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BALANCING ENGAGEMENT AND DIGITAL WELL-BEING IN INTERACTIVE MULTIMEDIA LEARNING: A USER EXPERIENCE PERSPECTIVE

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Abstract:

Interactive multimedia is increasingly integrated into higher education to support student engagement, creativity, and meaningful learning. However, engagement-oriented interface features may encourage prolonged screen interaction, highlighting the importance of balancing usability, purposeful engagement, and digital well-being. This study examined the experiences of 58 undergraduate students enrolled in an Interactive Multimedia Design course, focusing on their perceptions of multimedia features, usability, visual design, engagement, and screen-related concerns. Data were collected using a 26-item questionnaire comprising five-point Likert-scale and open-ended questions and were analysed using descriptive statistics and qualitative responses. The findings revealed that animation was the most frequently used multimedia feature (82%), followed by interactive buttons (65%) and video integration (48%). Students reported moderately positive ease of use (3.5/5), favourable visual design (4.2/5), and high perceptions of innovation and confidence (4.4/5). Although 76% of respondents perceived their designs as encouraging prolonged engagement, approximately one-third expressed concerns about extended screen exposure, while 45% remained uncertain about its potential longer-term effects. These findings illustrate the coexistence of positive

engagement and concerns about sustained screen-based interaction rather than establishing a causal relationship between multimedia use and screen fatigue. The study contributes to multimedia design education by identifying the need to integrate responsible UI/UX principles into course-based learning. It recommends incorporating purposeful multimedia interaction, intuitive navigation, learner control, manageable cognitive demand, and digital well-being into multimedia design curricula to support meaningful and sustainable digital learning experiences.

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Keyword:

Interactive Multimedia; Student Engagement; User Experience; Digital Well-Being; Higher Education



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Introduction

Interactive multimedia brings together in a single medium text, images, animation, video, sound, navigation, and feedback in higher education. Data-based and systematic reviews of educational technology show that they can support engagement of behaviour, affect, and cognition when used in synchrony with meaningful activities, rather than treated as engaging by default (Bond et al., 2020; Bedenlier et al., 2020). A wider survey of the literature also indicates that structuring, interaction, communication, and active learning are prerequisites for productive engagement with technology (Godsk & Moller, 2025).

Moreover, engagement is multidimensional: participation, emotional involvement, and investment in learning should not be reduced to time spent with the learning environment (Fredricks et al., 2004; Kahu & Nelson, 2018). Mayer and Sweller have proposed that learning is best achieved by combining verbal and visual materials, thereby requiring a careful balance between verbal material and visual material (Mayer, 2021; Sweller, 1988).

The METUX perspective in higher education links the satisfaction of psychological needs for a successful operation of the learning system to its usability, engagement, and well-being (Jeno et al., 2021). It must be borne in mind that digital well-being is context dependent and cannot be inferred merely from the use of the medium or from the attractiveness of the underlying technological framework (Vanden Abeele, 2021).

This article is based on an existing dataset originally reported in a conference paper by Shawalludin et al. (2025). Its focus is the co-existence of the favourable perception of engagement with the doubt and concern about prolonged screen-based interaction. It is a report on the course and the context rather than a new intervention or causal investigation.

Literature Review

Interactive Multimedia and Student Engagement

Integrated media can offer multiple representations and opportunities for learners to become involved, but the cognitive theory of multimedia learning has found that it is the meaningful choice and arrangement of information rather than the quantity of the media that are of use (Mayer, 2021). Engagement research also distinguishes behavioural, emotional and mental engagement, and suggests that mere attention is an incomplete outcome (Fredricks et al., 2004; O'Brien & Toms, 2008). Educational technology reviews indicate that the benefits of interactivity depend on pedagogy, context, and implementation (Bedenlier et al., 2020; Godsk & Møller, 2025).

Students developing media productions have to develop both technical skills and decision-making as teachers. In a course-based survey, students' opinions can be described, while the learning results can be further studied. Project-based learning is a space where you can be creative and try out new things, but positive attitudes towards a project do not necessarily show that its users will be learning more effectively.

