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Interactive Multimedia via LMS on a Reading Comprehension Course: Enhancing Engagement and Learning Outcomes in Islamic Higher Education

Dewi Hidayati [1*]
Joko Slamet [2]
STAI Diponegoro Tulungagung, Indonesia [1]
Universitas Negeri Malang, Indonesia [2]
*Corresponding author's email: dewiaansugianto@gmail.com
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Abstract

Research on the integration of interactive multimedia within LMS-based reading courses for undergraduate students identifies critical challenges. Noteworthy issues in Islamic educational settings include limited student access to technology, resulting in uneven engagement, disparities in digital literacy levels, and difficulties in achieving desired learning outcomes. This study employs a sequential mixed-methods approach involving a questionnaire, LMS activity tracking, and interviews with 42 undergraduate students. The findings show significant positive outcomes, including heightened engagement through increased student interaction with digital resources and improved learning outcomes manifested in enhanced academic performance. However, persistent challenges encompass technological barriers and digital literacy disparities. The research underscores the importance of tailored strategies to optimize interactive multimedia integration in LMS platforms. The findings bring crucial implications for enhancing equitable engagement and learning outcomes in Islamic Higher Education. This study provides specific strategies for optimizing LMS-based interactive multimedia to enhance student engagement and learning outcomes in Islamic Higher Education.

Keywords: engagement, interactive multimedia, learning outcomes, LMS, reading comprehension

In contemporary education, the integration of interactive multimedia within learning management systems (LMS) stands as a promising avenue for enhancing student engagement and facilitating effective learning experiences (Kerimbayev et al., 2020; Simanullang & Rajagukguk, 2020; Slamet et al., 2024a). Interactive multimedia encompasses a variety of digital tools and resources, including videos, simulations, interactive quizzes, and multimedia

presentations, designed to cater to diverse learning styles and preferences. By providing interactive and immersive learning experiences, interactive multimedia has the potential to transform traditional pedagogical approaches and enhance student motivation and learning outcomes (Manurung & Panggabean, 2020; Muhartoyo & Aryusmar, 2022; Oktarina et al., 2021; Slamet & Mukminatien, 2024). While research has extensively explored the role of interactive multimedia in educational settings, its implementation in Islamic Higher Education presents distinct challenges, particularly in aligning technological advancements with faith-based pedagogy, ethical considerations, and digital accessibility constraints (Iqbal et al., 2018, 2019; Rupere & Jakovljevic, 2021; Slamet & Basthomi, 2024).

One of the primary challenges in integrating interactive multimedia within LMS platforms is the limited engagement and digital literacy levels among students in Islamic Higher Education, compounded by contextual barriers such as technological infrastructure, cultural considerations, and pedagogical constraints. While the availability of interactive tools in LMS platforms is well-documented (Firman et al., 2021; Iqbal et al., 2019; Kerimbayev et al., 2020; Slamet et al., 2024b), students in Islamic Higher Education often exhibit lower engagement due to limited technological access, inadequate digital training, and religious constraints that shape learning practices. These institutions prioritize faith-based education, which may not seamlessly align with conventional LMS functionalities. For instance, the use of multimedia tools, such as animations or simulations, must align with ethical and religious principles, necessitating careful adaptation to ensure compatibility with Islamic pedagogical values (Borba et al., 2018). Furthermore, disparities in digital literacy levels further exacerbate these challenges, limiting students' ability to fully leverage the benefits of interactive multimedia within LMS platforms (Rupere & Jakovljevic, 2021; Simanullang & Rajagukguk, 2020).

Beyond engagement challenges, reading comprehension remains a critical skill for academic success, particularly in higher education, where students are required to analyze complex texts across disciplines (Castles et al., 2018; Chow et al., 2021). Effective reading comprehension relies on multiple factors, including vocabulary knowledge, background knowledge, fluency, and metacognitive strategies (Pallathadka et al., 2022; Sutherland & Incera, 2021). However, many students in Islamic Higher Education struggle with reading comprehension due to linguistic and cognitive barriers, particularly when engaging with English academic texts. While research has explored explicit reading comprehension strategies, such as summarization and inferencing (Kusumawati & Widiati, 2017; Pallathadka et al., 2022),

there are notable gaps that warrant further exploration. One such gap is the limited focus on the integration of technology, such as interactive multimedia within LMS, to enhance reading comprehension skills. While existing literature provides insights into effective reading comprehension strategies (Castles et al., 2018; Chow et al., 2021; Kusumawati & Widiati, 2017; Sutherland & Incera, 2021), there is a significant gap in understanding how interactive multimedia within LMS can support reading comprehension development in Islamic Higher Education, particularly by aligning digital content with culturally and religiously relevant instructional practices.

The integration of interactive multimedia into LMS-based reading comprehension courses presents a potential solution to address these challenges by offering multimodal resources that cater to diverse learning needs while fostering student engagement. Studies suggest that interactive elements, such as visual aids, quizzes, and gamified activities, enhance students' comprehension skills by facilitating deeper cognitive engagement (Manurung & Panggabean, 2020; Muhartoyo & Aryusmar, 2022). However, despite its potential benefits, empirical research specifically examining the impact of interactive multimedia in LMS-based reading courses in Islamic Higher Education remains scarce. While some studies have explored the role of technology in improving student engagement and learning outcomes (Iqbal et al., 2018, 2019; Park, 2022; Romsi et al., 2024; Slamet & Basthomi, 2024), there is limited evidence on how interactive multimedia can be tailored to meet the pedagogical and cultural needs of Islamic Higher Education students in reading comprehension courses.

Existing research provides valuable insights into strategies for improving LMS-based learning experiences. Recommendations include enhancing the design and functionality of multimedia tools to improve accessibility and usability (Kerimbayev et al., 2020; Rupere & Jakovljevic, 2021), offering professional development for educators to integrate multimedia effectively into instruction, and addressing technological barriers such as internet connectivity issues (Iqbal et al., 2018; Muhartoyo & Aryusmar, 2022; Park, 2022). Additionally, studies highlight the importance of developing culturally sensitive digital content that aligns with the ethical and educational values of Islamic Higher Education. While these findings contribute to the broader discussion on multimedia integration, they do not explicitly address the specific context of reading comprehension courses in Islamic Higher Education, where students' engagement, literacy development, and alignment with religious values remain key concerns.

