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MEDIAMENTOR: USER ACCEPTANCE OF AN INTERACTIVE MULTIMEDIA LEARNING TOOL WITH PEDAGOGICAL AGENT SUPPORT

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Abstract:

This study presents the design, development, and user acceptance evaluation of MediaMentor, an interactive multimedia learning application supported by a pedagogical agent. Grounded in Mayer's Multimedia Learning Theory and guided by user-centred design principles, MediaMentor delivers animated lessons, guided narration, formative quizzes, and game-based reinforcement to support undergraduate learners in understanding foundational multimedia concepts. The application was developed using multimedia tools and underwent expert review prior to user evaluation. A quantitative summative evaluation involving 34 undergraduate students was conducted using an instrument adapted from the Technology Acceptance Model (TAM) and the USE (Usefulness, Satisfaction, Ease of Use) framework. Descriptive analyses revealed high levels of perceived usefulness, ease of use, satisfaction, and overall acceptance. Students reported that MediaMentor improved conceptual understanding, was easy to navigate, and provided an enjoyable and engaging learning experience through its pedagogical agent and interactive features. The findings demonstrate that MediaMentor is an effective, user-friendly, and motivating digital learning tool that complements traditional instruction in multimedia education. The study underscores the potential of pedagogical-agent-supported, multimedia-rich applications to improve conceptual understanding and learner engagement in higher education.

Keywords:

MediaMentor, Pedagogical Agent, Multimedia Learning, Technology Acceptance Model, User Acceptance

Introduction

The rapid expansion of digital learning technologies has transformed the landscape of higher education, creating new opportunities for interactive, personalised, and self-paced learning experiences. Recent advancements in multimedia-based instructional environments have demonstrated strong potential to improve learner engagement, comprehension, and long-term retention, particularly when compared to traditional lecture-based instruction (Mayer, 2021; Noetel et al., 2021; Ghozali et al., 2024). As students increasingly expect dynamic and visually rich learning materials, universities are compelled to adopt digital tools that cater to modern learning preferences and diverse cognitive needs.

Foundational multimedia courses, such as Multimedia System Foundation, require students to understand visually complex and technically layered concepts including typography, colour theory, image resolution, compression, audio sampling, and file formats. Traditional approaches, such as static slides or textbook explanations, often fail to adequately illustrate these concepts or support active learning. Research consistently shows that students learn multimedia-related content more effectively when instructional materials integrate animation, narration, and visual demonstrations that reflect authentic creative workflows (Fiorella & Mayer, 2015; Clark & Mayer, 2016; de Koning et al., 2018).

In response to these challenges, pedagogical agents which are animated characters designed to provide guidance, explanations, and supportive feedback, have emerged as promising tools within digital learning environments. Numerous studies indicate that pedagogical agents can increase motivation, enhance social presence, and improve conceptual understanding by simulating elements of human instruction (Heidig & Clarebout, 2011; D'Mello & Graesser, 2021; Davis et al., 2021). Their effectiveness is particularly pronounced in self-paced learning contexts, where learners may experience isolation, reduced motivation, or uncertainty about complex topics (Kim & Baylor, 2016). Despite the growing body of evidence supporting pedagogical agents, their adoption remains limited in creative technology courses, especially those requiring visual–spatial reasoning such as multimedia education.

To address this gap, MediaMentor was developed as an interactive multimedia learning tool designed specifically for undergraduate multimedia learners. The application integrates animated instructional videos, a pedagogical agent with supportive dialogue, structured assessments, and gamified activities aligned with Mayer's Multimedia Learning Theory (Mayer, 2001; Mayer, 2021). By combining guided narration, visual demonstrations, and interactive elements, MediaMentor aims to reduce cognitive load, enhance meaningful learning, and offer students a more engaging alternative to traditional instructional materials.

This study examines the design, development, and user acceptance of MediaMentor through expert review and student evaluation. Drawing on the Technology Acceptance Model (Davis, 1989) and usability frameworks such as the USE Questionnaire (Lund, 2001), the research assesses learners' perceived usefulness, ease of use, satisfaction, and overall experience with the application. The findings contribute to ongoing discussions on technology-enhanced learning by demonstrating how pedagogical-agent-supported, multimedia-rich instructional tools can improve student engagement and support conceptual mastery in higher education.

Background of the Study

The evolution of digital learning technologies has reshaped pedagogical practices across higher education, particularly in fields requiring visual, conceptual, and experiential learning.

