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DESIGN IMPLICATIONS FROM A NEEDS ASSESSMENT FOR AR-BASED DIGITAL LEARNING MATERIALS WITH QUIZIZZ INTEGRATION IN SECONDARY EDUCATION

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ABSTRACT
In the context of global secondary education, rapid technological advancements have revolutionized learning environments. Educators are increasingly integrating immersive and interactive tools to better engage digital-native students. Augmented Reality (AR), when combined with gamified learning platforms, has shown great potential to boost student participation and comprehension. This study aims to analyze and compare the learning needs of Madrasah Tsanawiyah (MTs), including Islamic boarding schools, and Junior High School (JHS) students regarding AR-based digital learning materials integrated with the Quizizz platform. Using a descriptive quantitative design, the study employed data triangulation through questionnaires, classroom observations, and interviews to obtain a comprehensive view of students' needs and preferences. The results indicate that both MTs and JHS students share similar needs for AR-based learning materials, particularly in interactive visualization, immediate feedback, and gamification features, although differences were found in specific interaction and feedback preferences. In conclusion, integrating AR technology with Quizizz can create more engaging and adaptive learning environments for secondary students. The study implies that Islamic education institutions can effectively adopt AR-based digital learning to support active learning, strengthen student engagement, and align instructional practices with contemporary technological developments.

Keywords: Augmented Reality, Digital Learning, Junior High School, Madrasah Tsanawiyah, Quizizz

INTRODUCTION
The development of digital technology has driven significant transformation in the field of education, particularly in how teachers deliver content and how students access and process information. In the 21st century, education is not only expected to transfer knowledge but also to foster critical thinking, collaboration, creativity, and communication skills. Therefore, digital learning materials must go beyond simply presenting content; they must accommodate the increasingly diverse and dynamic learning needs of students (Wang et al., 2018; Abdinejad et al., 2021; Farokhah et al., 2025).

Characterizing digital learning materials is a crucial first step in designing effective and relevant instructional media. Through this characterization, developers can identify the key elements required in educational resources, such as interactivity, flexibility, media integration, and the ability to provide real-time feedback (Arici et al., 2019; Garcia, 2020; Maulid & Sakti, 2022). Effective digital learning materials should not only offer an engaging learning experience and be easy to understand but also foster active student participation throughout the entire

learning process. Building on this foundation, Ghartey et al. (2024) demonstrate that the use of digital media instruction has been proven to significantly enhance students' performance.

One notable innovation in digital learning material development is the use of Augmented Reality, a technology that integrates virtual objects into the real world in real time via devices such as smartphones and tablets (Buchner et al., 2022; Buchner & Kerres, 2021). AR provides a more immersive and contextual learning experience, allowing students to view, rotate, and interact directly with objects that are typically only seen as two-dimensional images in textbooks. With AR, abstract concepts such as geometry, the solar system, atomic structures, or historical events can be visualized in a more engaging and comprehensible way. AR is different from virtual reality (VR). VR combines virtual reality, which merges the real world with a virtual environment to create the sensation of another real-world setting. Conversely, AR integrates computer-generated digital elements with the real world in real time, adapting to the environment around it (Andriyandi et al., 2020).

In educational settings, augmented reality (AR) holds substantial potential to deepen students' conceptual understanding, foster imaginative engagement, and enhance overall learning interest. This technological medium encourages exploratory and active learning paradigms by enabling students to participate directly through digital interactions. Empirical research indicates that integrating AR into educational practices can lead to significant improvements in information retention and learning outcomes when compared to traditional instructional methods (Challenor & Ma, 2019; Doukianou et al., 2021).

Nevertheless, visualization is insufficient for a comprehensive assessment. Evaluating learning outcomes constitutes a crucial element in guaranteeing the efficacy of instructional methods. In this context, digital platforms such as Quizizz serve a significant role. Quizizz is an interactive learning application that utilizes gamification techniques, including scoring systems, time constraints, and leaderboards, to enhance the assessment experience. These gamified features not only render the evaluation process more engaging and competitive but also contribute to increased student participation and foster intrinsic motivation toward learning (Dichev & Dicheva, 2017; Dichev et al., 2020).

Integrating augmented reality (AR) based digital learning materials with the Quizizz platform enables the development of an innovative pedagogical approach that not only delivers visually stimulating content but also facilitates interactive, real-time assessments. This integration allows educators to promptly observe student performance and responses, thereby enabling them to tailor instructional strategies more effectively to meet individual student needs. For learners, this method enhances engagement and reduces monotony, transforming the educational process into an experience that resembles play, which has been shown to increase motivation and learning outcomes (Garzón et al., 2019; Gargrish et al., 2021; Khalikova, 2025). Such an approach underscores the potential of technology-enhanced instruction to foster more dynamic and responsive learning environments.

On the other hand, the implementation of digital technologies in education in Indonesia, especially in Madrasah Tsanawiyah (MTs) environments, still encompasses several challenges, such as limited technological infrastructure, teacher training, and internet access. Despite these barriers, MTs students have shown high enthusiasm for digital-based learning when the media used is designed to be both contextual and interactive. Therefore, technology-based learning approaches like AR and Quizizz can serve as innovative solutions to bridge the gap between the national curriculum and the specific, religious, and contextual needs of madrasah education. MTs is an Islamic junior high school in Indonesia that provides education equivalent to general Junior High Schools (JHS) for students in grades 7 to 9, typically aged 12 to 15. Operated under the supervision of the Ministry of Religious Affairs, MTs combines the national curriculum with Islamic religious education.

Previous research has supported the effectiveness of using AR and Quizizz separately in education. These studies concluded that the use of AR in mathematics learning can enhance students' understanding of abstract concepts (Angraini et al., 2025; Angraini et al., 2022; Angraini et al., 2024; Angraini et al., 2023; Angraini et al., 2024). Although other research suggests that Quizizz can enhance motivation and engagement in online learning and even improve numeracy literacy (Saefurohman et al., 2021), there are still very few studies that directly investigate the specific features of digital learning materials combining AR and Quizizz in MTs environments.