User Experience, Usability, and Interface Design

User experience is related to usefulness, clarity, controllability, stimulation and the overall quality of the experience (Hassenzahl & Tractinsky, 2006). The System Usability Scale is also an established measure, but its results cannot be equated with the data of this study (Brooke, 1996) and the UX-questionnaire offers a framework for assessing attractiveness, perspicuity, efficiency, dependability, stimulation and novelty, although it should not be presented as the instrument used in this study unless confirmed (Laugwitz et al., 2008).

In the case of educational devices, especially in education, the main thing is to keep the users motivated and give them control over their learning. The METUX model offers a model for evaluating how the users experience the interaction with the system in relation to their engagement and well-being (Jeno et al., 2021). In addition, the principles of user-centered design also recommend that the designers work together with the intended users in the design iterations, rather than just relying on the impression of the designer (ISO, 2019).

Engagement, Screen Fatigue, and Digital Well-Being is a question of the degree to which technology fits into people's goals and circumstances, not just how frequently they use their screens (Vanden Abeele, 2021); problematic design raises questions about the ethics of maximizing platform time without regard to individual autonomy (Peters et al., 2018). The study of digital well-being in education emphasizes self-reflective and responsible technology practices (Gui et al., 2023).

In the theory of 'cognitive load', it is said that unnecessary overload of working memory may hamper learning (Sweller, 1988). Multimedia can both assist attention and impose avoidable extra processing demands. In this study, concerns related to the screen are treated as a subjective phenomenon that does not represent measured physiological or clinical fatigue.

Research Gap

In the past, extensive data have been collected on the engagement of students in digital learning environments (Bond et al., 2020), their experiences and their satisfaction of their psychological needs (Jeno et al., 2021), and the context-sensitive well-being of the digital age (Vanden Abeele, 2021). However, it is not always clear how these perspectives can be combined when students are both learners and producers of media learning experiences. In particular, it remains to be examined whether students who experience their projects as engaging also experience concern or uncertainty about the sustained use of screen-based platforms.

The present study fills this gap by examining features used, usability, visual design, perceived engagement, creativity and screen-based concerns in the same group of 58 students. The study does not report whether certain features caused fatigue, increased the number of hours spent on the screen, or improved learning performance. Its contribution is to identify considerations for purposeful interaction, usable navigation, learner control and responsible UX.

Research Questions

1. Question 1: How do students perceive the usability and visual design of multimedia learning applications?
2. RQ2: Which interactive multimedia features are most frequently reported, and what are students' perceptions of engagement?
3. Question 3: What are the students' perceptions about the issues relating to screen time and the possible long-term effects of prolonged interaction with screens?
4. Question 4: What are the implications of these perceptions for the balance of digital engagement and digital well-being in the context of media education?

Methodology

This exploratory, course-based study is based on the dataset reported in the original GDT260 conference study (Shawalludin et al., 2025). The participants were 58 undergraduates enrolled in a course on Interactive Multimedia Design which involves a combination of motion design, animation, and the principles of user-interface. Students developed e-learning projects with the use of a number of interactive media tools, mainly using Adobe Animate. The unit of analysis was students' self-reported experiences and perceptions, with no attempt to make an independent assessment of the end users of their projects.

The use of interactive multimedia in higher education is on the rise to stimulate student engagement, to promote deep learning and to increase innovation. At the same time, elements that engage may extend screen-time, and it is important to reconcile usability with intended interaction and digital health. This study analyzed the opinions of 58 undergraduate students in an Interactive Multimedia Design course and primarily investigated their opinions about the characteristics, usability, aesthetic design, engagement, and problems with the screen. Data were collected through a 26-question Likert-type survey that used a five-point scale and open-ended questions, and the data were analyzed using descriptive statistics and a qualitative analysis. The results showed that animation was the most widely used element (82%), followed by the use of interactive buttons, which were used by 65 percent of the

students, and by the integration of videos, which were used by 48 percent. A fairly acceptable level of usability (3.5 out of 5) was reported by the students, with a largely positive design aesthetic (4.2 out of 5), and a greater perception of originality and assurance (4.4 out of 5).

