EDUMATSAINS
JURNAL PENDIDIKAN MATEMATIKA DAN SAINS
E-ISSN:2527-7235
Volume 9 Issue. 2 January, 2025, pp 219-231
http://ejournal.uki.ac.id/index.php/edumatsains

Developing an Interactive E-Module Based on Flipbook for Solid Geometry

Santri Chintia Purba [1,*], Jitu Halomoan [2], Diva Dwi Nathania[3]
[1,2,3] Pendidikan Matematika Universitas Kristen Indonesia, Jakarta
e-mail: *Divanath02@gmail.com

Article Info
Article history:
Received : January 10, 2025
Revised : January 28, 2025
Accepted : January 29, 2025
Available online : January 31, 2025

https://doi.org/10.33541/edumatsains.v9i2.6524

Abstract
This study aims to develop a valid and feasible interactive E-Module based on flipbook technology for solid geometry. Using a Research and Development (R&D) approach, the study follows Sugiyono's Level 1 development model. Data collection methods include interviews, observations, and questionnaires conducted at SMPN 50 East Jakarta. The developed E-Module was validated by experts in three categories: material, media, and language. The validation results indicate that the module achieved an 80% feasibility rating in material validation, 91.8% in media validation, and 88% in language validation, categorizing it as highly feasible. These findings confirm that the interactive E-Module effectively supports mathematics learning for seventh-grade students by enhancing engagement and conceptual understanding of solid geometry.

Keywords: E-Module Development, Interactive E-Module, Solid Geometry

1. Introduction

The rapid advancements in technology over the past decade have significantly transformed educational practices worldwide, particularly with the advent of the Industrial Revolution 4.0. The integration of digital tools into teaching and learning processes has become more critical than ever, driven by the need to make education more accessible, engaging, and effective (Kumar & Vig, 2022). In this context, interactive digital learning platforms, such as E-Modules, have gained substantial attention for their potential to enhance student engagement and learning outcomes in subjects like mathematics.

Mathematics education, particularly in solid geometry, presents unique challenges for both educators and students. Traditional teaching methods often struggle to make abstract concepts tangible and relatable, resulting in reduced engagement and lower academic performance (Zhu & Han, 2020). Research indicates that students frequently face difficulties in understanding three-dimensional geometric shapes when presented solely through static, two-dimensional images, which limits their ability to develop spatial reasoning skills (Bakar et al., 2021). Therefore, there is a growing need for innovative instructional strategies that transform abstract ideas into more concrete and visual learning experiences.

One of the most effective modern educational approaches is the integration of interactive learning tools, which have been shown to enhance students' cognitive engagement and deepen conceptual understanding (García-Santillán et al., 2021). Interactive E-Modules, when incorporated into mathematics instruction, provide dynamic opportunities for students to manipulate and visualize geometric concepts, thereby strengthening their problem-solving and critical thinking abilities (Lin et al., 2019). The developed E-Module caters to diverse learning styles through various multimedia features. Visual learners benefit from animated 3D models that demonstrate geometric transformations, auditory learners engage with narrated explanations and interactive discussions, while kinesthetic learners can interact with virtual manipulatives and quizzes that encourage hands-on problem-solving. These design elements align with Mayer's Multimedia Learning Theory, which emphasizes the role of multiple representations in improving comprehension (Mayer, 2021). Previous studies on E-Modules in geometry education also highlight the importance of combining visual and interactive elements to enhance student engagement and retention (Malik & Rizvi, 2021). Expanding upon these findings, this study aims to further refine digital learning interventions to support a broader range of learner needs in solid geometry.

Recent studies emphasize that technology-enhanced learning environments can significantly increase student motivation and interest in subjects that are traditionally considered difficult, such as mathematics (Agyei & Voogt, 2019). For instance, a study by Malik and Rizvi (2021) demonstrated that students who engaged with interactive digital tools in their learning processes showed a higher level of understanding and retention compared to those who followed conventional teaching methods. Moreover, the inclusion of gamified elements in E-Modules has been linked to a positive impact on student motivation, making learning more enjoyable and less intimidating (Cheng & Su, 2020).