Thus, this study seeks to bridge this research gap by investigating the integration of interactive multimedia within LMS platforms in a

reading comprehension course for undergraduate students in Islamic Higher Education. By focusing on engagement and learning outcomes, this research aims to provide empirical insights into the potential benefits and challenges of using interactive multimedia in faith-based academic settings. The study seeks to address the following research questions:

1. How do undergraduates perceive the use of interactive multimedia in a reading comprehensive course through LMS in Islamic Higher Education?

2. To what extent does the integration of interactive multimedia within LMS influence engagement and learning outcomes for undergraduates in Islamic Higher Education?

Literature Review

Multimedia in Language Education

The integration of multimedia within language education has been explored extensively, underscoring its potential to enhance student engagement and learning outcomes. Manurung and Panggabean (2020) highlight the role of interactive multimedia in facilitating vocabulary retention and cultural understanding, demonstrating that tools like videos and virtual simulations significantly contribute to language acquisition. These findings align with Muhartoyo and Aryusmar (2022), who argue that multimedia tools provide immersive learning experiences that cater to diverse learning styles, which are crucial for effective language teaching. Park (2022) further supports this by emphasizing the importance of multimedia in addressing cognitive challenges, such as complex grammatical structures, thus enhancing learners' comprehension and retention. However, these studies predominantly focus on general language education contexts, with limited attention to specific challenges faced by learners in Islamic Higher Education.

While multimedia has been integrated into various educational settings, there is a notable gap in understanding how these tools are tailored to the unique needs of Islamic Higher Education institutions. Research by Oktarina et al. (2021) and Rupere and Jakovljevic (2021) provide valuable insights into the adoption of technology in language education; however, they largely overlook the pedagogical and cultural factors at play in Islamic contexts. Islamic Higher Education institutions typically blend linguistic proficiency with religious and ethical values, which may influence students' reception and engagement with multimedia tools. The existing studies also fail to consider the varied digital literacy levels among students, which can impact how effectively multimedia is used to teach reading comprehension. More importantly, these studies do not address the need for multimedia

tools that align with Islamic pedagogical principles, such as incorporating Quranic knowledge-seeking principles and balancing Western educational models with Islamic perspectives. This gap presents an opportunity for research to explore how multimedia can be designed and implemented to enhance reading comprehension in Islamic Higher Education while respecting the unique cultural and pedagogical needs of these institutions.

Reading Comprehension, Enhancing Engagement, and Learning Outcomes

Reading comprehension is a fundamental skill that underpins academic success, prompting extensive research into strategies that enhance students' engagement and learning outcomes. Castles et al. (2018) emphasize the cognitive processes involved in reading comprehension, suggesting that instructional approaches must go beyond text decoding to develop deeper analytical skills. Similarly, Chow et al. (2021) highlight how pedagogical interventions can improve students' ability to interpret and analyze texts, while Ritonga et al. (2022) argue that integrating technology into reading instruction enhances comprehension by fostering interactive and engaging learning experiences. These studies collectively suggest that reading comprehension benefits from dynamic instructional methods, yet they do not specifically address the role of multimedia in structured Reading Comprehension courses within Islamic Higher Education.

Interactive multimedia has been increasingly recognized as a means to improve engagement and facilitate deeper comprehension. Ismail et al. (2020) and Kusumawati and Widiati (2017) demonstrate that integrating videos, animations, and interactive exercises can significantly enhance student motivation and retention of reading materials. Pallathadka et al. (2022) further argue that multimedia fosters a multimodal learning environment, making abstract concepts more accessible. However, while these studies affirm multimedia's impact on general reading instruction, they do not consider how its design and application should be adapted to align with the epistemological and pedagogical frameworks of Islamic Higher Education. Research by Radia (2019) and Ritonga et al. (2022) acknowledges multimedia's potential in improving learning outcomes, yet it remains unclear whether these tools effectively cultivate higher-order thinking skills such as inferencing, contextual interpretation, and critical analysis within Islamic academic settings. The existing literature fails to explore whether multimedia-based reading strategies can support students in engaging with texts through an Islamic intellectual lens, which is crucial in disciplines where reading comprehension extends beyond textual understanding to ethical and theological interpretation. This gap underscores

the need for further research into how multimedia can be tailored to foster deep comprehension while maintaining alignment with Islamic educational philosophies.

Multimedia and LMS in Higher Education

The integration of multimedia within LMS has transformed teaching and learning in higher education, providing educators with tools to create, deliver, and assess multimedia-rich content that promotes interactive and engaging learning environments. Iqbal et al. (2018, 2019) and Romsi et al. (2024) emphasize how LMS platforms enhance student interaction and knowledge retention by facilitating collaboration and offering diverse learning resources. Similarly, Slamet and Basthomi (2024) argue that multimedia integration within LMS encourages active participation and improves student motivation. Borba et al. (2018) and Kerimbayev et al. (2020) further support this by demonstrating how multimedia elements in LMS platforms improve student engagement and foster deeper comprehension through interactive features. However, these studies primarily focus on general higher education contexts, with limited attention to the unique pedagogical needs of Islamic Higher Education.

Islamic Higher Education institutions often prioritize collaborative, discussion-based learning grounded in Islamic scholarly traditions. This requires LMS platforms to integrate features such as discussion forums, annotation tools for textual analysis, and multimedia resources that support both secular and Islamic perspectives on learning materials. While Iqbal et al. (2018) and Park (2022) highlight the effectiveness of multimedia in enhancing student engagement, they do not address how these tools can be tailored to accommodate Islamic pedagogical values. Rupere and Jakovljevic (2021) and Slamet et al. (2024b) also affirm the benefits of LMS in promoting knowledge retention, but they overlook the specific literacy and comprehension challenges faced by students in Islamic Higher Education. Furthermore, Iqbal et al. (2019) and Kerimbayev et al. (2020) note that cultural and religious factors may influence the effectiveness of multimedia in LMS, yet they do not explore how ethical considerations related to content presentation can ensure alignment with Islamic educational values. Simanullang and Rajagukguk (2020) suggest that peer interaction and guided inquiry are critical in Islamic learning traditions, but it remains unclear whether current LMS platforms adequately support these elements in reading comprehension courses. Despite evidence showing the positive effects of multimedia on engagement and collaboration, empirical research

is needed to examine how LMS platforms can support deep textual analysis and reading comprehension in Islamic Higher Education.