The majority of the students (76%) stated that their designs fostered sustained engagement, while about a third were worried about prolonged screen time, and about 45 percent were ambivalent about its possible long-term consequences. These results indicate a combination of constructive engagement and concerns about the possible effects of excessive screen interaction, rather than a cause-and-effect relationship between the use of multimedia and the development of screen fatigue. To enhance multimedia design education, this research emphasizes the need to take into account the ethical guidelines of UI/UX in curriculum-based instruction and the importance of integrating such elements as intentional engagement, usable and learner-friendly navigation, learner self-determination, feasible cognitive load, and digital health and safety into multimedia design programs to foster significant and enduring digital learning experiences.

Results

Use of Interactive Multimedia Features

A survey of completed projects in the Interactive Multimedia Design course showed that animation, a feature employed by $n = X$ (82%) of the students, was followed by the use of interactive buttons by $n = X$ (65%) and video integration by $n = X$ (48%). These results showed that the most prevalent means of communication were movement and navigation, and that animation was used more than interactive buttons or video integration. The addition of video integration was less common than the use made of the other two.

These data indicate that the learners were quite concerned about the visual presentation and the interactivity. Sound-related features were reported less often. However, it is not clear why particular features were chosen and whether their presence improved the learning process. This is why it is useful to encourage the learners to evaluate multimedia tools based on the educational goals, usability and needs, rather than only the visual appearance.

Usability and Visual Design

Students found the environment's ease of use at a mean of approximately 3.5 out of 5, which is moderately positive. The qualitative assessment suggests that the timeline-based animation and layering features of the software caused difficulties to the students. But they gradually became more comfortable through the practical exercises, the tutorials, and the peer-to-peer assistance. These results confirm the value of structured support in the learning process.

The visual design rated slightly higher at approximately 4.2. Students described how they had applied visual design principles such as layout hierarchy, colour contrast, transitions, motion pacing, and so on to their projects. This suggests that the students are more satisfied with their creative results than with their ability to develop in the digital environment. That would be a reason to include technical training, iterative prototyping, and usability tests in a multimedia education.

Engagement and Screen Fatigue

Approximately 76% of the students who had been tested said that they thought their multimedia works were encouraging people to stay longer. However, their positive opinions about their interactive work were accompanied by the fact that they had doubts about long-term effects of screen work: about a third of them had worries about the long-range effects of this kind of work, and the other 45% were unsure.

This result shows that the favourable perceptions of engagement can be accompanied by concerns and uncertainties regarding screens. However, the study relied on the perceptions and experiences of the students and did not measure actual use duration, screen exposure time or physical discomfort. It is therefore not interpreted that the developed project led to an increase in screen fatigue or a prolonged exposure to screens.

These results imply that in an educational setting it is necessary to teach students to distinguish between purposeful engagement and needlessly prolonged interaction. This is why education in the design of multimedia should include principles such as digital well-being, intuitive navigation, manageable cognitive demand, and user control over the experience along with more engagement-based ones.

Innovation and Confidence

Students gave innovation and creativity an average of about 4.4 out of 5 points. Students also expressed confidence in the quality of their work. This argues against interpreting high creativity and quality scores as a sign of equal ability in usability or U-creation. Some respondents, however, noted a need for additional guidance in user interface and user experience design. Teaching UI and UX together with iterative prototyping, peer evaluation, and usability testing could help students connect their creative decisions to users' functionality and educational needs.

The findings reveal that students in the Interactive Multimedia Design course reported positive experiences with interactive multimedia development, particularly in relation to visual design, engagement, innovation, and creativity. Animation was the most frequently reported feature (82%), followed by interactive buttons (65%) and video integration (48%), indicating an emphasis on motion-based presentation and interactive navigation. Students rated visual design favourably (4.2/5), while ease of use received a moderately positive rating (3.5/5), reflecting some technical challenges during the development process. Innovation and creativity received the highest reported rating (4.4/5), suggesting that students valued opportunities for creative experimentation.