Multimedia education is one such area, demanding students to master a diverse range of concepts spanning text design, image processing, colour theory, audio editing, and basic animation. These concepts are inherently abstract and technical, often requiring visual demonstration and hands-on experimentation to achieve meaningful understanding (Clark & Mayer, 2016). As a result, traditional lecture-based approaches, although useful for theoretical grounding, are often insufficient for promoting deep learning, engagement, and knowledge transfer among multimedia learners. Recent findings also highlight that multimedia-rich learning environments, especially those that incorporate coordinated visuals and narration, lead to improved conceptual understanding and retention compared to static instructional materials (de Koning et al., 2018; Noetel et al., 2021; Ghozali et al., 2024).

The growing need for interactive and visually rich teaching tools has driven the development of multimedia learning environments that integrate text, graphics, narration, and animation. Grounded in Mayer's (2001; 2020) Cognitive Theory of Multimedia Learning (CTML), these environments emphasise principles such as dual-channel processing, coherence, signalling, and segmenting to reduce cognitive load and enhance meaningful learning. A substantial body of research demonstrates that learners benefit more when instructional content is delivered through coordinated visual–verbal formats rather than text-heavy materials (Fiorella & Mayer, 2015). More recent work also highlights the importance of affective and motivational factors in multimedia learning, noting that well-designed multimedia environments can support both cognitive processing and emotional engagement (Schoor & Bannert, 2021; Ghozali et al.,2024).

In parallel, pedagogical agents have gained increasing attention in digital learning environments. These animated or virtual characters serve as instructional companions that guide, prompt, and support learners throughout the learning process. Research indicates that pedagogical agents can enhance social presence, motivation, and learning satisfaction (Heidig & Clarebout, 2011; Veletsianos & Russell, 2014). Learners often perceive such agents as credible and supportive, particularly when the agents exhibit clear verbal cues, human-like gestures, and empathy-oriented behaviours (Kim & Baylor, 2016). Systematic reviews further emphasise that the effectiveness of pedagogical agents depends heavily on design elements such as visual appearance, dialogue style, interactivity, and alignment with instructional goals (Davis, Jivet & Pardo, 2021). These design considerations play a crucial role in shaping cognitive load, attention, and learner engagement.

Despite the established potential of pedagogical agents and multimedia-based instructional tools, their application remains underexplored within creative technology and design-oriented programmes. Courses such as Multimedia System Foundation require learners to visualise concepts dynamically, yet instructional materials often remain static, fragmented, or overly theoretical. This mismatch creates challenges in supporting learners' cognitive processing, leading to overload, reduced engagement, and surface-level understanding (Sweller et al., 2019). Although research on gamification in education suggests that game-based and interactive elements can improve intrinsic motivation and learner engagement, such approaches are still limited in introductory multimedia courses, where conceptual understanding relies heavily on visual and experiential scaffolding.

To address these challenges, MediaMentor was conceptualised as an integrated multimedia learning tool designed to support foundational multimedia education through animated lessons, visual demonstrations, interactive quizzes, and game-based activities. The inclusion of a pedagogical agent provides an added layer of cognitive and emotional support, promoting learner autonomy and reducing the sense of isolation typical in self-paced digital environments. By aligning with established multimedia learning theories and contemporary insights into learner motivation, MediaMentor aims to bridge the gap between theory, practice, and user experience.

This study builds upon existing literature by evaluating students' acceptance of MediaMentor using the Technology Acceptance Model (Davis, 1989) and usability criteria from the USE Questionnaire (Lund, 2001). By examining learners' perceptions of usefulness, ease of use, satisfaction, and overall experience, this research contributes to the broader discourse on designing effective, learner-centred digital tools for higher education.

Problem Statement

Despite significant advancements in digital learning technologies, foundational multimedia courses in higher education continue to rely heavily on traditional instructional materials such as lecture slides, printed notes, and static demonstrations. These approaches often fail to convey the dynamic, visual, and conceptual nature of multimedia elements, such as typography, image resolution, colour models, and audio properties, which require interactive and multimodal explanations for deeper understanding. Research consistently shows that students learn multimedia concepts more effectively when instruction incorporates coordinated visual and verbal channels, animation, and guided narration (Mayer, 2022; Fiorella & Mayer, 2015). However, many existing classroom resources do not fully leverage these evidence-based design principles, and studies show that multimedia-rich, interactive tools significantly outperform static instructional formats in promoting conceptual understanding (de Koning, Hoogerheide, & Boucheix, 2018).

At the same time, pedagogical agents which are animated characters designed to support learning, have demonstrated strong potential to improve motivation, engagement, and comprehension in digital environments (Heidig & Clarebout, 2011; Kim & Baylor, 2016). Yet, their adoption within multimedia education remains limited, particularly in Malaysian higher education settings where course materials rarely include interactive agents or gamified elements. As a result, learners often experience reduced engagement, surface-level understanding, and limited opportunities for self-paced exploration of complex concepts. Recent empirical findings further emphasise that the design and behaviour of pedagogical agents, including their emotional expressions, social cues, and instructional roles, significantly influence learner motivation and cognitive processing (Dai et al., 2022; Wang et al., 2023; (Zhang et al.,2024).