Integrating Multimedia through LMS in Islamic Higher Education in Reading Courses

The integration of multimedia through LMS presents a transformative approach to instructional delivery, fostering active learning and engagement in reading courses. Iqbal et al. (2018, 2019) and Rupere and Jakovljevic (2021) highlight how LMS-based multimedia enhances interactivity and student participation. However, despite these advantages, the existing literature does not sufficiently address how this integration aligns with the pedagogical structures and digital literacy levels of students in Islamic Higher Education. While broader educational research underscores the effectiveness of multimedia in facilitating comprehension and engagement (Muhartoyo & Aryusmar, 2022; Oktarina et al., 2021), these studies remain largely focused on general higher education settings and do not explore the unique instructional needs of Islamic institutions.

A critical limitation in the exsiting research is the tendency to generalize multimedia integration in LMS platforms without considering the distinct nature of Reading Comprehension courses in Islamic Higher Education. Iqbal et al. (2019) and Muhartoyo and Aryusmar (2022) examine multimedia's role in improving literacy skills, yet they do not investigate how LMS tools can be structured to accommodate the diverse textual traditions present in Islamic academic settings. Rupere and Jakovljevic (2021) argue that multimedia fosters deeper engagement with course materials, but their study does not address how students in Islamic institutions, who engage with both classical religious texts and modern scholarly works, require tools that support layered textual analysis. Features such as interactive glossaries, thematic discussion prompts, and multimedia annotations could facilitate these analytical processes, yet research has not explored their effectiveness in LMS-integrated reading courses. While Iqbal et al. (2018) and Park (2022) acknowledge the cognitive benefits of multimedia in higher education, they do not examine how these tools influence comprehension skills and the ability to interpret texts through an Islamic intellectual lens. The lack of empirical research on the intersection of multimedia, LMS platforms, and reading comprehension within Islamic Higher Education underscores the need for further study on how digital learning environments can be optimized to support critical engagement with texts while maintaining alignment with Islamic educational values.

Method

Research Design

This study employed a sequential mixed-methods approach. By using a sequential approach, the study first collected quantitative data through a structured questionnaire, followed by a qualitative phase in which semi-structured interviews were conducted.

The quantitative component focused on measuring students' perceptions and engagement levels with the interactive multimedia elements within the LMS. The results from the questionnaire provided a broad overview of how students interacted with course materials, including their attitudes towards the use of multimedia in enhancing reading comprehension. In contrast, the qualitative component enriched the research by offering in-depth insights into the students' personal experiences, challenges, and perceptions of the multimedia-based learning environment. The sequential design structure not only allowed for the collection of data from different sources but also ensured that the qualitative findings could elaborate on the initial quantitative findings. This allowed for a deeper and more nuanced understanding of the subject matter. Additionally, the LMS data-tracking component provided supplementary quantitative data regarding the students' interaction patterns with the multimedia content, thus allowing for the triangulation of findings across multiple data sources.

Participants

The participants were 42 undergraduate students enrolled in a reading comprehension course at one of the private universities in East Java, Indonesia during the first semester of the 2024/2025 academic year. The course was conducted via the DiptaLearn LMS, integrating interactive multimedia to enhance student engagement and comprehension. Participants were selected through purposive sampling, a non-random technique chosen to ensure the inclusion of students with diverse demographic characteristics, including gender, age, and varying levels of English proficiency. This method was selected to achieve a balanced representation, allowing for a richer understanding of how different student profiles interact with multimedia-based reading instruction. By intentionally targeting a heterogeneous group, the study aimed to capture a comprehensive range of perspectives, ensuring that the findings reflect the varied learning experiences and challenges within the broader student population.

The English proficiency levels of the participants were assessed using a self-reported questionnaire, where students categorized themselves

into Beginner, Intermediate, or Advanced levels based on their prior English learning experiences and academic performance in language courses. Additionally, students' majors were within Islamic Studies and English Language Education, ensuring that the research findings are contextually relevant to both general EFL learners and those in Islamic educational settings. The inclusion criteria ensured that students from various age groups, gender backgrounds, and proficiency levels were represented. This diversity was crucial in identifying potential variations in how interactive multimedia content influences engagement and learning outcomes across different demographic groups.

Table 1
The Participants' Demographic Information

	Participants (n = 42)	Percentage (%)
Age	18–24 = 18	42.86
	25–34 = 24	57.14
Gender	Male = 36	85.71
	Female = 6	14.29
English Proficiency	Beginner = 30	71.43
	Intermediate = 12	28.57
	Advanced = 0	0

Instruments

This study utilized three primary instruments to measure student engagement and learning outcomes: a Likert-scale questionnaire, semi-structured interviews, and LMS tracking data.

Likert-Scale Questionnaire

The questionnaire used in this study was adapted from Rupere and Jakovljevic (2021) and Firman et al. (2021), with modifications to align with the context of multimedia integration in a reading comprehension course. The instrument was validated through expert reviews, with three Ph.D. holders specializing in EFL learning technology evaluating its content validity, clarity, and relevance to the research objectives. The validation process involved two phases. In the first phase, the experts independently assessed the questionnaire items, providing feedback on wording precision, item redundancy, and relevance to engagement and learning outcomes. In the second phase, a consensus meeting was conducted to discuss discrepancies and ensure agreement on necessary adjustments. Adjustments included refining ambiguous items, rephrasing double-barreled questions,

and adding context-specific prompts to reflect students' experiences with multimedia tools. The instrument included 20 items, divided into two distinct sections: 10 items addressing learning engagement and 10 items assessing learning outcomes. The learning engagement items aimed to measure the degree to which students interacted with and were motivated by the multimedia content. The learning outcomes items evaluated how effectively the multimedia integration contributed to the students' reading comprehension and their overall academic progress. The questionnaire used a five-point Likert scale, where participants indicated their level of agreement with each statement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). This scale enabled the measurement of participants' attitudes towards the multimedia integration in a standardized manner, providing quantifiable data that could be easily analyzed.

Semi-Structured Interviews

In addition to the questionnaire, semi-structured interviews were conducted with six participants. These interviews aimed to gain deeper insights into the participants' personal experiences with the multimedia-integrated course, as well as their perceptions of how the multimedia content affected their engagement and learning outcomes. The interview guide, reviewed by the three experts, consisted of open-ended questions, allowing participants to share their thoughts and experiences in their own words. The interviews were audio-recorded, transcribed verbatim, and analyzed thematically to identify recurring patterns and key themes related to engagement and learning outcomes.