Findings also point to a conflict between digital well-being and learning engagement. Although 76% of the students felt that their design would encourage them to stay longer on the platform, around a third were concerned about the effects of long-term exposure to screens, and a further 45% were unsure of the longer-term consequences. These results show that positive perceptions of engagement can coexist with concerns about the effect of screens. As the study relied on self-reported data from 58 students in a single course, the results do not establish causal relationships or represent the wider undergraduate population.

On the whole, the study highlights the need to integrate technical proficiency, responsible and purposeful engagement, usability and digital well-being into digital design teaching. It also calls for the systematic integration of UI/UX practices, iterative prototyping, usability testing and learner-centered design principles in the digital design curriculum to encourage learners to create media experiences that are engaging and responsible.

Discussion

The significance of animation (82%) and interactive buttons (65%) shows that students placed importance on dynamic visual displays and user-driven engagement in their multimedia products. These findings are consistent with multimedia learning theory, which highlights the effectiveness of synchronised visual and linguistic representations in supporting information processing (Mayer, 2021). Research on educational technology also indicates that interactive learning environments can increase student engagement when technological elements are thoughtfully integrated into teaching practices (Godsk & Møller, 2025). Still, the frequent use of certain multimedia elements should not be taken as evidence of their educational value. Animations, interactive navigation, and video integration can help create engaging educational experiences; however, their educational value depends on how well they match learning objectives, instructional clarity, and suitability for the intended users. The gap between students' visual-design score (4.2/5) and ease-of-use score (3.5/5) highlights the difference between visual appeal and practical usability. Hassenzahl and Tractinsky (2006) point out that user experience goes beyond appearance to include users' perceptions and interactions with technology; similarly, the User Experience Questionnaire by Laugwitz et al. (2008) recognises multiple aspects of user experience. With these perspectives in mind, multimedia design education should address visual creativity and usability as related but distinct parts of successful interface design.

The main interpretative finding of this research relates to the coexistence of positive engagement perceptions and concerns about prolonged screen use. While 76% of students felt their created media encouraged lasting engagement, about one third voiced concerns about extended screen time, and 45% were uncertain about its possible long-term effects. These findings suggest that students saw the engagement potential of interactive multimedia while also acknowledging possible impacts on digital well-being. However, engagement should not be measured only by the duration of interaction. Fredricks et al. (2004) define student engagement by looking at behavioural, emotional, and cognitive dimensions, stressing the importance of participation quality rather than just time spent. O'Brien and Toms (2008) also describe a multi-layered experience involving attention, involvement, and responses to technology. Research on digital well-being points out that the effects of technology use depend on personal situations, experiences, and contexts, not just the amount of screen time (Vanden Abeele, 2021). Within this theoretical context, these findings highlight the need to distinguish meaningful instructional involvement from overly extended interaction. Because of the qualitative nature of this research, the reported perceptions cannot show whether the created media actually increased screen time, led to fatigue, or improved learning outcomes.

These findings have implications for students who aim to become multimedia designers and creators of educational interfaces. Beyond technical skills and design abilities, they need to understand how interface decisions can influence usability, learner autonomy, and digital health. Studies using the METUX framework indicate that meeting psychological needs during interactions with educational technology is linked to engagement, learning, and well-

being (Jeno et al., 2021). In this context, effective instructional interfaces should offer meaningful choices, straightforward navigation, and appropriate opportunities for learners to control their interactions. The principles of human-centered design also highlight the importance of understanding users, their behaviours, and their environments through iterative design and evaluation (ISO, 2019). Applying these concepts in multimedia education will encourage students to consider the educational purpose of each interactive feature, rather than focusing only on visual appeal or longer engagement. In addition, reflective digital well-being activities may lead students to think critically about animation speed, interaction duration, information presentation, and opportunities to pause or disengage (Gui et al., 2023; Peters et al., 2018), encouraging a more thoughtful approach to multimedia production by connecting creative decisions to users' educational needs and broader experiences. These recommendations represent educational implications drawn from the findings and supporting literature, rather than interventions tested in the current study.