Furthermore, while interactive multimedia learning tools exist in various domains, few have been developed specifically for the Multimedia System Foundation curriculum. Even fewer have undergone systematic evaluation of user acceptance, usability, and perceived instructional value among actual undergraduate learners. Without such evidence, educators lack data-driven insights into whether pedagogical-agent-based multimedia tools can effectively support learning in this context. Meta-analytic findings on gamified learning also indicate a lack of domain-specific interactive applications tailored for conceptual subjects such as multimedia,

despite clear benefits of gamification for learner engagement, intrinsic motivation, and academic performance (Bai, Hew, & Huang, 2020; Sailer & Homner, 2020).

Therefore, there is a clear need to design and evaluate an interactive multimedia learning tool that integrates pedagogical agents, visual demonstrations, and game-based activities aligned with established instructional design principles. Understanding students' acceptance of such a tool is essential to determine its practicality and potential for integration into multimedia education. This study addresses this gap by developing MediaMentor and evaluating its perceived usefulness, ease of use, satisfaction, and overall learning experience among undergraduate multimedia students.

MediaMentor: An Interactive Multimedia Learning Tool for Multimedia System Foundation

MediaMentor was conceptualised as an interactive multimedia learning tool designed to support undergraduate students enrolled in the Multimedia System Foundation course by transforming abstract theoretical concepts into engaging, visually supported learning experiences. The development of the application was grounded in Mayer's Cognitive Theory of Multimedia Learning (2001; 2022), which emphasises integrating visual and verbal channels, managing cognitive load, and segmenting information to promote deeper processing. Recent research reinforces that CTML-aligned instructional strategies remain essential for supporting conceptual clarity and reducing cognitive load in digital learning environments (de Koning, Hoogerheide, & Boucheix, 2018). By embedding visual demonstrations, animated narratives, and guided explanations, MediaMentor supports learners in understanding foundational multimedia concepts that are often challenging to grasp through text-based materials.

In addition to these multimedia learning principles, MediaMentor incorporates a pedagogical agent, drawing upon research showing that animated instructional companions can positively influence learners' motivational and cognitive engagement. Studies indicate that pedagogical agents support learning by modelling tasks, providing explanatory cues, and sustaining attention through human-like gestures and supportive dialogue (Kim & Baylor, 2016; Heidig & Clarebout, 2011; Zhang et al.,2024). Systematic reviews further demonstrate that the design features of pedagogical agents, including voice, expressiveness, social cues, and interaction patterns to significantly shape learners' motivation, social presence, and comprehension (Dai et al., 2022; Wang et al., 2023). The inclusion of a pedagogical agent in MediaMentor is therefore intended to simulate instructor immediacy, reduce feelings of isolation in self-paced environments, and foster an emotionally supportive learning experience.

The instructional structure of MediaMentor aligns with the Multimedia System Foundation syllabus and is organised into three core modules: Text, Image, and Audio. Rather than relying on static slides or descriptive notes, each module begins with an animated lesson narrated by the pedagogical agent, who introduces key concepts such as typography categories, image resolution and file formats, or audio sampling and waveform characteristics. These animations use simplified visual metaphors and step-by-step explanations to make abstract concepts more concrete which is an approach consistent with multimedia learning recommendations for reducing extraneous processing and promoting meaningful learning (Mayer, 2022; Fiorella & Mayer, 2015).

After viewing the lesson, learners progress to a quiz component in which they answer multiple-choice or drag-and-drop items and receive immediate feedback. This formative assessment stage reinforces understanding and encourages reflection, aligning with evidence that timely corrective feedback strengthens generative learning and supports self-regulated learning processes (Fiorella & Mayer, 2015). To consolidate learning, each module concludes with a mini-game designed to reinforce key ideas through low-stakes interactive practice. These gamified activities, such as font-matching, image-classification, or sound-identification, is incorporated to enhance engagement and promote repeated practice. Meta-analyses consistently show that gamification improves intrinsic motivation, participation, and learning outcomes when challenge, progression, and feedback are integrated into the learning process (Sailer & Homner, 2020; Li, Ma, & Shi, 2023).

The application's interface was purposefully designed using universal design and multimedia usability principles to ensure clarity, consistency, and ease of use. All screens employ a minimalist layout with clear iconography, structured spacing, and classroom-inspired visual themes that guide learners intuitively between modules while reducing cognitive overload. The lesson screen presents animations and agent-narrated explanations in a clean, distraction-free environment, while the quiz and feedback screens use simple controls and immediate responses to support smooth navigation. These design choices align with empirical findings showing that intuitive, coherent layouts and timely feedback improve usability, engagement, and learning efficiency in digital learning environments (Lund, 2001; Moreno & Mayer, 2007). More recent research further emphasises that user-centred interface design plays a crucial role in sustaining learner engagement and reducing extraneous cognitive load (Bai, Hew, & Huang, 2020). Expert evaluators reviewed early prototypes and provided feedback on menu clarity, button alignment, transitions, and game readability, which were incorporated to strengthen usability and coherence. Figure 1(a-h) illustrate the user interfaces of MediaMentor application.