The triangulated approach provides a more valid and comprehensive picture of student needs concerning AR and Quizizz-based learning materials, as well as their perceptions of these technologies in an educational context. The novelty of this study: 1) it offers a comparative analysis of student needs in diverse educational settings by examining the distinct learning requirements of students from MTs and JHS. This approach highlights the unique educational challenges and opportunities inherent in each type of institution, providing valuable insights into how digital learning tools can be effectively adapted to suit varied contexts; 2) the study features the integration of dual educational technologies Augmented Reality and Quizizz to create an enhanced learning experience. AR is employed to support interactive content visualization, allowing students to engage more deeply with abstract concepts, while Quizizz introduces gamification elements that promote active learning and motivation. This combination offers an innovative model for digital instruction that balances interactivity and assessment in a complementary way; 3) the study makes a significant contribution to the development of technologically adaptive learning materials and policy recommendations. The results not only inform the creation of digital content tailored to the characteristics of students in both educational settings but also provide evidence-based input for the development of technology-driven educational policies. These contributions are particularly relevant for enhancing educational practices in madrasahs and public schools throughout Indonesia.

METHOD

This study employs a descriptive quantitative method with a triangulation approach in data collection, which included questionnaires, observations, and interviews. This approach was chosen to obtain a more valid and comprehensive understanding of the characteristics and needs of MTs and JHS students regarding digital learning materials based on Augmented Reality integrated with the Quizizz platform.

Figure 1 comprehensively illustrates the main stages in the research process, which include research planning, data collection, data processing and analysis, and reporting of results. Each stage is interrelated and forms a systematic workflow that aims to ensure that this research is carried out in a structured, valid, and accountable manner. In the context of this research, the figure provides a visual illustration of how the process begins from the planning stage which includes problem formulation and method determination then continues with data collection activities in the field, processing and analysis of the data that has been obtained, until finally producing a research report that presents findings, discussions, and conclusions from the entire process that has been carried out.

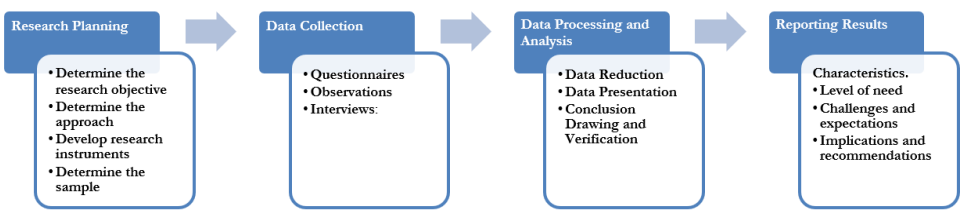

Figure 1. Stages of Research Implementation

The Data collection was carried out using three primary techniques: questionnaires, classroom observations, and interviews, each serving to explore specific aspects related to the characteristics and needs of AR and Quizizz-based digital learning materials. The initial data collection technique utilized were Questionnaires. These were used to measure students' responses regarding their needs for AR and Quizizz-based digital learning materials. Several aspects were assessed, including: Use of technology; Use of digital materials into learning; students' experiences with Augmented Reality; use of Quizizz in their learning process; the integration of AR and Quizizz in digital resources; challenges faced when using AR-based materials; and students' expectations and suggestions for developing AR Quizizz digital learning tools materials. The questionnaire was designed using a Likert scale and administered to students after the learning sessions, aiming to capture their perceptions of various aspects of the materials used.

The subsequent phase involved observation, which was conducted throughout the learning process. These observations primarily concentrated on students' interactions with digital media, their levels of participation, and any technical or pedagogical challenges encountered. This approach aimed to offer an in-depth understanding of how students engaged with augmented reality (AR) and Quizizz-based learning platforms, while also identifying potential opportunities and obstacles associated with the integration of such technologies within the classroom environment.

Finally, interviews were conducted with subject teachers to obtain more comprehensive insights into the contextual background of technology integration in instructional practices, as well as their perspectives on the potential benefits and challenges associated with implementing augmented reality (AR) and Quizizz within the classroom environment. These interviews also aimed to explore teachers' expectations and gather their suggestions for the development of AR and Quizizz-based digital learning materials. Utilizing a pre-determined interview guide, the discussions fostered open dialogue, thereby facilitating a deeper understanding and more nuanced collection of relevant data.

Data analysis was carried out in three main stages. First, Data Reduction involved selecting and streamlining raw field data to focus on information relevant to the research objectives, removing unnecessary data to highlight key findings. Second, Data Presentation consisted of displaying the streamlined data through descriptive narratives, tables, and charts, making it easier to identify and understand emerging patterns. Lastly, Conclusion Drawing and Verification entailed analyzing the presented data to detect patterns, interpreting the results, and confirming findings via cross-source triangulation, which compared observations, questionnaires, and interviews to ensure more reliable and valid conclusions.

This study involved 180 eighth grade students from two types of educational institutions MTs and JHS located in Riau Province, Indonesia. The participants were selected using purposive sampling, a non-random sampling technique based on specific criteria deemed relevant and supportive of the study's objectives. The selection criteria for the student participants were threefold. First, students were required to have access to personal digital devices, such as smartphones or tablets, which were essential for engaging with digital learning materials based on Augmented Reality and the Quizizz platform. Second, students had to come from schools or madrasahs that supported technology-based learning. This included institutional support in the form of school policies, available internet infrastructure, and the encouragement of innovation in teaching and learning by school leadership. Third, teachers involved in the selected classes had already received initial training or orientation on the use of AR and Quizizz-based materials, and were actively involved in facilitating and evaluating their implementation in the classroom. In general, most of the students were between the ages of 13

and 14 years, which aligns with the typical age range for eighth-grade students in Indonesia. They came from middle socioeconomic backgrounds, which typically allowed for access to digital tools for learning purposes.

RESULTS AND DISCUSSION

This study aimed to provide an in-depth description of the characteristics and needs of students from MTs and JHS regarding digital learning materials based on Augmented Reality integrated with the Quizizz platform, as well as to explore the perceptions of end users, both students and teachers, regarding the implementation of technology-based learning media in these educational settings. Based on data collected through questionnaires, observations, and interviews, the findings indicate that the implementation of AR Quizizz based learning media has not yet been evenly adopted across schools, with varying levels of user readiness and infrastructure support.

