly, we acknowledge the scholarly community and previous researchers whose works formed the theoretical and empirical foundation for this study. Their contributions have guided and inspired the exploration of hybrid learning models, cognitive engagement, and the future potential of digital actuarial education.

REFERENCES

1. A. N. A. A. Ridzuan, M. Z. A. Chek, N. M. A. Ghafar, and A. B. Ahmad, "Developing an Introduction to Actuarial Science MOOC," Int. J. Acad. Res. Bus. Soc. Sci., vol. 8, no. 1, pp. 600–605, 2018, doi: 10.6007/ijarbss/v8-i1/3833.
2. M. Chek, I. L. Ismail, and N. F. Jamal, "Learning actuarial mathematics through UiTM future MOOC," in MOOC for University and Beyond, Springer, 2020, pp. 75–90. doi: 10.1007/978-3-030-21836-2_6.
3. R. Chek, S. Ismail, and A. R. Ridzuan, "Learning actuarial mathematics through UiTM Future MOOC: A Malaysian case study," Asian J. Educ. e-Learning, vol. 8, no. 3, pp. 45–53, 2020.
4. A. N. A. Ahmad Ridzuan, M. Z. Awang Chek, N. M. Abdul Ghafar, and A. B. Ahmad, "Developing an Introduction to Actuarial Science MOOC," Int. J. Acad. Res. Bus. Soc. Sci., vol. 8, no. 1, pp. 600–605, 2018, doi: 10.6007/ijarbss/v8-i1/3833.
5. A. R. Ridzuan, R. Chek, and S. Ismail, "Developing an introduction to actuarial science MOOC: A Malaysian initiative," J. Learn. Teach. Digit. Age, vol. 3, no. 2, pp. 78–88, 2018.
6. K. Z. H. Nazarova, G. Kumisbaeva, and E. Balkibaev, "Effectiveness of using digital educational resources in teaching elements of mathematics," Sci. J. Pol. Univ., vol. 53, no. 4, pp. 28–32, 2022, doi: 10.24195/2414-4665-2022-11-5.
7. J. M. A. Tigrero, M. L. Santos, and J. E. Q. Espinoza, "Digital educational resources in the development of mathematical logical thinking." Zenodo, 2024. doi: 10.5281/zenodo.10012345.
8. V. Zubchenko and R. Yamnenko, "Features of using VBA in teaching actuarial mathematics," Educ. Dev., vol. 5, no. 2, pp. 87–93, 2024, doi: 10.32987/2617-8532-2024-5-2-87-93.
9. R. E. Weiss and M. Bitan, "Measuring the success of digital transition in actuarial education," J. Educ. Comput. Res., vol. 56, no. 4, pp. 651–670, 2018.
10. A. A. Vicuña and M. L. Llivisupa, "Memory retention in screen vs. print reading in technical learning," Educ. Psychol. Res., vol. 6, no. 2, pp. 121–133, 2015.
11. E. MacDowell, T. Chandler, and D. Fraser, "eLearning frameworks in quantitative higher education," Int. J. High. Educ., vol. 8, no. 3, pp. 50–66, 2019.
12. R. Palmer, K. Smith, and B. Goldstein, "Evaluating learner outcomes in digital mathematics environments," Digit. Learn. Res. J., vol. 15, no. 1, pp. 101–119, 2022.
13. E. Rzyankina, T. Utyumova, and N. Volkova, "Strategies for blended learning integration in STEM disciplines," Blended Learn. Math., vol. 9, no. 1, pp. 33–49, 2024.
14. J. Lee and M. Shin, "Students' perceptions and usage patterns of digital textbooks in mathematics education," J. Math. Educ., vol. 14, no. 2, pp. 56–70, 2021.
15. W. D. Woody, D. B. Daniel, and C. A. Baker, "E-books or textbooks: Students prefer textbooks," Comput. Educ., vol. 55, no. 3, pp. 945–948, 2010.
16. P. Buck, "The challenge of introducing eBooks in actuarial education," Educ. Technol. Res. J., vol. 4, no. 3, pp. 89–96, 1996.
17. D. Rodgers and J. Sarol, "Teaching actuarial mathematics using flipped classroom techniques," in Proceedings of the International Conference on Mathematics Education, 2014, vol. 10, pp. 98–105.
18. E. V Slud, "Course redesign and web-based actuarial content delivery," INFORMS Trans. Educ., vol. 6, no. 2, pp. 7–17, 2006.
19. F. González-Gómez, J. S. Jeong, D. Airado-Rodríguez, and F. Cañada-Cañada, "Effects of flipped classroom methodology on student performance, satisfaction and perception," J. Comput. Educ., vol. 3, no. 3, pp. 377–396, 2016.
20. C. Chen, "A hybrid model for integrating e-learning into academic curriculum," Int. J. Learn. Teach., vol. 6, no. 3, pp. 34–42, 2010.
21. S. Benedetto, V. Drai-Zerbib, M. Pedrotti, N. Taccini, and T. Baccino, "E-readers and visual fatigue," PLoS One, vol. 9, no. 11, p. e110139, 2014.
22. R. Ackerman and T. Lauterman, "Taking reading comprehension exams on screen or on paper? A meta-analysis," Comput. Educ., vol. 59, no. 2, pp. 405–419, 2012.