Figure 1(a): Title page

Figure 1(b): Menu page
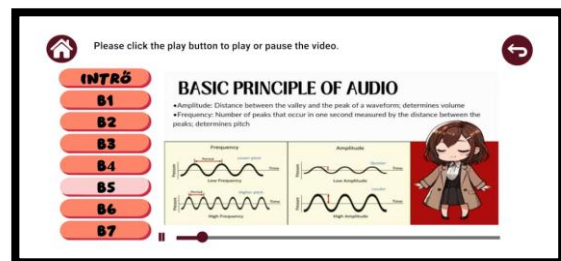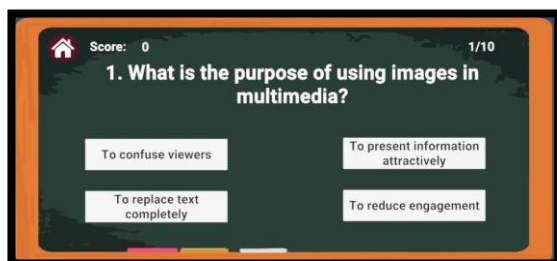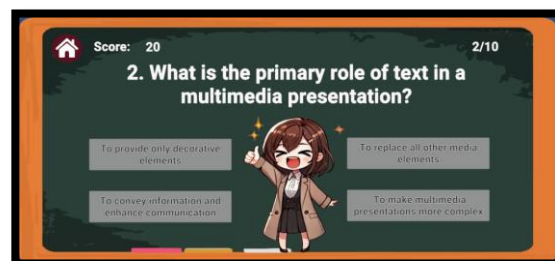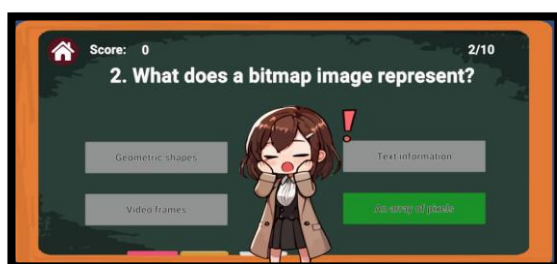

Figure 1(c): Lesson page

Figure 1(d): Lesson page

Figure 1(e): Quiz page

Figure 1(f): Correct feedback

Figure 1(g): Incorrect feedback

Figure 1(h): Game page

Technically, MediaMentor was developed using Adobe Animate to produce animated instructional sequences, Adobe Illustrator and Photoshop to create visual assets, and Adobe Audition to refine narration and sound effects. The Unity engine served as the primary development environment for integrating animations, quizzes, and mini-games into a cohesive application. All graphical and audio elements, including the pedagogical agent, icons, backgrounds, and voiceovers, were custom-designed to ensure originality and alignment with course learning outcomes. The final application was compiled as a mobile-friendly APK to accommodate smartphones, tablets, and laptops, recognising that contemporary learners frequently access educational materials through portable devices.

Overall, MediaMentor offers a structured and pedagogically grounded approach to supporting multimedia education. By blending animation, guided narration, assessment, and gamification into a unified learning experience, the application addresses gaps in traditional instructional materials and responds to calls for more interactive, student-centred digital tools in higher education. Its design is anchored in established multimedia principles and contemporary research on pedagogical agents and gamification, making it a practical solution for enhancing learners' understanding, motivation, and autonomy in multimedia learning environments.

Methodology
The user acceptance of the MediaMentor application was examined through a summative evaluation conducted with undergraduate students enrolled in multimedia-related programmes. The primary objective of this evaluation was to assess learners' perceptions of the application's usefulness, ease of use, satisfaction, and overall experience after interacting with the tool. By focusing on these constructs, the methodology aimed to provide empirical insights into the extent to which MediaMentor meets students' learning needs and whether its core features; animated lessons, pedagogical-agent guidance, quizzes, and gamified activities, contribute to an engaging and meaningful learning experience.

A quantitative research design was adopted, guided by two established theoretical frameworks; the Technology Acceptance Model (TAM) and the USE (Usefulness, Satisfaction, Ease of Use) Questionnaire. These frameworks were selected because of their longstanding relevance in evaluating digital learning environments and their ability to provide valid indicators of user acceptance, perceived instructional value, and usability (Davis, 1989; Lund, 2001). Together, they informed the evaluation of four key constructs: Perceived Usefulness, Perceived Ease of Use, User Satisfaction, and Overall Acceptance.