Table 1 presents the results of the descriptive data analysis, which shows that both students from Islamic schools and those from general junior high schools in Riau Province demonstrated a relatively high level of acceptance of technology use in learning. The average scores derived from technology usage indicators reveal that both groups feel comfortable and accustomed to using technological devices in their learning processes. This is a positive sign that the digitalization of education has reached various types of educational institutions, including Islamic schools that are traditionally more conservative.

Furthermore, acceptance of digital learning materials was also high in both groups, with junior high school students showing slightly higher levels of acceptance compared to their counterparts in Islamic schools. This difference may be attributed to broader access to digital facilities in general schools than in Islamic boarding schools. Nevertheless, the gap remains within a reasonable range, suggesting that digital learning materials have significant potential to be implemented across diverse educational environments, provided adequate infrastructure and support are in place.

Table 1. Descriptive Analysis of the Use of Technology in Learning in Madrasah Tsanawiyah and Junior High Schools

Indicator	Mean (MTs Students)	Mean (JHS Students)	Max	Min	Range SD	Standard Deviation
Use of Technology	4.10	4.25	5	3	0.52	0.72
Use of Digital Teaching Materials	4.00	4.20	5	3	0.58	0.76
AR in Learning	2.40	4.10	5	3	0.65	0.81
Quizizz in Learning	2.50	4.15	3	1	0.70	0.84
Integration of AR with Quizizz	2.30	4.05	3	1	0.68	0.82
Barriers in Using Digital Materials	3.90	4.00	5	2	0.72	0.85
Interest in AR based Quizizz	4.30	4.45	5	3	0.50	0.71

The results of the parametric statistical test (t-test) indicate that there are significant differences between MTs and JHS School students across three main indicators: AR in Learning, Quizizz in Learning, and Integration of AR with Quizizz. These three indicators have p-values far below the significance threshold of 0.05. This suggests that students' perceptions, experiences, or readiness regarding the use of technology-based learning media differ substantially between the two types of educational institutions.

The significant difference in AR use in the Learning indicator suggests that Junior High School students are more accustomed to or more receptive to using Augmented Reality in the learning process than students in MTs. This may be attributed to several factors, such as better access to technological facilities, institutional support, or more frequent use of AR in their daily learning activities. Likewise, the higher scores among Junior High School students in the Quizizz in Learning indicator suggest that gamification through platforms like Quizizz is more commonly used or more effective in their learning environment.

Subsequently, the notable discrepancy observed in the integration of AR and Quizizz indicators underscores a significant gap in students' readiness and familiarity with accessing and effectively utilizing integrated digital learning technologies. This finding offers valuable insights for developers of educational media and academic institutions alike, highlighting the necessity for adopting a more inclusive and adaptive strategy. Such an approach is essential to ensure equitable access to advanced learning tools across diverse educational settings, thereby fostering a more uniformly equipped student body capable of engaging with emerging technological advancements in education. On the other hand, indicators such as Technology Use, Digital Teaching Materials, Barriers to Using Digital Materials, and Interest in AR-based Quizizz showed no significant differences, indicating similar perceptions among MTs and JHS students in these areas.

During the course of this study's observation, notable differences were identified in the indicators associated with the application of Augmented Reality (AR) and online learning platforms such as Quizizz. Specifically, junior high school students demonstrated a greater familiarity with these technological tools and displayed a higher level of enthusiasm towards their integration into the learning process. This is evidenced by their average scores, which exceeded 4, indicating a positive attitude and active engagement with AR and Quizizz as educational resources. In contrast, students from Islamic schools (such as MTs) recorded much lower scores, suggesting they were either unfamiliar with or had never used these technologies. This poses a particular challenge for developing AR- and Quizizz-based learning materials that are inclusive and accessible across all types of educational institutions.

Notably, despite observable variations in experience and the degree of acceptance of specific technologies, students from both Islamic and general education backgrounds demonstrated a pronounced enthusiasm for the prospective integration of augmented reality (AR) and Quizizz-based learning tools. This enthusiasm was evidenced by high scores in measures of hope and constructive suggestions from both groups, reflecting a strong interest in engaging with more interactive and innovative digital learning modalities. Such a positive attitude constitutes a valuable asset in the development of a digital curriculum that effectively addresses the needs and preferences of contemporary learners.

Based on these findings, it is recommended that the implementation of AR and Quizizz-based digital learning materials be carried out gradually and adaptively. There is a need for training for both students and teachers, particularly in Islamic school settings, as well as the provision of necessary devices and supporting infrastructure. Guided trials and the development of content tailored to local contexts are also essential to ensure that this innovation is not just

advanced technology, but a tool that genuinely enhances the quality and motivation of students' learning across various types of schools.

Figure 2 portrays a graphical analysis that reinforces the explanation of the notable differences between junior high school and MTs students in their perceptions of using technology in education, particularly regarding Augmented Reality and the Quizizz platform. Junior high school students consistently recorded higher average scores on indicators related to the use of AR and Quizizz. This suggests that they are more open and have a higher level of familiarity with these technologies. They also appeared more confident in utilizing interactive and gamified digital learning media, indicating their readiness to embrace technological innovations in education.

On the contrary, although MTs students generally agreed with the use of technology and digital learning materials in general, they showed lower levels of interest and experience specifically with AR and Quizizz. This could be due to limited access, exposure, or prior experience with modern learning technologies, particularly those that are visual and interactive, like AR. Despite the differences in experience levels, both junior high and Islamic school students showed a positive interest in using AR and Quizizz-based learning systems in the future. This indicates that both groups see potential in this learning approach to make the educational process more engaging and effective, provided it is supported with appropriate training, infrastructure, and content adaptation that aligns with the context of each educational institution.