LMS Tracking Data

Finally, data regarding the participants' interactions with the interactive multimedia content within the LMS platform were collected and analyzed. The LMS platform tracked various metrics, such as the frequency of interactions with multimedia elements (e.g., videos, quizzes, and interactive readings), the duration of these interactions, and the sequence in which participants engaged with the content. These data provided valuable quantitative insights into how students interacted with the multimedia materials, which helped complement the self-reported data from the questionnaires and interviews.

Data Collection Procedure

Data collection was carried out in several stages, beginning with the distribution of the Likert-scale questionnaire, followed by the semi-structured interviews, and finally, the collection of LMS tracking data.

Phase 1: Questionnaire Distribution

The first stage of data collection involved the distribution of the Likert-scale questionnaire to all 42 participants. The questionnaire was administered online via the LMS platform, ensuring ease of access for participants. Students were given a one-week window to complete the questionnaire, and reminders were sent to encourage participation. The responses were collected and entered into SPSS for statistical analysis.

Phase 2: Semi-Structured Interviews

Following the completion of the questionnaires, six participants were purposively selected for in-depth interviews. These participants were chosen based on their diverse demographic characteristics and their responses to the questionnaire, ensuring that a range of perspectives would be captured. Each interview lasted approximately 30–45 minutes and was conducted online via video conferencing platforms. The interviews were audio-recorded and later transcribed for analysis.

Phase 3: LMS Tracking

Throughout the course, the participants' interactions with the interactive multimedia content were automatically tracked by the LMS. Data on how often participants engaged with the multimedia elements, the time spent on each element, and the sequence of interactions were collected. These data were used to assess engagement patterns and to make comparisons with the self-reported data from the questionnaires and interviews.

Data Analysis

Data analysis for this study was carried out using both quantitative and qualitative methods to address the research questions and ensure a comprehensive understanding of the effects of multimedia integration.

Quantitative Data Analysis

The quantitative data collected from the Likert-scale questionnaire were analyzed using SPSS version 26. Descriptive statistics, including means,

frequencies, and percentages, were computed for each of the 20 items in the questionnaire. These descriptive statistics provided an overview of participants' perceptions of multimedia integration in the course. Reliability analysis was performed using Cronbach's alpha to assess the internal consistency of the questionnaire items. The resulting coefficient of 0.886 indicated high reliability, suggesting that the items consistently measured the constructs of learning engagement and learning outcomes.

Qualitative Data Analysis

The qualitative data from the semi-structured interviews were transcribed verbatim to ensure accuracy and preserve the integrity of the participants' responses. Thematic analysis was employed as the primary method for analyzing the data. This process involved several systematic steps, beginning with initial coding, where the transcripts were reviewed multiple times to ensure familiarity with the content. During the coding phase, open coding was applied, wherein meaningful segments of text were labeled with codes that reflected key concepts or ideas. These codes were then grouped into broader categories through axial coding, which allowed for the identification of recurring patterns, themes, and subthemes. This step was crucial in recognizing the nuances in the students' experiences, such as the types of multimedia elements that were the most engaging or the challenges they faced in using multimedia tools for reading comprehension. The final step, selective coding, involved synthesizing the categorized data into core themes that provided a deeper understanding of the students' perceptions of multimedia integration in the course. Throughout the analysis, constant comparison was used to ensure consistency and to refine the emerging themes. The thematic coding procedure also included member checking, where a subset of participants was invited to review the themes and findings to confirm the accuracy and resonance of the identified patterns. This comprehensive coding procedure ensured that the analysis was thorough, transparent, and reflective of the participants' diverse experiences with multimedia in the reading comprehension course.

Ethical Considerations

Informed consent was obtained from all participants before the commencement of data collection. Participants were assured of the confidentiality of their responses and were informed that their participation was voluntary and that they could withdraw from the study at any time without penalty. To further ensure participant confidentiality, all data were anonymized, and any identifiable information was removed during the analysis process. Additionally,

the audio-recorded interviews were securely stored and only accessible to the research team.

Findings and Discussion

Undergraduates' Perceptions of Interactive Multimedia Use on an LMS

The findings of the questionnaire revealed nuanced perceptions.

Table 2
Results of Dimension of Learning Engagement

Code	Items	SD *n* (%)	D *n* (%)	N *n* (%)	A *n* (%)	SA *n* (%)
LE1	I found the interactive multimedia helpful in understanding course materials.	0 (0)	1 (2.38)	8 (19.05)	11 (26.19)	22 (52.38)
LE2	I thought the multimedia elements increased my engagement with the course content.	0 (0)	2 (4.76)	5 (11.90)	9 (21.43)	26 (61.90)
LE3	I was actively engaged with multimedia during the course.	0 (0)	1 (2.38)	5 (11.90)	11 (26.19)	25 (59.52)
LE4	I thought the multimedia content helped me retain information better.	0 (0)	0 (0)	3 (7.14)	4 (9.52)	35 (83.33)
LE5	I found that the interactive multimedia facilitated my learning experience.	0 (0)	0 (0)	0 (0)	10 (23.81)	32 (76.19)
LE6	I found the multimedia materials engaging and informative.	0 (0)	2 (4.76)	3 (7.14)	14 (33.33)	23 (54.76)
LE7	I believe the multimedia components improved my understanding of the course concepts.	0 (0)	2 (4.76)	7 (16.67)	15 (35.71)	18 (42.86)
LE8	I thought that the multimedia content was engaging and kept me interested in the course.	0 (0)	0 (0)	6 (14.29)	11 (26.19)	25 (59.52)
LE9	I could actively participate with multimedia elements during the course.	1 (2.38)	2 (4.76)	5 (11.90)	15 (35.71)	19 (45.24)
LE10	I believed that the interactive multimedia elements enhanced my overall learning experience.	0 (0)	0 (0)	3 (7.14)	8 (19.05)	31 (73.81)

One notable finding from Table 2 is the students' strong consensus on the effectiveness of interactive multimedia in enhancing their comprehension of course materials (LE1), with 52.38% strongly agreeing and 26.19% agreeing. This suggests that multimedia tools played a significant role in making the content more understandable, supporting prior research

that highlights its positive impact on comprehension (Iqbal et al., 2019; Muhartoyo & Aryusmar, 2022). In contrast, responses related to engagement levels (LE2) show greater variability, with 61.90% of students strongly agreeing and 21.43% agreeing that multimedia increased their engagement with the course content. However, 4.76% of students disagreed, and 11.90% were neutral. This variability indicates that while many students found the multimedia elements engaging, others did not, possibly due to differences in individual learning preferences, technological familiarity, or attitudes toward digital learning tools (Manurung & Panggabean, 2020). These mixed results highlight that while multimedia can boost engagement, its effectiveness in sustaining engagement may depend on various personal and contextual factors, pointing to the importance of considering diverse learner needs and preferences in future implementations of multimedia-based learning tools.