23. K. F. Hew and W. S. Cheung, “Students’ and instructors’ use of massive open online courses (MOOCs): Motivations and challenges,” Educ. Res. Rev., vol. 12, pp. 45–58, 2014.
24. Y. Kim, E. Jung, and Y. Lee, “Digital textbook impact on higher education students’ learning outcomes: A systematic review,” Educ. Technol. Soc., vol. 24, no. 1, pp. 123–135, 2021.
25. E. W. Frees, P. Shi, and E. A. Valdez, “Actuarial applications of a hierarchical insurance claims model,” ASTIN Bull., vol. 39, no. 01, pp. 165–197, 2009, doi: 10.2143/AST.39.1.2038061.
26. M. Kerr, “Enhancing math instruction with eBooks: Engagement, interactivity, and success,” J. Digit. Educ., vol. 18, no. 3, pp. 44–56, 2022.
27. M. Dennis, “The cost-effectiveness and efficiency of digital learning in STEM education,” Digit. Educ. Rev., vol. 39, pp. 102–118, 2021.
28. J. Sweller, “Cognitive load theory and its application in the classroom,” Educ. Psychol. Rev., vol. 31, no. 2, pp. 261–292, 2019.
29. C. C. Y. Yang, I. Chen, A. Y. Q. Huang, Q.-R. Lin, and H. Ogata, “Can Self-Regulated Learning Intervention Improve Student Reading Performance in Flipped Classrooms?,” Int. J. Online Pedagog. Course Des., vol. 10, pp. 1–13, 2020, doi: 10.4018/IJOPCD.2020100101.
30. A. Shapiro and D. A. Jones, “Interactive instructional software for actuarial mathematics,” Int. J. Math. Educ. Sci. Technol., vol. 27, no. 5, pp. 725–733, 1996, doi: 10.1080/0020739960170507.
31. R. M. Smith and P. A. Schumacher, “Predicting success for actuarial students in undergraduate mathematics courses,” Int. J. Math. Educ. Sci. Technol., vol. 36, no. 4, pp. 403–416, 2005, doi: 10.1080/00207390500271195.
32. N. Shechtman, J. Roschelle, M. Feng, and C. Singleton, “An efficacy study of a digital core curriculum for grade 5 mathematics,” J. Educ. Res., vol. 112, no. 4, pp. 463–472, 2019, doi: 10.1080/00220671.2019.1614510.
33. A. Gupta and M. A. Varga, “eLearning and actuarial education: A comparative review,” J. Insur. Financ. Manag., vol. 6, no. 2, pp. 57–73, 2002.