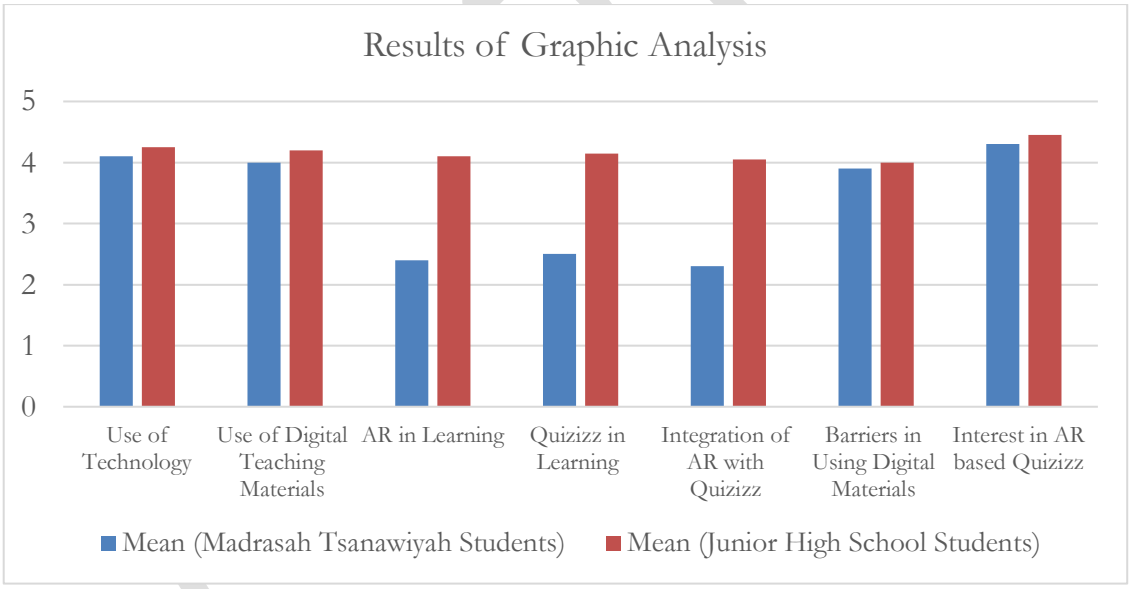

Figure 2. Results of Graphic Analysis on the Use of Technology in Learning at MTs and JHS

Based on interviews conducted with several teachers from MTs and general JHS, a deeper understanding was obtained regarding their perceptions and readiness to use digital teaching materials based on Augmented Reality integrated with the Quizizz platform. In general, teachers stated that the use of technology in learning is considered effective in increasing students' interest and understanding. They expressed that technology has become an essential part of the teaching and learning process, encouraging more intensive use of digital media. Technology is seen as a bridge between theory and practice and as a means of making complex material easier to understand through visualization and interactivity (TT, personal communication, May 02, 2025).

However, when asked specifically about the use of AR and Quizizz, all interviewed teachers admitted that they had never used either tool directly in their teaching activities. While they were aware of, or had heard of, AR and Quizizz, they lacked access to, or sufficient training in, implementing them in the classroom. Teachers recognized the great potential of these technologies, particularly in increasing student motivation and presenting more engaging and interactive materials. Nonetheless, they also mentioned several challenges, such as limited digital devices, uneven internet access, and varying levels of technological literacy among teachers (LL, personal communication, May 02, 2025)

Likewise, in the context of expectations and digital teaching material development, the teachers highlighted three key areas they consider important: first, continuous training for teachers so they can independently design and implement digital learning media; second, improvement of infrastructure, such as internet connectivity and supporting devices (laptops, projectors, and student devices); and third, the development of interactive learning methods that not only focus on content but also emphasize active student engagement in the learning process. They hoped that the digital teaching materials developed would not only be technologically innovative but also relevant to the learning context, curriculum needs, and the characteristics of students in their respective environments (AA, personal communication, May 02, 2025), and also increase conceptual understanding and sustainability awareness through digital learning media in the learning process. (Fiandini, M., et al. 2023)

Overall, these interviews show that although the use of AR and Quizizz has not been widely implemented, teachers are highly enthusiastic about adopting these technologies if supported by adequate training, infrastructure, and appropriate pedagogical approaches. Observation was conducted in Grade VIII classes of both MTs and JHS during lessons using AR-based digital teaching materials integrated with Quizizz. The aim of this observation was to directly monitor student behavior, interaction, participation, and responses to the use of such learning technologies.

a) Student Interaction with Digital Media: In JHS settings, most students appeared enthusiastic and actively engaged when interacting with AR-based learning content. They showed strong curiosity about the 3D visuals and explored the AR objects displayed on smartphones. Conversely, students in MTs seemed less familiar with AR applications; several needed more intensive guidance to access and operate the content.
b) Level of Participation and Engagement: The use of Quizizz features encouraged increased participation among both student groups, though JHS students showed more consistent engagement. In JHS, students actively competed by answering questions using the leaderboard and point scoring features, while in MTs, some students appeared confused during the digital quiz due to a lack of experience with similar platforms. Nevertheless, students in both MTs and JHS expressed interest in competitive and gamified learning formats.
c) Technical and Pedagogical Challenges: In practice, several technical difficulties were encountered, especially in MTs. Common issues included slow internet connections, a lack of AR-compatible devices, and limited teacher preparedness to handle technical problems when media failed to function properly. In JHS, technical barriers were minimal as most students were already accustomed to using digital applications in their learning.
d) Emotional and Social Responses: JHS students generally appeared more confident and open to discussion after the digital learning sessions, while MTs students tended to be quieter and more passive, although some showed high interest after becoming familiar with the media. Both groups demonstrated increased collaboration when directed to engage in group discussions in response to visual content or challenging Quizizz questions.

In terms of the observation results, it is uncovered that JHS students have a higher level of technological readiness and adaptability to AR and Quizizz-based digital learning media compared to MTs students. However, in both MTs and JHS, visual and gamified learning approaches significantly increased student interest and participation. This disparity in readiness underscores the importance of differentiated approaches in developing digital teaching materials, including teacher training, content adaptation based on student backgrounds, and the provision of adequate infrastructure to ensure effective and equitable implementation of these technologies.