Furthermore, the results demonstrate that the majority of students reported active engagement with multimedia resources (LE3), with 59.52% strongly agreeing and 26.19% agreeing. This suggests that the interactive nature of the multimedia materials, including videos, quizzes, and texts, played a significant role in encouraging active participation, aligning with previous research that highlights multimedia's potential to foster participatory learning (Iqbal et al., 2018; Rupere & Jakovljevic, 2021). Additionally, 83.33% of students strongly agreed that multimedia content helped them retain information better (LE4), reinforcing the notion that multimedia can enhance memory retention, as suggested by earlier studies (Iqbal et al., 2018; Muhartoyo & Aryusmar, 2022). However, while the majority found the multimedia materials effective, the neutral responses, particularly in LE6 (engagement and informativeness), where 7.14% were neutral and 4.76% disagreed, point to the fact that engagement and effectiveness are not solely determined by the multimedia content itself. External factors, such as internet connectivity, platform usability, and familiarity with digital tools, may influence students' experiences (Iqbal et al., 2019; Slamet et al., 2024a). These results underscore the importance of considering a range of contextual factors that could impact the effectiveness of multimedia in enhancing engagement and learning outcomes.

Interestingly, the finding that a majority of students agree that multimedia components enhance their understanding of course concepts is evident in LE7, where 35.71% agreed and 42.86% strongly agreed, totaling 78.57%. This aligns with previous studies highlighting the effectiveness of multimedia in facilitating learning, especially in engaging students with complex or abstract material (Romsi et al., 2024; Slamet & Mukminatien, 2024).

However, the presence of neutral responses (16.67%) suggest that some multimedia resources may not effectively support deep learning, particularly when dealing with abstract or challenging topics. This underlines the importance of employing structured instructional designs and scaffolding techniques to guide students through more complex concepts (Park, 2022). Furthermore, in LE8, 26.19% agreed and 59.52% strongly agreed that the multimedia content was engaging and kept them interested in the course, demonstrating that a significant majority (85.71%) perceived the content as attention-sustaining, though 14.29% remained neutral. This result indicates that while multimedia can capture attention, factors such as instructional design and the pedagogical approach play crucial roles in sustaining engagement (Firman et al., 2021). In LE9, 35.71% agreed and 45.24% strongly agreed that they could actively participate with multimedia elements, accounting for 80.95%, reflecting the interactive model of multimedia learning, where active student involvement is crucial for deeper engagement and enhanced learning (Iqbal et al., 2019). Lastly, LE10 shows a strong consensus, with 19.05% agreeing and 73.81% strongly agreeing that multimedia enhanced their overall learning experience, amounting to a substantial 92.86%, reaffirming its essential role in education, reinforcing existing literature on its ability to improve learning outcomes and engagement (Borba et al., 2018). These findings emphasize the need for thoughtful integration of multimedia in educational design to maximize its potential benefits.

Furthermore, the findings of the questionnaire revealed insightful perspectives. The results are presented in Table 3, which displays the dimension of learning outcomes.

Table 3
Results of Dimension of Learning Outcomes

Code	Item Description	SD *n* (%)	D *n* (%)	N *n* (%)	A *n* (%)	SA *n* (%)
LO1	I can apply learned concepts in practical situations.	1(2.38)	1 (2.38)	8 (19.05)	12 (28.57)	20 (47.62)
LO 2	I can analyze and evaluate information critically.	1 (2.38)	2 (4.76)	8 (19.05)	19 (45.24)	12 (28.57)
LO 3	I can solve problems effectively.	0 (0)	0 (0)	5 (11.90)	22 (52.38)	15 (35.71)
LO 4	I can demonstrate a deeper understanding of course materials.	0 (0)	2 (4.76)	9 (21.43)	11 (26.19)	20 (47.62)
LO 5	I find the course content more logically stimulating.	1 (2.38)	2 (4.76)	5 (11.90)	16 (38.10)	18 (42.86)

Table 3
Results of Dimension of Learning Outcomes (Cont.)

Code	Item Description	SD *n* (%)	D *n* (%)	N *n* (%)	A *n* (%)	SA *n* (%)
LO 6	I can recall information learned.	0 (0)	3 (7.14)	12 (28.57)	15 (35.71)	12 (28.57)
LO 7	I can understand course concepts more effectively.	0 (0)	3 (7.14)	7 (16.67)	18 (42.86)	14 (33.33)
LO 8	I can collaborate effectively with peers on academic tasks.	2 (4.76)	4 (9.52)	11 (26.19)	10 (23.81)	15 (35.71)
LO 9	I feel more confident in my academic abilities.	3 (7.14)	4 (9.52)	9 (21.43)	18 (42.86)	8 (19.05)
LO 10	I have improved overall in my academic performance.	0 (0)	3 (7.14)	5 (11.90)	11 (26.19)	23 (54.76)

The findings from Table 3 provide valuable insights into how undergraduates perceive the impact of interactive multimedia on learning outcomes. For instance, 76.19% of students agreed or strongly agreed that they could apply learned concepts in practical situations (LO1), while 19.05% responded neutrally and 4.76% disagreed, which highlights a critical gap in the transfer of theoretical knowledge to real-world applications, despite the support multimedia offers for theoretical understanding. This observation is consistent with Rupere and Jakovljevic's (2021) findings, where multimedia was found effective in promoting theoretical knowledge but less so in fostering practical applications. The high number of neutral responses (19.05%) in this study further suggests that the lack of authentic learning contexts, such as problem-based learning opportunities, may hinder students' ability to bridge theory with practice. It is important to note that the use of an odd-numbered Likert scale may have contributed to this ambiguity, underscoring a limitation in the instrument that future research should address by considering even-point scales to reduce neutral bias. Future research could explore integrating problem-based learning with multimedia to better prepare students for real-world application. Regarding LO2, 73.81% of students agreed or strongly agreed that they could analyze and evaluate information critically, while 19.05% responded neutrally and 7.14% disagreed. Although this reflects a generally positive perception of learning outcomes, the neutral responses suggest ambiguity in how students perceive their ability to critically engage with content, potentially due to limitations in the questionnaire's scale design. This ambiguity highlights the need to refine the instrument for clearer measurement of perceived learning outcomes in future studies. The variation in responses may also reflect differences in how students interact with multimedia

content based on instructional design and individual learning experiences. This is in line with Iqbal et al. (2018), who emphasized that the effectiveness of multimedia in fostering analytical engagement depends on how the content is structured and delivered. Therefore, while interactive multimedia shows potential in supporting students' analytical abilities, these findings underscore the importance of purposeful instructional design and the need for further research to explore how such tools can be optimized for deeper learning engagement.