A total of 34 undergraduate students participated in the summative evaluation. All participants were Year 3 students enrolled in multimedia-related courses, and most had previously completed the Multimedia System Foundation subject. This prior familiarity with foundational multimedia concepts enabled them to critically assess the relevance, accuracy, and clarity of the application's instructional content. Participation was voluntary, and students accessed MediaMentor using their own devices, including laptops, tablets, and smartphones, allowing them to interact with the application in a natural, authentic learning environment.

Data were collected through a structured questionnaire adapted from TAM and the USE framework. The instrument assessed learners' perceptions across several dimensions. Perceived Usefulness measured the extent to which MediaMentor enhanced understanding of multimedia concepts. Perceived Ease of Use captured students' impressions of navigation clarity, interface responsiveness, and overall usability. The Satisfaction construct evaluated learners' enjoyment, perceived value, and satisfaction with specific features such as the pedagogical agent, instructional flow, quizzes, and gamified activities. The Overall Experience and Recommendation section explored students' general impressions and their willingness to recommend the application to others. All items used a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree," supplemented by optional open-ended questions that allowed participants to describe positive experiences, challenges, and suggestions for improvement.

The summative evaluation was conducted after the complete development of MediaMentor. At the beginning of the session, participants received a briefing on the study's purpose and an overview of the tasks. They were then instructed to complete all three modules; Text, Image, and Audio, which included animated lessons delivered by the pedagogical agent, formative quizzes with immediate feedback, and gamified reinforcement activities. Students explored the application at their own pace to experience its instructional flow, visual structure, and interactive features. Upon completion, they anonymously submitted their responses through an online questionnaire. Prior to this summative evaluation, a formative review involving expert evaluators had been conducted to refine interface design, ensure content accuracy, and improve instructional clarity. Their feedback resulted in several design enhancements, ensuring that the version tested was pedagogically robust and technically stable across devices.

Data were analysed using descriptive statistics to determine learners' perceptions for each construct. Mean scores and frequency distributions provided insight into the levels of perceived usefulness, ease of use, satisfaction, and acceptance. Additionally, thematic analysis was applied to the qualitative responses from open-ended questions. This analysis highlighted recurring themes such as positive learner impressions, perceived benefits, challenges encountered, and recommendations for improvement. Together, the quantitative and qualitative

findings offered a comprehensive understanding of learners' acceptance of MediaMentor and provided direction for future refinement of the application.

Findings

The summative evaluation of MediaMentor yielded highly positive results across all constructs measured; Perceived Usefulness, Perceived Ease of Use, Satisfaction, and Overall Experience. A total of 34 undergraduate students participated in the usability evaluation, and their responses demonstrate strong acceptance of the application as an effective supplementary tool for learning multimedia concepts. The findings were derived from questionnaire items adapted from Davis' Technology Acceptance Model (1989) and Lund's USE Questionnaire (2001), providing a robust structure for evaluating user perceptions. Table 1 summarized the analysis of the descriptive analysis for User Acceptance of the MediaMentor application.

Table 1: Summary of the Descriptive Statistics for User Acceptance of the MediaMentor Application

Construct	Measure	Mean (M)	SD	% Agree / Strongly Agree	Description of Findings
Perceived Usefulness (PU)	MediaMentor improves understanding; content is relevant; animations clarify concepts	4.60	0.45	94.1%	Students strongly agreed that MediaMentor enhanced comprehension, aligned with course content, and made complex concepts easier to understand.
Perceived Ease of Use (PEOU)	Easy navigation; clear interface; smooth performance across devices	4.70	0.38	97.0%	Learners reported that the courseware was simple to use, with clear instructions, smooth navigation, and no major technical difficulties.
Satisfaction	Enjoyment of the pedagogical agent, visuals, module flow, quizzes, and games	4.65	0.42	97.0%	Most students were highly satisfied with the agent, design, and interactive elements, describing the learning as enjoyable and engaging.
Overall Acceptance	General experience; willingness to recommend; perceived value	4.75	0.36	94.1%	Students expressed strong acceptance of MediaMentor and indicated they would recommend it for future multimedia courses.

Note. Items were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) (N = 34)

Across the Perceived Usefulness dimension, the majority of students agreed that the courseware significantly improved their understanding of multimedia concepts. As shown in the original tables, 94.1% of respondents agreed or strongly agreed that MediaMentor enhanced

their conceptual understanding, particularly due to the animated explanations and step-by-step guidance provided by the pedagogical agent. Similarly, 97% of students agreed that the animated pedagogical agent enriched their learning experience by making difficult concepts easier to follow. The relevance of the content to the Multimedia System Foundation course was also strongly endorsed, with another 94.1% of students affirming alignment with the syllabus. Interactive elements such as quizzes and mini-games were regarded as especially effective, with 82.4% strongly agreeing that these activities helped reinforce their learning.