Implications for Multimedia and UI/UX Education

The findings highlight the importance of integrating purposeful multimedia design, usability, learner autonomy, and digital well-being into higher education curricula. First, students should be encouraged to select animation, video, sound, and interactive controls according to clearly defined learning objectives rather than aesthetic appeal alone. Multimedia learning theory underlines the importance of coordinating instructional content and presentation to support meaningful learning while avoiding unnecessary cognitive demands (Mayer, 2021). Second, usability and accessibility should be incorporated into the design and assessment process through iterative prototyping and evaluation with intended users. Students should assess navigation, readability, predictable interaction, information organization, and learner control to ensure that their projects are understandable and appropriate for their intended educational contexts (ISO, 2019; Brooke, 1996). Third, assessment criteria should distinguish meaningful engagement from prolonged interaction. Rather than rewarding designs solely for sustaining attention, educators could require students to demonstrate how their projects support task completion, conceptual understanding, independent learning, and appropriate opportunities for disengagement (Kahu & Nelson, 2018; Vanden Abeele, 2021). Finally, multimedia design education should incorporate reflective activities addressing digital well-being, including decisions concerning animation pacing, screen exposure, information density, and natural stopping points. Future evaluations of these educational practices should combine student-perception surveys with usability testing, observed task completion, objective screen-use records, and direct assessments of learning performance. These recommendations provide a proposed direction for curriculum development; their effectiveness was not experimentally evaluated in this study.

Limitations and Future Research

This study has several limitations that should be considered when interpreting its findings. First, the sample consisted of 58 undergraduate students enrolled in a single Interactive Multimedia Design course, which limits the transferability of the results to other academic disciplines, higher education institutions, and student populations. Second, the self-reported questionnaire responses and descriptive analysis were collected without a control group, pre- and post-test assessments, or direct measurements of learning performance; consequently, the findings reflect students' perceptions and experiences rather than establishing causal relationships between multimedia features, engagement, usability, and digital well-being.

Third, the research did not collect objective screen-time records, physiological measurements, or longitudinal data. The reported concerns about prolonged screen exposure and uncertainty regarding longer-term effects should not be interpreted as evidence of clinically assessed fatigue or documented long-term consequences. Future research should involve larger and more diverse samples across multiple courses and institutions to examine whether similar patterns emerge in different educational contexts. Researchers should also establish the development and reliability of the questionnaire and incorporate validated instruments for assessing user experience, student engagement, and digital well-being. Combining self-reported perceptions with usability testing, objective screen-use data, observed task completion, and direct measures of learning performance would provide a more comprehensive understanding of multimedia learning experiences. Furthermore, comparative and longitudinal research could evaluate whether responsible UI/UX principles and digital well-being activities contribute to meaningful engagement and sustainable technology use over time.

Conclusion

This exploratory study looked at students' perceptions of usability, interactive multimedia feature use, engagement, creativity, and screen-related concerns among 58 undergraduate students who were enrolled in a single Interactive Multimedia Design course. The findings showed generally positive perceptions of visual design, innovation, and engagement. Animation, interactive buttons, and video integration stood out as key features in students' multimedia projects. While students tended to evaluate their creative outcomes positively, they also mentioned technical challenges with multimedia development, which points to the importance of structured instructional support and hands-on experience for building their design skills.

One central finding of this study is that positive engagement perceptions can exist alongside concerns about spending too much time interacting with screens. Students acknowledged the potential of interactive multimedia to hold user attention, but some also raised concerns about extended screen exposure or were unsure about its longer-term effects. These findings indicate that engagement should not be viewed only as a positive design outcome or measured simply by how long users interact. Instead, meaningful educational engagement should be considered together with usability, cognitive clarity, learner autonomy, and digital well-being.