Regarding LO3, 88.09% of students agreed or strongly agreed that they could solve problems effectively, while 11.90% responded neutrally, and no students disagreed. This high level of agreement indicates that students perceive interactive multimedia as a valuable tool for enhancing problem-solving skills, which is consistent with Kerimbayev et al. (2020) and Simanullang and Rajagukguk (2020), who found that interactive multimedia fosters analytical reasoning. However, the presence of neutral responses suggests that not all problem-solving contexts are equally influenced by multimedia. Factors such as the complexity of the problems presented, the level of scaffolding provided, and students' prior problem-solving experience may contribute to these variations. Regarding LO4, 73.81% of students agreed or strongly agreed that multimedia helped them demonstrate a deeper understanding of course materials, while 21.43% responded neutrally, and 4.76% disagreed. This aligns with Rupere and Jakovljevic's (2021) and Slamet and Basthomi's (2024) findings that multimedia facilitates deep learning. Yet, the neutral responses indicate that certain content types may require alternative instructional methods to fully enhance comprehension. Similarly, regarding LO5, 80.95% of students agreed or strongly agreed that multimedia made the course content more logically stimulating, while 16.67% responded neutrally, and 2.38% disagreed. This result supports Iqbal et al. (2018) and Slamet et al. (2024b), who highlighted the role of multimedia in promoting active and engaging learning experiences. These findings suggest that interactive multimedia, when thoughtfully integrated into an LMS, has a strong positive influence on students' engagement and learning outcomes, though content design and instructional support are critical to ensuring its full effectiveness.

Regarding LO6, 64.29% of students agreed or strongly agreed that they could recall information learned, while 28.57% responded neutrally, and 7.14% disagreed. This high level of agreement suggests that multimedia can support memory retention, aligning with Park (2022), who emphasizes its role in enhancing memory retention. However, the neutral responses imply that multimedia may not be universally effective for all learners, potentially

due to differences in cognitive processing styles or the complexity of presented content. Regarding LO7, 76.19% of students agreed or strongly agreed that multimedia helped them understand course concepts more effectively, while 16.67% responded neutrally, and 7.14% disagreed. This supports Borba et al. (2018) and Iqbal et al. (2019), who highlight multimedia's pedagogical advantages of multimedia in fostering understanding. Yet, neutral responses suggest that not all concepts are equally reinforced through multimedia, necessitating an investigation into which instructional designs best facilitate comprehension. Similarly, LO8, 64.52% of students agreed or strongly agreed that multimedia facilitated effective collaboration with peers, while 26.19% responded neutrally, and 9.52% disagreed. These findings resonate with Slamet and Basthomi (2024), who emphasize its interactive nature. However, the presence of neutral responses suggests that factors such as task design, communication barriers, or varying levels of digital literacy may influence collaboration effectiveness. These results highlight the importance of thoughtfully structured multimedia activities that support collaborative engagement and enhance learning outcomes within LMS platforms.

Regarding LO9, 61.91% of students agreed or strongly agreed that multimedia increased their confidence in their academic abilities, while 21.43% responded neutrally, and 16.66% disagreed. This high level of agreement supports Rupere and Jakovljevic (2021), who highlight multimedia's potential to enhance self-efficacy. However, the presence of dissenting views suggests that not all students equally benefit from multimedia in terms of confidence, which may be influenced by individual learning styles or prior experiences with digital tools. Regarding LO10, 80.95% of students agreed or strongly agreed that multimedia contributed to an improvement in their academic performance, while 11.90% responded neutrally, and 7.14% disagreed. This consensus supports findings from Firman et al. (2021) and Iqbal et al. (2018), who emphasize the positive impact of multimedia on academic achievements. However, the variation of responses in this study suggests that the impact of multimedia on academic performance is multifaceted, dependent on factors like the design of multimedia content and students' previous exposure to such learning methods. These results underline the need for further investigation into specific performance indicators and the role multimedia plays in supporting academic success within LMS platforms.

In summary, the findings suggest that while multimedia integration positively influences learning outcomes, variations in student responses highlight the complexity of these relationships. This study supports existing

research on the benefits of multimedia, particularly by showing that instructional design, learner differences, and content specificity significantly impact its effectiveness. Specifically, the study extends prior findings by demonstrating that not all students benefit equally from multimedia, as factors such as individual learning styles, prior experiences, and the complexity of the content play a crucial role. By analyzing diverse student responses and correlating them with instructional strategies, this research emphasizes the need for tailored multimedia content that accommodates varied learner needs. Future studies should explore how multimedia can be optimized to support diverse learners, ensuring that all students can maximize its benefits within Reading Comprehension courses in Islamic Higher Education.

The Influence of Interactive Multimedia Integration within LMS on Undergraduate Students' Engagement and learning Outcomes

The integration of interactive multimedia within LMS platforms significantly influenced undergraduate students' engagement and learning outcomes in a reading comprehension course. Participants (ST.1 to ST.6) articulated both benefits and challenges, revealing the multifaceted nature of multimedia-enhanced learning. The discussion below critically analyzes these findings, providing deeper interpretations and comparisons with previous research.

Students widely acknowledged the positive impact of interactive multimedia on engagement, emphasizing how videos and interactive exercises made content more immersive. For instance, ST.4's statement, *"The videos and interactive exercises really grab my attention. It's like the content comes alive."* and ST.1's perspective, *"The interactive elements make learning more enjoyable and interactive."* indicate a strong affinity for multimedia's ability to capture attention, which resonates with Muhartoyo and Aryusmar (2022), who note that multimedia enhances student motivation by increasing content interactivity. Similary, ST.6's comment, *"I feel more engaged with the course content when multimedia is incorporated.",* further reinforces the findings of Iqbal et al. (2019) and Slamet and Basthomi (2024), who emphasize multimedia's role in creating interactive learning environments that foster deeper student involvement. These insights suggest that the immersive and interactive features of multimedia are key drivers of engagement, aligning with previous studies that advocate for multimedia's role in transforming traditional learning experiences into more dynamic and motivating ones.