This study further demonstrates that the adoption of digital learning resources, including augmented reality (AR) applications, is exhibiting a marked increase within both Madrasah Tsanawiyah (MTs) and Junior High Schools (JHS). Despite this growth, a considerable portion of educators report feeling inadequately prepared to effectively integrate these technological tools into their pedagogical practices. Such a scenario underscores the critical need for ongoing professional development and enhanced infrastructural support. To fully harness the potential of AR technologies and platforms such as Quizizz, it is essential that teachers develop greater proficiency and confidence in using these digital tools. Ultimately, the technological readiness of educators constitutes a fundamental factor influencing the quality and effectiveness of AR-based learning experiences.

AR-based digital learning materials have proven effective in facilitating students' understanding of abstract concepts, such as function graphs or spatial structures (Bacca et al., 2018; Li et al., 2022). This technology allows for the presentation of material in a visual and interactive manner, which helps students build a deeper understanding compared to traditional teaching methods (Georgiou & Kyza, 2021; Hegg et al., 2018; Bedewy et al., 2021). The three-dimensional visualization provided by AR allows students to interact directly with the concepts being taught, creating a more practical and enjoyable learning experience (Chen et al., 2016; Meryansumayeka et al., 2022; Aslan et al., 2024; Al-Alwani & Alzahrani, 2020).

An essential component of augmented reality (AR)-based learning is the integration of gamification strategies through platforms such as Quizizz. Incorporating gamification elements, including leaderboards, point systems, and reward mechanisms, serves to enhance student motivation and promote deeper engagement within the learning environment. Empirical research indicates that gamification not only fosters a more stimulating and enjoyable educational atmosphere but also actively encourages students to participate more actively in their learning processes (Belda-Medina & Calvo-Ferrer, 2022; Pujiastuti & Haryadi, 2024; Hanid et al., 2022). Additionally, features such as real-time feedback from Quizizz help students quickly correct their mistakes, deepening understanding and enhancing information retention (Nindiasari et al., 2024; Nadzri et al., 2023; Chiu et al., 2015). Moreover, Quizizz can also increase students' motivation and interest in learning through its immediate feedback and interactive format (Fadillah, I.N., and Maryanti, R., 2021).

Furthermore, the implementation of this technology positively influences classroom dynamics by enhancing student interaction. By integrating augmented reality (AR) and gamification strategies, the learning environment shifts toward greater collaboration, transforming traditionally passive students into actively engaged participants in discussions and exploration of the subject matter (Musa, 2022; Rahman et al., 2020; Arifin et al., 2020; Bedewy et al., 2022). Additionally, AR facilitates the development of students' skills by rendering abstract concepts more tangible, thereby serving as an effective learning resource that enables students to cultivate the ability to create submicroscopic representations (Irwansyah et al., 2017). This demonstrates that technology not only enhances students' understanding of the subject matter but also supports the development of their social and collaborative skills (Ibáñez & Kloos, 2018; Gecu-Parmaksiz & Delialioglu, 2019; Halim & Mohd Salleh, 2021).

Despite the many benefits, challenges remain, particularly related to technical limitations, such as access to adequate devices and stable internet connections. Some teachers also feel the need for time and training to fully understand how to effectively use digital learning materials. Therefore, support from schools and policymakers in the form of improved facilities and the development of teachers' capacities is crucial to ensuring the smooth and sustainable implementation of this technology (Ismail et al., 2023; Alsolami et al., 2022; Aisyah et al., 2023; Masran & Abidin, 2018).

Teachers also emphasize the importance of their involvement in the development of digital learning content. Facilitating conditions and social influence are key factors influencing teachers' willingness to adopt mobile technologies in the classroom (Buraimoh, Boor, & Aladesusi, 2023). By being directly involved in creating the learning materials, teachers can ensure that the content produced is relevant and suitable for the students' needs and context. Collaboration between technology developers, researchers, and educational practitioners is essential to create learning materials that are not only innovative but also relevant and applicable in the educational context of MTs and JHS.

Overall, this research illustrates that there is a significant need for more interactive and AR-based learning materials, integrated with platforms like Quizizz, for both MTs and JHS students. Although there are differences in readiness and experience levels between the two student groups, both show great potential to embrace technology-based learning. Table 2 is a draft of the blueprint made according to these findings, which open up opportunities to create a more adaptive and interactive digital learning ecosystem that can address the challenges of education in the digital transformation era.

Table 2. Draft Of Blue Print Media AR-Integrated, Quizizz Gamified Digital Learning for MTs and JHS Students

No	Screen	Description
1	Welcome Screen	Displays the application title and main menu buttons: Start, Instructions, and Exit.
2	AR Scanner Screen	The camera is activated. Students are instructed to scan a specific marker or textbook image. MTs paper based and JHS digital based media.
3	AR Content Display	A 3D model appears on screen (e.g., a cell, atom, or planet). An explanation is provided via text (MTs only) or voice narration.
4	Proceed to Quiz Button	After exploring the AR object, a button labelled "Proceed to Quiz" appears.
5	Quizizz Interface	The screen shows an embedded or linked Quizizz quiz. Students answer interactive questions (e.g., multiple-choice, matching).
6	Score and Feedback	After completing the quiz, the score is shown along with a motivational message. Students can retry or exit.

The integration of AR and gamification into digital learning can provide students with a more profound, effective, and enjoyable learning experience, preparing them for future challenges. Thus, a draft of the interface media according to the impacts of this research, how to integrate AR with Quizizz, and all menus are shown in Figure 3.