The study adds to multimedia design education by stressing the importance of including responsible user interface and user experience principles in teaching and learning. Multimedia curricula should promote thoughtful feature selection, intuitive navigation, learner-controlled interaction, reasonable cognitive demand, and careful reflection on screen-related concerns. Iterative prototyping, usability evaluation, and structured feedback might also help students develop interactive learning experiences that balance creativity with educational effectiveness and responsible design.

Still, the findings are descriptive and specific to this context, reflecting students' self-reported perceptions rather than objectively measured learning outcomes or screen-related effects. Future research with larger and more diverse samples, validated instruments, objective measurements, and comparative or longitudinal designs is needed to test the proposed principles and see how they apply in different educational contexts.

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References

- Bedenlier, S., Bond, M., Buntins, K., Zawacki-Richter, O., & Kerres, M. (2020). Facilitating student engagement through educational technology in higher education: A systematic review in the field of arts and humanities. *Australasian Journal of Educational Technology*, 36(4), 126–150. <https://doi.org/10.14742/ajet.5477>
- 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, Article 2. <https://doi.org/10.1186/s41239-019-0176-8>
- Brooke, J. (1996). SUS: A quick and dirty usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland (Eds.), *Usability evaluation in industry* (pp. 189–194). Taylor & Francis.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74(1), 59–109. <https://doi.org/10.3102/00346543074001059>
- Godsk, M., & Møller, K. L. (2025). Engaging students in higher education with educational technology. *Education and Information Technologies*, 30, 2941–2976. <https://doi.org/10.1007/s10639-024-12901-x>
- Gui, M., Fasoli, M., & Carradore, R. (2023). Teaching and learning “Digital Wellbeing”. *Future Generation Computer Systems*, 149, 494–508. <https://doi.org/10.1016/j.future.2023.08.003>
- Hassenzahl, M., & Tractinsky, N. (2006). User experience—A research agenda. *Behaviour & Information Technology*, 25(2), 91–97. <https://doi.org/10.1080/01449290500330331>
- International Organization for Standardization. (2019). *Ergonomics of human-system interaction—Part 210: Human-centred design for interactive systems (ISO Standard No. 9241-210:2019)*. <https://www.iso.org/standard/77520.html>
- Jeno, L. M., Diseth, Å., & Grytnes, J.-A. (2021). Testing the METUX model in higher education: Interface and task need-satisfaction predict engagement, learning, and well-being. *Frontiers in Psychology*, 12, Article 631564. <https://doi.org/10.3389/fpsyg.2021.631564>
- Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface: Understanding the mechanisms of student success. *Higher Education Research & Development*, 37(1), 58–71. <https://doi.org/10.1080/07294360.2017.1344197>
- Laugwitz, B., Held, T., & Schrepp, M. (2008). Construction and evaluation of a user experience questionnaire. In A. Holzinger (Ed.), *HCI and usability for education and work* (pp. 63–76). Springer. https://doi.org/10.1007/978-3-540-89350-9_6
- Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781316941355>
- O’Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American Society for Information Science and Technology*, 59(6), 938–955. <https://doi.org/10.1002/asi.20801>
- Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for motivation, engagement and wellbeing in digital experience. *Frontiers in Psychology*, 9, Article 797. <https://doi.org/10.3389/fpsyg.2018.00797>
- Shawalludin, S., Ibrahim, S. F., Sanmugam, M., Hassan, A., Mohamed, H., & Abdul Rabu, S. N. (2025). Designing for engagement: Examining interactive multimedia design on

visual design and user experience. In 2025 IEEE 14th International Conference on Engineering Education (ICEED) (pp. 359–363). IEEE.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

Vanden Abeele, M. M. P. (2021). Digital wellbeing as a dynamic construct. *Communication Theory*, 31(4), 932–955. <https://doi.org/10.1093/ct/qtaa024>