The recurring theme of multimedia's flexibility highlights its role in fostering personalized learning experiences. ST.2 acknowledged, *"I can*

revisit the videos or exercises if I need more clarification. It allows me to learn at my own speed.", underscores the self-directed nature of multimedia learning, aligning with Iqbal et al. (2018) and Park (2022), who emphasize adaptive learning's potential to accommodate diverse learning paces. While previous studies have primarily examined self-paced learning in traditional settings, this study extends the discussion by situating it within LMS-based multimedia courses, where students have greater autonomy over their learning trajectories. Furthermore, ST.6's insights that *"The interactive elements challenge me to think critically and solve problems. It's not just passive reading"* reinforces findings by Borba et al. (2018) and Park (2022), who highlight multimedia's cognitive benefits. The feedback provided by students indicates that LMS-integrated multimedia not only enhances engagement but also supports improved learning outcomes. Students expressed how interactive multimedia features, such as videos and exercises, fostered a more engaging and dynamic learning environment, which contributed to their overall learning experience. Based on the students' perspectives, the integration of multimedia was perceived as a key factor in making the course content more immersive, engaging, and accessible, which in turn had a positive impact on their learning outcomes.

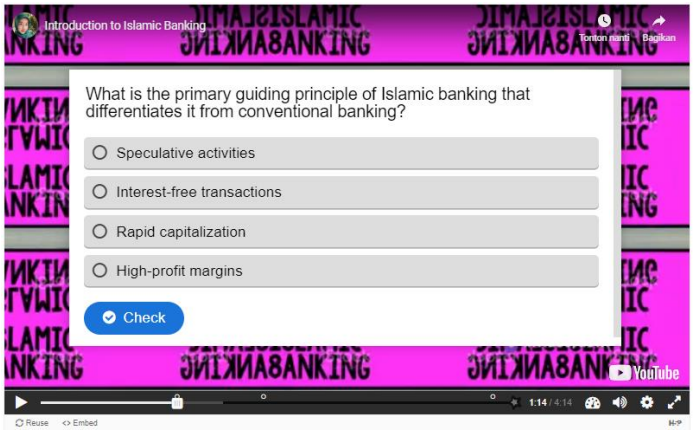
However, challenges related to cognitive overload and surface-level learning emerged as significant concerns in this study, shedding light on the complexities of multimedia integration within LMS environments. ST.5's remark, *"Sometimes, there's too much happening on the screen. It can be overwhelming, and I lose focus."* reflects the cognitive strain caused by excessive visual stimuli, aligning with Rupere and Jakovljevic's (2021) findings on the adverse effects of information overload. This study extends these insights by emphasizing that cognitive overload is not only about the volume of information but also how multimedia elements are structured and presented. ST.5's comment illustrates that the layout and frequency of multimedia stimuli can contribute to cognitive strain. This suggests that the pacing, visual complexity, and the sequencing of multimedia components play a critical role in students' ability to process information effectively. When multimedia elements are not carefully organized or appropriately paced, they can overwhelm learners, diminishing their focus and engagement. These findings support the need for thoughtful design in multimedia-based courses to ensure that content is not only rich in information but also structured in a way that minimizes cognitive overload, enhancing the learning experience. Similarly, ST.3 stated, *"The multimedia elements can sometimes feel disjointed, making it hard to concentrate",* underscores the

need for coherence and instructional design that ensures seamless content flow. While previous studies have warned against overwhelming students with multimedia (Mayer, 2019), this study situates the issue within an LMS context, where balancing interactivity and cognitive load is crucial. Moreover, ST.2's admission, *"I worry that I might be memorizing rather than truly understanding",* highlights the risk of passive engagement, despite multimedia's interactive nature. This reflects Mayer's (2019) call for deeper learning strategies and aligns with Kerimbayev et al. (2020) and Simanullang and Rajagukguk (2020), who emphasize critical thinking and reflection to counteract superficial comprehension.

Findings from LMS Activity Tracking

The LMS activity tracking data provides empirical insights into student engagement and progress within the reading comprehension course. Figure 1 presents an example of a quiz embedded within an interactive video, demonstrating students' engagement with formative assessments.

Figure 1
An Example of a Quiz in an Interactive Video



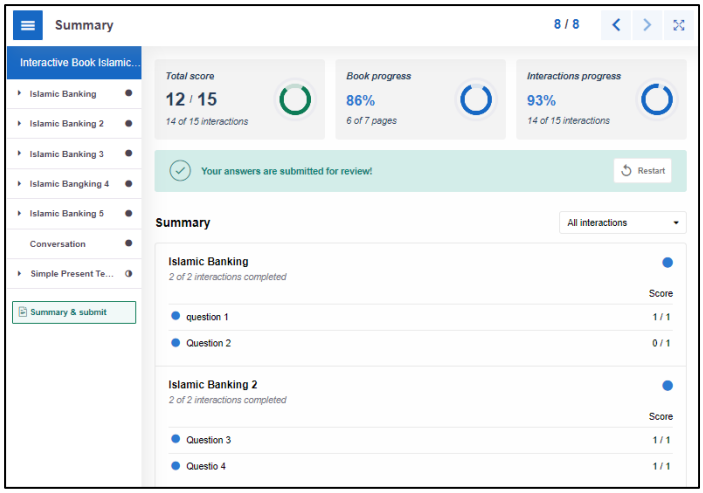
The integration of quizzes within the LMS platform is crucial for promoting active learning by encouraging students to engage with the content through interactive assessments. The data suggests that students were actively involved in these quizzes, reinforcing learning through retrieval practice. This aligns with Iqbal et al. (2018) and Slamet and Mukminatien (2024), who emphasize that interactive assessments enhance retention by promoting deeper processing through immediate feedback. The tracking data further indicates that students who made multiple attempts at the quizzes showed

improvements in recall accuracy, supporting the testing effect theory (Karpicke & Roediger, 2008). This suggests that frequent retrieval practice is effective in consolidating long-term memory. The findings underscore the value of using quizzes embedded within the LMS system, which provided opportunities for iterative feedback and reinforced learning outcomes. These insights demonstrate how integrating quizzes within the LMS contributes not only to reinforcing memory but also to fostering more engaged and reflective learning behavior, as students used the quizzes to gauge and improve their own understanding of the material.