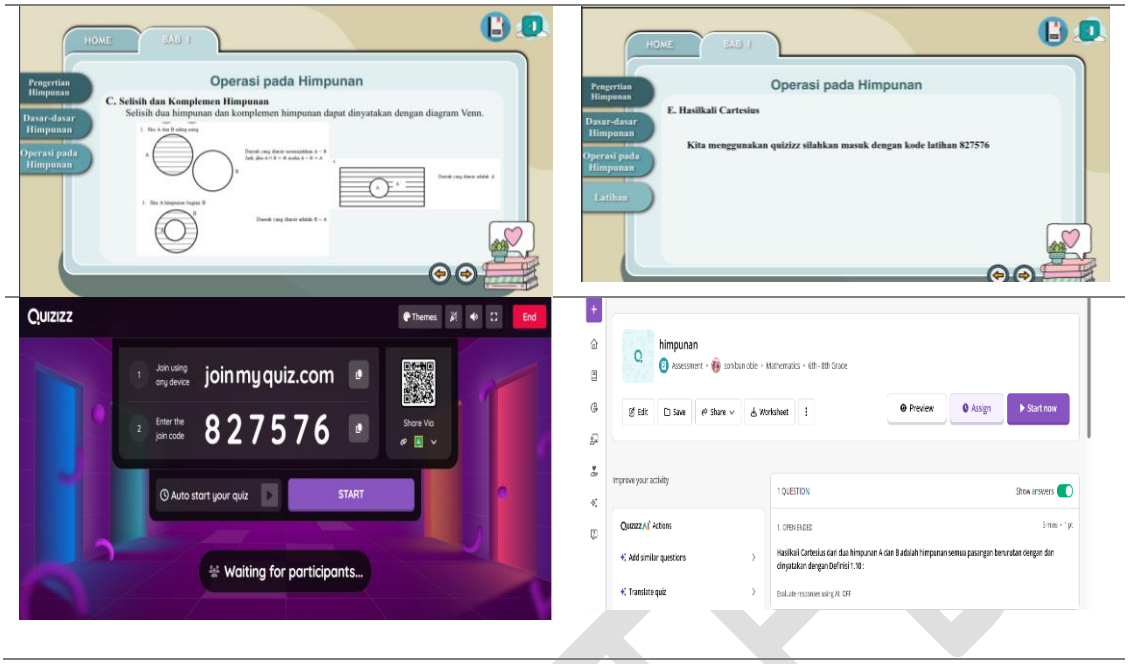

Figure 3. Learning Media Draft

The image shows a media draft based on input from research findings, beginning with the use of digital media through AR and integrated with Quizizz. The integration is evident during the delivery of material using AR, followed by a Quizizz-based exercise, where students immediately receive learning feedback. For the next research, the need to develop the media into a professional product comes from these findings.

CONCLUSION

This study successfully identified and mapped the characteristics and needs of MTs and JHS students regarding the use of Augmented Reality (AR)-based digital learning materials integrated with the Quizizz platform. The findings indicate that this integration enhances student engagement, supports the understanding of abstract concepts, and creates a more interactive and enjoyable learning experience. Despite high enthusiasm from both students and teachers, challenges such as limited infrastructure, internet access, and insufficient teacher training remain significant barriers. Therefore, the study recommends improving infrastructure, providing targeted teacher training, and developing more contextual learning materials. Overall, this research contributes to the development of AR-based learning models aligned with students' needs and highlights the potential of technology integration to improve the quality of education, particularly in Islamic schools.

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BIBLIOGRAPHY

Abdinejad, M., Talaie, B., Qorbani, H. S., & Dalili, S. (2021). Student perceptions using augmented reality and 3D visualization technologies in chemistry education. *Journal of Science Education and Technology, 30*(1), 87-96. https://doi.org/10.1007/s10956-020-

09880-2

Andriyandi, A. P., Darmalaksana, W., Maylawati, D. S. A., Irwansyah, F. S., Mantoro, T., & Ramdhani, M. A. (2020). Augmented reality using features accelerated segment test for learning tajweed. *TELKOMNIKA (Telecommunication Computing Electronics and Control), 18*(1), 208-216. http://doi.org/10.12928/telkomnika.v18i1.14750

Angraini, L. M., Kusuma, D. A., Wahyuni, R., Noto, M. S., Wahyuni, A., Susilawati, A., et al. (2025). Augmented reality (AR) for geometry based on prior mathematical knowledge. *Journal of Engineering Science and Technology, Special Issue ISCoE2024, 20*(2), 182-189. Retrieved from https://jestec.taylors.edu.my/Special%20Issue%20ISCoE%202024_3.htm

Angraini, L. M., Alzaber, A., Sari, D. P., Yolanda, F., & Muhammad, I. (2022). Improving mathematical critical thinking ability through augmented reality based learning. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 11*(4), 3533-3544. https://doi.org/10.24127/ajpm.v11i4.5968

Angraini, L. M., Susilawati, A., Noto, M. S., Wahyuni, R., & Andrian, D. (2024). Augmented reality for cultivating computational thinking skills in mathematics completed with literature review, bibliometrics, and experiments for students. *Indonesian Journal of Science and Technology, 9*(1), 225-260. https://doi.org/10.17509/ijost.v9i1.67258

Angraini, L. M., Yolanda, F., & Muhammad, I. (2023). Augmented reality: The improvement of computational thinking based on students' initial mathematical ability. *International Journal of Instruction, 16*(3), 1033-1054. https://doi.org/10.29333/iji.2023.16355a

Angraini, L. M., Noto, M. S., & Muhammad, I. (2024). Augmented reality based learning media on mathematical computational thinking ability. *International Journal of Science, Mathematics and Technology Learning, 31*(2), 89-118. https://doi.org/10.18848/2327-7971/CGP/v31i02/89-118

Arici, F., Yildirim, P., Caliklar, Ş., & Yilmaz, R. M. (2019). Research trends in the use of augmented reality in science education: Content and bibliometric mapping analysis. *Computers and Education, 142*, 103647. https://doi.org/10.1016/j.compedu.2019.103647

Aslan, D., Dağaynası, S., & Ceylan, M. (2024). Technology and geometry: Fostering young children's geometrical concepts through a research based robotic coding program. *Education and Information Technologies, 29*(17), 22699-22721. https://doi.org/10.1007/s10639-024-12747-3

Al-Alwani, A. J., & Alzahrani, S. M. (2020). Integrating blended learning in teaching STEM subjects in Islamic schools: Challenges and opportunities. *International Journal of Islamic Education, 8*(2), 215–233. https://doi.org/10.18326/ijie.v8i2.215-233

Alsolami, B., Khoja, S., & Albusalah, H. (2022). Ethical implications of artificial intelligence in Islamic education: A conceptual framework. *International Journal of Islamic Educational Technology, 2*(1), 1–15. https://doi.org/10.18196/ijiet.v2i1.11432