Findings for Perceived Ease of Use were also overwhelmingly positive. Students reported minimal difficulty navigating the application, with 94.1% agreeing that the interface was easy to use. Every participant indicated that they encountered no technical difficulties while engaging with the content, demonstrating the stability and reliability of the application across devices. The courseware also ran smoothly on students' smartphones and laptops, with 97% reporting a positive performance experience. Clear instructions, intuitive navigation, and visually organised layouts contributed to 100% of users agreeing that the instructions were helpful and easy to follow. These results confirm that the user interface design successfully minimized cognitive load and supported seamless interaction throughout the learning process. Across the dimension of User Satisfaction, the findings were consistently strong. Nearly all participants (97%) expressed satisfaction with the pedagogical agent, appreciating its clarity, friendliness, and contribution to a more personalised learning experience. Satisfaction with the learning content, visuals, and interactive elements was similarly high. For instance, 97% of respondents agreed that the overall design and visuals were appealing, while 85.3% expressed strong satisfaction with the interactive quizzes and games. Remarkably, all 34 respondents indicated that they were satisfied overall with the learning experience provided by MediaMentor, marking a 100% positive response in the overall satisfaction item. This level of satisfaction suggests that the combination of animations, guidance, and interactivity was perceived as meeting students' expectations for modern digital learning tools.

In analysing the Overall Experience and Suggestions, the findings highlight the specific features that students found most valuable. As displayed in the original tables, interactive quizzes and games (85.3%) and engaging multimedia elements (85.3%) were the top-rated features, followed closely by visually appealing design (79.4%) and clear instructions (76.5%). Students described the courseware as enjoyable, convenient, and "cute," and many commented that its visual consistency and gamified elements enhanced their motivation to learn. Challenges reported were generally minor: some students suggested improvements in loading speed (17.6%), clearer instructions (11.8%), or better adaptation to mobile devices (17.6%). However, these issues did not significantly affect their learning experience, as many selected "no issues at all" when asked about challenges faced. For future improvements, the most common suggestions included adding more interactive elements (52.9%), enhancing visual design (41.2%), including more real-life examples (32.4%), and expanding game-based activities with more levels or variety. These suggestions indicate a desire for even richer engagement, demonstrating that users see strong potential for further expansion of MediaMentor's features.

Overall, the findings demonstrate that MediaMentor successfully met students' expectations for an engaging, user-friendly, and pedagogically valuable learning tool. The consistently high ratings across all constructs highlight its effectiveness in improving multimedia learning,

supporting comprehension, and providing a modern digital learning experience suited to the needs of today's learners.

Discussion

The findings of this study suggest that pedagogical-agent-supported multimedia environments may support learners' conceptual understanding by aligning visual explanations with guided instructional support. Rather than merely indicating positive user reactions, the results point to how animated demonstrations and narrated explanations function together to address learners' difficulties with abstract multimedia concepts. This interpretation is consistent with Mayer's Multimedia Learning Theory (2001; 2022), illustrating how the theory operates in practice within multimedia education, where abstract concepts benefit from coordinated visual–verbal explanations that reduce cognitive load and support meaningful learning.

Students' qualitative feedback further illustrates this mechanism, as learners reported that agent-guided animations helped them visualise processes such as pixel resolution, colour models, and audio sampling—concepts that are often challenging to grasp through static text. These findings are in line with prior research showing that dynamic multimedia materials can facilitate deeper understanding and conceptual retention (Fiorella & Mayer, 2015), and they support more recent evidence that multimedia-rich environments outperform text-heavy instructional formats in higher education contexts (Stanevičienė et al., 2024).

Learners' perceptions of ease of use provide additional insight into how MediaMentor supports learning. The reported clarity, intuitiveness, and responsiveness of the interface suggest that usability played a role in minimising extraneous cognitive demands, allowing learners to focus their attention on instructional content rather than navigation. This observation aligns with Lund's (2001) usability framework, which highlights clarity and consistency as key determinants of effective user experience. From a cognitive perspective, these findings are also consistent with recommendations for multimodal learning environments that prioritise simplicity and reduce unnecessary distractions (Moreno & Mayer, 2007). Recent studies further indicate that intuitive interface design is associated with sustained engagement and continued use of digital learning platforms (Li, Hew, & Du, 2023), suggesting that usability is a pedagogical consideration rather than a purely technical one.