Beyond quizzes, Figure 2 illustrates interactive e-books with student progress tracking, offering insights into students' navigation of course materials.

Figure 2

An Example of a Progress Report on an Interactive E-book



The progress monitoring tools within the LMS played a crucial role in fostering student engagement by enabling them to track their learning progress. According to the LMS data, students who frequently checked their progress reports demonstrated active interaction with the course material, particularly in the context of the interactive e-books. This supports Firman et al. (2021), who emphasize that metacognitive awareness, which is facilitated by progress monitoring tools, can improve student engagement and learning outcomes. These tools allowed students to revisit sections of the e-book, thereby reinforcing content and addressing individual knowledge gaps. This personalized learning experience aligns with the

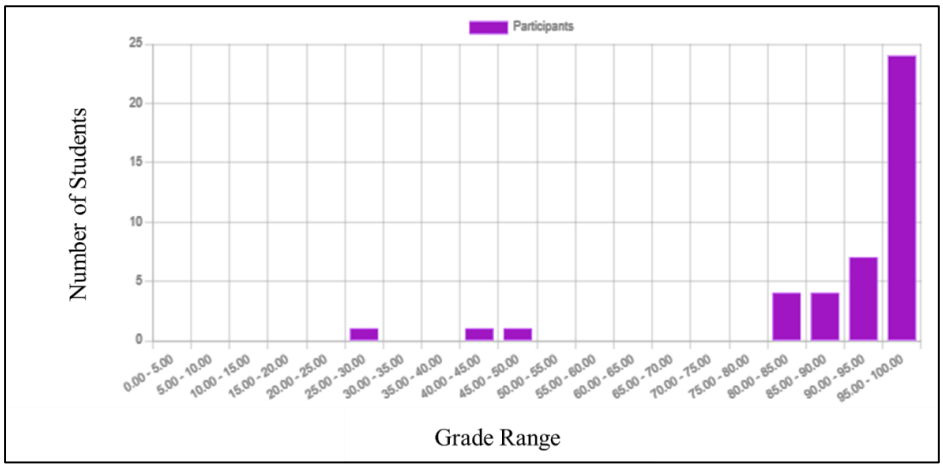
work of Kerimbayev et al. (2020), who found that adaptive technologies, such as progress tracking in LMS platforms, are effective in catering to diverse learning styles. The ability to monitor their own progress appears to have encouraged students to adjust their learning strategies based on their self-assessments. This observation further underscores the importance of progress tracking in supporting students' engagement with course content and providing them with the opportunity to focus on areas needing improvement.

Additionally, the LMS tracking data indicated that students who engaged more frequently with multimedia content, such as interactive videos and quizzes, tended to perform better in comprehension assessments. This observation aligns with Mayer's (2019) cognitive theory of multimedia learning, which emphasizes the role of dual-channel processing in enhancing retention and understanding. However, the data also indicated that students with lower digital literacy or less familiarity with the LMS engaged less consistently with the multimedia resources. This finding suggests that technological familiarity can influence engagement levels, which is consistent with the argument made by Rupere and Jakovljevic (2021), who emphasize the importance of prior technology training in maximizing the benefits of digital learning environments. The data highlights a need for targeted digital literacy interventions to help all students fully benefit from multimedia-enhanced learning experiences.

The final visualization, Figure 3, provides a distribution of learning outcomes based on assessment scores, illustrating overall student performance.

Figure 3

Distribution of Learning Outcome in a Reading Comprehension Course



The performance distribution in Figure 3 provides a breakdown of student assessment scores in the reading comprehension course. Most students demonstrated high performance, with only a small number of students scoring low. This distribution suggests that interactive multimedia contributed to improved comprehension, likely by fostering active engagement with the content. This aligns with Firman et al. (2021), who found that well-structured multimedia environments can enhance academic performance by catering to diverse cognitive needs. However, the presence of a few students with lower scores indicates that individual differences, such as self-regulated learning abilities, digital literacy, and prior content knowledge, may influence the effectiveness of multimedia in improving learning outcomes. Kerimbayev et al. (2020) emphasize that adaptive learning strategies are essential to support learners who may struggle in digital learning environments. In this case, the relatively small number of low performers suggests that these disparities may not be widespread, but they highlight the need for differentiated instructional approaches to ensure that all students can benefit from multimedia-enhanced learning. The low-performing students may have faced challenges in engagement or in utilizing the multimedia tools effectively, indicating the importance of addressing individual learning needs for more equitable outcomes.

Overall, the LMS activity tracking findings confirm that the integration of interactive multimedia within LMS platforms positively influences student engagement and learning outcomes in the reading comprehension course. The data suggests that multimedia elements, such as interactive videos and quizzes, enhance student interaction with the content and contribute to better performance, aligning with the research question regarding the impact of multimedia on engagement and learning outcomes in Islamic Higher Education. While the majority of students demonstrated improved comprehension, the findings also highlight the importance of addressing individual differences in digital literacy and learning strategies to optimize the benefits of multimedia integration. These insights underscore the value of incorporating interactive multimedia in online courses to foster a more engaging and effective learning environment.

Conclusion

This study investigated the impact of interactive multimedia in a reading comprehension course within Islamic Higher Education, focusing on the undergraduate students' perceptions and the influence on engagement and learning outcomes.

Regarding the first research question, students generally expressed positive perceptions of interactive multimedia, noting that it enhanced their engagement with the course content. Interactive videos, quizzes, and multimedia elements were highlighted as motivating factors that made the learning process more dynamic. However, some students reported feeling overwhelmed by excessive content, indicating a potential issue with cognitive overload. This suggests that while multimedia can enhance engagement, it must be carefully structured to avoid overburdening students. For the second research question, the integration of multimedia within the LMS had a noticeable impact on students' learning outcomes, particularly in terms of comprehension. Students who engaged more actively with the multimedia content tended to perform better in assessments. However, the study also identified that certain students, particularly those with lower digital literacy, engaged less with the resources, which affected their learning outcomes. This highlights the importance of considering individual differences, such as prior knowledge and technological familiarity, in designing effective multimedia-based courses.

While interactive multimedia in the LMS significantly supports student engagement and learning outcomes, its effectiveness is influenced by factors such as digital literacy and course design. This study underscores the need for a balanced approach in multimedia integration, ensuring that content is engaging yet manageable for all students. Future research should explore adaptive strategies to personalize learning experiences and further investigate the long-term impact of multimedia on academic performance.

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