Aisyah, N., Susanti, E., Meryansumayeka, M., Siswono, T. Y. E., & Maat, S. M. (2023). Proving geometry theorems: Student prospective teachers' perseverance and mathematical reasoning. *Infinity Journal, 12*(2), 377–392. https://doi.org/10.22460/infinity.v12i2.p377-392

Arifin, A. M., Pujiastuti, H., and Sudiana, R. (2020). Pengembangan media pembelajaran STEM dengan augmented reality untuk meningkatkan kemampuan spasial matematis siswa [Development of STEM learning media with augmented reality to improve students' mathematical spatial abilities]. *Jurnal Riset Pendidikan Matematika, 7*(1), 59–73. https://doi.org/10.21831/jrpm.v7i1.32135

Bedewy, S. E., Choi, K., Lavicza, Z., Fenyvesi, K., & Houghton, T. (2021). STEAM practices to explore ancient architectures using augmented reality and 3D printing with

GeoGebra. *Open Education Studies, 3*(1), 176–187. https://doi.org/10.1515/edu-2020-0150

Bedewy, S. E., Lavicza, Z., Haas, B., & Lieban, D. (2022). A STEAM practice approach to integrate architecture, culture and history to facilitate mathematical problem-solving. *Education Sciences, 12*(1), 9. https://doi.org/10.3390/educsci12010009

Bacca, J., Baldiris, S., & Fabregat, R. (2018). Insights into the factors influencing student motivation in augmented reality learning experiences in vocational education and training. *Frontiers in Psychology, 9*, 1486. https://doi.org/10.3389/fpsyg.2018.01486

Belda-Medina, J., & Calvo-Ferrer, J. R. (2022). Integrating augmented reality in language learning: Pre-service teachers' digital competence and attitudes through the TPACK framework. *Education and Information Technologies, 27*(9), 12123–12146. https://doi.org/10.1007/s10639-022-11123-3

Buchner, J., Buntins, K., & Kerres, M. (2022). The impact of augmented reality on cognitive load and performance: A systematic review. *Journal of Computer Assisted Learning, 38*(1), 285-303. https://doi.org/10.1111/jcal.12617

Buchner, J., & Kerres, M. (2021). Students as designers of augmented reality: Impact on learning and motivation in computer science. *Multimodal Technologies and Interaction, 5*(8), 41. https://doi.org/10.3390/mti5080041

Buraimoh, O.F., Boor, C.H.M., & Aladesusi, G.A. (2023). Examining facilitating condition and social influence as determinants of secondary school teachers' behavioural intention to use mobile technologies for instruction. *Indonesian Journal of Educational Research and Technology*, 3(1), 25-34. https://doi.org/10.17509/ijert.v3i1.44720

Challenor, J., & Ma, M. (2019). A review of augmented reality applications for history education and heritage visualisation. *Multimodal Technologies and Interaction, 3*(2), 39. https://doi.org/10.3390/mti3020039

Chiu, J. L., Dejaegher, C. J., & Chao, J. (2015). The effects of augmented virtual science laboratories on middle school students' understanding of gas properties. *Computers and Education, 85*, 59-73. https://doi.org/10.1016/j.compedu.2015.02.007

Chen, C., Chou, Y.-Y., & Huang, C.-Y. (2016). An augmented-reality-based concept map to support mobile learning for science. *Asia-Pacific Education Researcher, 25*, 567–578. https://doi.org/10.1007/s40299-016-0284-3

Dichev, C., & Dicheva, D. (2017). Gamifying education: What is known, what is believed and what remains uncertain A critical review. *International Journal of Educational Technology in Higher Education, 14*(9), 1-36. https://doi.org/10.1186/s41239-017-0042-5

Dichev, C., Dicheva, D., & Irwin, K. (2020). Gamifying learning for learners. *International Journal of Educational Technology in Higher Education, 17*(1), 1-14. https://doi.org/10.1186/s41239-020-00231-0

Doukianou, S., Daylamani-Zad, D., & O'Loingsigh, K. (2021). Implementing an augmented reality and animated infographics application for presentations: Effect on audience engagement and efficacy of communication. *Multimedia Tools and Applications, 80*(20), 30969-30991. https://doi.org/10.1007/s11042-021-10963-4

Fadillah, I.N., & Maryanti, R. (2021). Application of learning videos and quizizz in increasing students' interest in learning English in middle schools. *Indonesian Journal of Multidiciplinary Research*, 1(2), 329-336. https://doi.org/10.17509/ijomr.v1i2.37853

Farokhah, L., Herman, T., Wahyudin, W., Khasanah, L.A.I.U., Zulfadhli, M., Abidin, Z., Huda, M.M., & Ariffiando, N.F. (2025). How to teach fraction for empowering student mathematics literacy: Definition, bibliometric, and application using digital module. *ASEAN Journal of Science and Engineering,* 5(1), 77-102. https://doi.org/10.17509/ajse.v5i1.80940

Irwansyah, F. S., Ramdani, I., & Farida, I. (2017). The development of an Augmented Reality (AR) technology-based learning media in metal structure concept Ideas for 21st century education. *AES 2016 Taylor & Francis Group, London.* https://doi.org/10.1201/9781315166575-56

Fiandini, M., Nandiyanto, A.B.D., & Kurniawan, T. (2023). Bibliometric analysis of research trends in conceptual understanding and sustainability awareness through artificial intelligence (AI) and digital learning media. *Indonesian Journal of Multidiciplinary Research, 3(2), 477-486*. https://doi.org/10.17509/ijomr.v3i2.77343

Gargrish, S., Kaur, D. P., Mantri, A., Singh, G., & Sharma, B. (2021). Measuring effectiveness of augmented reality based geometry learning assistant on memory retention abilities of the students in 3D geometry. *Computer Applications in Engineering Education, 29*(6), 1811-1824. https://doi.org/10.1002/cae.22424

Garzón, J., Pavón, J., & Baldiris, S. (2019). Systematic review and meta-analysis of augmented reality in educational settings. *Virtual Reality, 23*(4), 447-459. https://doi.org/10.1007/s10055-019-00379-9