The high level of learner satisfaction with the pedagogical agent warrants particular attention. Students' descriptions of the agent as friendly, supportive, and engaging suggest that its role extended beyond content delivery to include motivational and affective support. This finding is consistent with pedagogical agent research indicating that animated instructional companions can enhance social presence, sustain attention, and support conceptual understanding through conversational cues and human-like behaviours (Kim & Baylor, 2016). This finding suggests that pedagogical agents may function not only as instructional guides but also as motivational and affective supports, particularly in visually complex, self-paced learning environments.

The agent's tone, pacing, and gestures appear to have contributed to a sense of personal guidance, reinforcing Veletsianos and Russell's (2014) assertion that an agent's design and social cues play a significant role in shaping learner engagement and cognitive processing.

Despite the generally positive findings, it is important to acknowledge that pedagogical-agent-supported multimedia environments may not be equally effective for all learners or learning contexts. Learners with higher prior knowledge or stronger self-regulation skills may prefer more autonomous exploration with minimal instructional guidance. In addition, the positive learner perceptions observed in this study may be influenced by novelty effects associated with first-time exposure to an interactive, agent-supported learning tool. These considerations suggest that the effectiveness of pedagogical agents may depend on learner characteristics, instructional context, and sustained use over time.

Gamified components within MediaMentor also appear to have contributed to learner engagement by encouraging repeated practice and active participation. Rather than functioning as entertainment alone, quizzes and mini-games provided opportunities for learners to apply concepts and receive immediate feedback. This supports generative learning principles, which emphasise the importance of timely corrective feedback in refining understanding and strengthening long-term retention (Fiorella & Mayer, 2015). The findings are consistent with broader gamification literature demonstrating that well-designed game elements can enhance intrinsic motivation and learning outcomes through challenge, feedback, and meaningful interaction (Li, Ma, & Shi, 2023; Zeng et al., 2024).

From a technology acceptance perspective, learners' overall acceptance of MediaMentor reflects the combined influence of perceived usefulness and perceived ease of use, as proposed by the Technology Acceptance Model (Davis, 1989). The findings illustrate how perceived usefulness and ease of use jointly shape learners' willingness to adopt interactive multimedia tools within academic contexts. Their willingness to recommend the application and their suggestions for additional modules and expanded game features indicate not only satisfaction with the current design but also perceived potential for further development. This aligns with research suggesting that positive user perceptions are strong predictors of continued adoption and sustained use of digital learning tools in educational contexts (Granić & Marangunić, 2019).

Although learner feedback was largely positive, minor issues such as occasional loading delays and the need for clearer instructions in specific sections highlight the importance of iterative refinement in educational technology development. Such observations are typical of early-stage prototypes and reinforce the view that multimedia learning tools benefit from continuous evaluation and improvement. Taken together, the findings suggest that MediaMentor provides a theoretically grounded and pedagogically supportive learning environment, illustrating how pedagogical agents, multimedia explanations, and interactive activities can be integrated to support foundational multimedia education. Together, these interpretations suggest that established learning and acceptance theories remain relevant, but require contextualisation when applied to creative and visually intensive disciplines such as multimedia education.

Implications

The findings of this study offer several practical implications for teaching practice, digital learning design, and curriculum development in multimedia education. Rather than focusing on learner perceptions alone, these implications highlight how pedagogical-agent-supported multimedia tools can be meaningfully integrated into instructional practice.

For teaching practice, the study suggests that foundational multimedia courses may benefit from the intentional integration of multimedia learning principles, particularly when addressing abstract and visually complex concepts. Educators teaching topics such as typography, image resolution, and audio properties may consider supplementing traditional lectures with animated explanations and guided narration to support learners' conceptual understanding. Consistent with Mayer's multimedia learning principles (Mayer, 2022), coordinated visual and verbal explanations can help learners process information more effectively, particularly in self-paced or blended learning environments where instructor guidance may be limited.

For digital learning design, the findings highlight the pedagogical value of incorporating pedagogical agents as instructional supports rather than decorative elements. Designers should consider how agent characteristics—such as tone, pacing, clarity of explanation, and instructional role—can be aligned with learning objectives to provide both cognitive scaffolding and motivational support. The results suggest that even relatively simple agents, when consistently designed and purposefully integrated, can enhance learners' engagement without introducing unnecessary cognitive load. This reinforces prior research emphasising the importance of agent design attributes in shaping learner experience and instructional effectiveness (Heidig & Clarebout, 2011; Veletsianos & Russell, 2014; Dai et al., 2022).