Garcia, M. B. (2020). Augmented reality in history education: An immersive storytelling of American colonisation period in the Philippines. *International Journal of Learning Technology, 15*(3), 234. https://doi.org/10.1504/IJLT.2020.112170

Georgiou, Y., & Kyza, E. A. (2021). Bridging narrative and locality in mobile based augmented reality educational activities: Effects of semantic coupling on students' immersion and learning gains. *International Journal of Human Computer Studies, 145*, 102546. https://doi.org/10.1016/j.ijhcs.2020.102546

Gecu-Parmaksiz, Z., & Delialioglu, O. (2019). Augmented reality based virtual manipulatives versus physical manipulatives for teaching geometric shapes to preschool children. *British Journal of Educational Technology, 50*(6), 3376-3390. https://doi.org/10.1111/bjet.12740

Ghartey, W., Kumi, N.A., Bunbun, D.U., Fenuku, S.D., & Ghartey, K.B. (2024). The effects of digital media instruction on senior high school students' performance in organic chemistry nomenclature. *Indonesian Journal of Teaching in Science, 4(1), 97-108*. Retrieved from https://www.researchgate.net/profile/William-Ghartey-2/publication/379838202_The_Effects_of_Digital_Media_Instruction_on_Senior_High_School_Students%27_Performance_in_Organic_Chemistry_Nomenclature/links/661e21ac66ba7e2359dd34dd/The-Effects-of-Digital-Media-Instruction-on-Senior-High-School-Students-Performance-in-Organic-Chemistry-Nomenclature.pdf

Hanid, M. F. A., Said, M. N. H. M., Yahaya, N., & Abdullah, Z. (2022). Effects of augmented reality application integration with computational thinking in geometry topics. *Education and Information Technologies, 27*(7), 9485-9521. https://doi.org/10.1007/s10639-022-10994-w

Hegg, M., Papadopoulos, D., Katz, B., & Fukawa-Connelly, T. (2018). Preservice teacher proficiency with transformations based congruence proofs after a college proof-based geometry class. *The Journal of Mathematical Behavior, 51*, 56-70. https://doi.org/10.1016/j.jmathb.2018.07.002

Halim, L., & Mohd Salleh, S. (2021). Integrating Islamic values in STEM education: A conceptual framework. *International Journal of Islamic Educational Psychology, 2*(1), 19-37. https://doi.org/10.18196/ijiep.v2i1.10102

Ismail, R., Zakariya, H., & Ahmad, A. R. (2023). Development of STEM based Islamic educational materials: A design and development research. *International Journal of Interactive Mobile Technologies, 17*(3), 70-85. https://doi.org/10.3991/ijim.v17i03.31439

Ibáñez, M. B., & Kloos, C. D. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*, 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

Khalikova, K.A. (2025). Integrating artificial intelligence into education: Opportunities, challenges, and future prospects. *Indonesian Journal of Educational Research and Technology, 5(2), 137-144*. https://doi.org/10.17509/ijert.v5i1.82703

Li, S., Shen, Y., Jiao, X., & Cai, S. (2022). Using augmented reality to enhance students' representational fluency: The case of linear functions. *Mathematics, 10*(10), 1718. https://doi.org/10.3390/math10101718

Masran, M. N., & Abidin, R. (2018). Tangram game software in helping understanding of geometric concepts among preschool children. *Advanced Science Letters, 24*(7), 5338-5341. https://doi.org/10.1166/asl.2018.11730

Maulid, M.N., & Sakti, A.W. (2022). The effectiveness of learning videos as a source of digital literacy on poster learning in elementary schools. *Indonesian Journal of Multidiciplinary Research*, 2(1), 51-56. https://doi.org/10.17509/ijomr.v2i1.38623

Meryansumayeka, M., Zulkardi, Z., Putri, R. I. I., & Hiltrimartin, C. (2022). Designing geometrical learning activities assisted with ICT media for supporting students' higher order thinking skills. *Journal on Mathematics Education, 13*(1), 135–148. https://doi.org/10.22342/jme.v13i1.pp135-148

Musa, M. (2022). Tawhidic epistemology and its implications for STEM education in Islam. *International Journal of Islamic Educational Psychology, 3*(1), 1-18. https://doi.org/10.18196/ijiep.v3i1.11433

Nindiasari, H., Pranata, M. F., Sukirwan, S., Sugiman, S., Fathurrohman, M., Ruhimat, A., et al. (2024). The use of augmented reality to improve students' geometry concept problem-solving skills through the STEAM approach. *Infinity, 13*(1), 119-138. https://doi.org/10.22460/infinity.v13i1.p119-138

Nadzri, A. Y. N. M., Ayub, A. F. M., & Zulkifli, N. N. (2023). The effect of using augmented reality module in learning geometry on mathematics performance among primary students. *International Journal of Information and Education Technology, 13*(9), 1478-1486. https://doi.org/10.18178/ijiet.2023.13.9.1952

Pujiastuti, H., & Haryadi, R. (2024). The effectiveness of using augmented reality on the geometry thinking ability of junior high school students. *Procedia Computer Science, 234*, 1738-1745. https://doi.org/10.1016/j.procs.2024.03.180

Rahman, N. A., Halim, L., & Ahmad, A. R. (2020). Integrating STEM education with Islamic values: A conceptual model for 21st-century Muslim learners. *Journal of Islamic Education, 5*(1), 62-80. https://doi.org/10.15408/tjems.v5i1.13552

Saefurohman, S., Maryanti, R., Azizah, N.N., Al Husaeni, D.F., Wulandary, V., & Irawan, A.R. (2021). Efforts to increasing numeracy literacy of elementary school students through quiziz learning media. *ASEAN Journal of Science and Engineering Education*, 3(1), 11-18. https://doi.org/10.17509/ajsee.v3i1.38570

Wang, M., Callaghan, V., Bernhardt, J., White, K., & Peña-Rios, A. (2018). Augmented reality in education and training: Pedagogical approaches and illustrative case studies. *Journal of Ambient Intelligence and Humanized Computing, 9*(5), 1391–1402. https://doi.org/10.1007/s12652-017-0547-8