The findings also underscore the importance of user-centred interface design in educational applications. Clear navigation, intuitive controls, and coherent layout structures are not merely usability considerations but pedagogical ones. When learners are able to navigate learning environments effortlessly, they can allocate greater cognitive resources to understanding instructional content rather than managing interface demands. Designers and educators should therefore prioritise simplicity, consistency, and clarity in interface design to minimise extraneous cognitive load and support focused learning (Lund, 2001; Moreno & Mayer, 2007). In terms of gamification, the study suggests that embedding low-stakes quizzes and concept-reinforcing mini-games within instructional content can support engagement and repeated practice. Educators and developers may consider using gamified activities strategically to reinforce key concepts rather than as standalone motivational features. Immediate feedback within these activities can further support generative learning processes by helping learners identify misconceptions and refine understanding (Chandrasehgaran & Ismail, 2024).

Finally, the findings have implications for curriculum development and institutional planning. The structure of MediaMentor illustrates how interactive, agent-supported multimedia tools can be expanded beyond a single course to support broader multimedia programmes, including subjects such as animation, image editing, video production, and audio design. Higher education institutions may therefore consider investing in the development of theory-driven, multimedia-rich learning tools that complement traditional instruction and align with the digital competencies required in IR4.0-driven industries (Noetel et al., 2021).

Overall, the study indicates that pedagogical-agent-supported multimedia applications can serve as practical, scalable supplements to conventional teaching approaches. When grounded in established learning theories and designed with learner experience in mind, such tools have the potential to enhance instructional clarity, learner engagement, and accessibility in multimedia education.

Limitations and Future Work

Although the findings of this study demonstrate strong acceptance of the MediaMentor application, several limitations should be acknowledged. First, the study involved a relatively small sample of 34 undergraduate students from a single academic programme. While the sample was appropriate for a summative usability evaluation, a larger and more diverse cohort across different institutions or multimedia courses may yield broader insights into the generalisability of the results. Second, the evaluation relied primarily on self-reported perceptions using quantitative measures. Although students' responses were largely positive, the study did not include direct measurements of learning performance or retention, which could provide deeper evidence of MediaMentor's instructional effectiveness.

Another limitation concerns the technical environment used during testing. Students accessed the application on their personal devices, which varied in performance capability. A few respondents noted minor issues, such as loading delays or interface scaling differences on certain mobile devices. These factors may have influenced their overall experience, suggesting the need for further optimisation to enhance cross-device compatibility and performance stability.

Future work should therefore explore expanding MediaMentor with additional modules covering more advanced multimedia concepts, such as video editing principles, animation fundamentals, and colour theory in design practice. Incorporating adaptive learning features, such as personalised pacing, branching scenarios, or differentiated difficulty levels, may also further improve its effectiveness for learners with diverse backgrounds. Longitudinal studies would be valuable to examine how sustained use of MediaMentor influences learning outcomes, long-term retention, and student confidence in applying multimedia concepts. Future iterations may also benefit from integrating analytics dashboards to track learner progress and provide instructors with insights for targeted support. Finally, exploring the potential of more expressive or AI-based pedagogical agents could enhance social presence and personalised learning support.

Conclusion

This study examined the user acceptance of MediaMentor, an interactive multimedia learning application supported by a pedagogical agent, developed to support undergraduate learning in foundational multimedia courses. Rather than focusing solely on learner reactions, the study contributes to understanding how pedagogical-agent-supported multimedia tools can be designed and perceived within creative, visually intensive learning contexts.

The findings position MediaMentor as a theory-informed example of how multimedia learning principles, pedagogical agents, and interactive reinforcement can be integrated to support conceptual understanding and learner engagement. By transforming abstract multimedia concepts into visually structured and guided learning experiences, the application illustrates how digital tools can complement traditional instruction and address limitations associated with static, text-based teaching approaches. In doing so, the study extends existing pedagogical-agent and multimedia learning research into the domain of multimedia education, which remains comparatively underexplored.

Beyond its immediate instructional context, the study contributes to broader discussions on the role of interactive, agent-supported learning environments in higher education. The design of MediaMentor demonstrates how pedagogical agents may function not only as instructional guides but also as motivational and affective supports within self-paced digital learning environments. The inclusion of gamified reinforcement further illustrates how engagement can be sustained without compromising conceptual depth, offering a balanced approach to interactive learning design.

At the same time, the study acknowledges the need for continued refinement and evaluation. Future iterations of MediaMentor may benefit from expanded content coverage, enhanced technical optimisation, and the inclusion of adaptive or personalised learning features. Longitudinal investigations would also provide deeper insight into the tool's impact on learning outcomes, retention, and skill development over time.

To conclude, this study highlights the potential of pedagogical-agent-supported, multimedia-rich learning tools to enrich foundational multimedia education. By grounding design decisions in established learning theories and aligning them with learner experience, MediaMentor contributes a practical and transferable design example to the evolving landscape of student-centred digital learning in higher education. These findings should be interpreted within the context of an early-stage evaluation involving undergraduate students in a foundational multimedia course, a relatively small sample size, and short-term exposure to the application.

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