The shift toward digital learning has been further accelerated by the global COVID-19 pandemic, which necessitated remote learning solutions. During this period, the reliance on digital educational tools increased exponentially, highlighting the importance of developing robust and accessible resources like interactive E-Modules for distance learning (Karakas & Manisaligil, 2021). E-Modules that utilize flipbook technology have gained popularity due to their ability to present educational content in a user-friendly, visually appealing manner that mimics the experience of reading a physical book, but with added multimedia features (El-Sabagh, 2021).

Implementing these technological advancements in educational practices aligns with global trends in pedagogy that emphasize student-centered learning and the development of 21st-century skills (Tondeur et al., 2020). Interactive E-Modules not only provide learners with immediate feedback and a customized learning pathway but also empower them to take control of their educational journey by offering resources that are accessible anytime and anywhere (Rasheed et al., 2020). This approach is particularly effective in enhancing students' engagement with complex subjects like solid geometry, which benefits greatly from interactive visual aids and simulations (Smith et al., 2021).

In Indonesia, where traditional teaching methods are still prevalent in many schools, the integration of digital tools in mathematics education is seen as a critical step towards improving learning

outcomes. Schools like SMPN 50 Jakarta Timur face significant challenges due to limited resources and minimal use of technology in the classroom (Rahman & Utomo, 2020). Addressing these issues by incorporating interactive E-Modules into the curriculum can help bridge the gap in educational inequality and ensure that all students have the opportunity to engage with quality learning materials.

This study aims to develop a valid and feasible interactive E-Module based on flipbook technology for teaching solid geometry to seventh-grade students. While previous studies have demonstrated the effectiveness of interactive E-Modules in mathematics education, many existing modules primarily focus on arithmetic and algebra, with limited emphasis on complex spatial concepts like solid geometry (Malik & Rizvi, 2021). Additionally, prior research has often overlooked the integration of diverse multimedia elements tailored to different learning styles, which are essential for improving student engagement and conceptual understanding (Lin et al., 2019). Some studies have explored the use of animations and virtual manipulatives in mathematics instruction (García-Santillán et al., 2021), but few have examined how flipbook-based E-Modules can bridge the gap between static and dynamic representations of geometric concepts. By addressing these gaps, this research seeks to develop an interactive digital learning tool that enhances students' understanding, retention, and motivation in learning solid geometry. Furthermore, it aims to provide empirical evidence on the feasibility and effectiveness of flipbook-based E-Modules in modernizing mathematics instruction in Indonesian schools and beyond.

2. Methods

This study employed a Research and Development (R&D) approach following Sugiyono's Level 1 development model, which focuses on producing a valid and feasible educational product through structured phases: needs analysis, design, development, and validation. This approach ensures that the resulting product undergoes systematic refinement to meet pedagogical and technological standards.

The research was conducted at SMPN 50 East Jakarta, where access to advanced learning resources and digital tools in mathematics instruction is limited. Participants included seventh-grade students and three mathematics teachers who were directly involved in teaching and learning solid geometry. The selection of this school and grade level was based on the identified challenges students face in grasping three-dimensional geometric concepts. However, the study is limited to a single school, which may affect the generalizability of the findings. Future research could explore multiple schools with diverse student backgrounds to provide a more comprehensive evaluation of the module's effectiveness.

To collect data, a combination of qualitative and quantitative methods was used. Interviews were conducted with mathematics teachers to gather insights into instructional challenges, student difficulties, and the potential of interactive E-Modules in solid geometry learning. Classroom observations allowed for a direct understanding of how students engage with traditional instructional methods and the areas where digital tools could provide improvement. Additionally,

questionnaires were administered to both students and teachers to assess their familiarity with digital learning tools, their perceptions of the E-Module, and the challenges they face in understanding solid geometry. This mixed-method approach provided a deeper understanding of the instructional needs and ensured that the E-Module was both pedagogically sound and contextually relevant.

The research process was carried out in several stages, beginning with a needs analysis to identify the primary difficulties students encountered when learning solid geometry. Based on these findings, the E-Module was designed and developed using Flip PDF Professional software, selected for its ability to integrate multimedia elements such as 3D models, animations, audio, and interactive quizzes. The module's design followed Mayer's Multimedia Learning Theory to ensure that content was presented in a way that maximized student engagement and comprehension. The validation process involved assessments from experts in three areas: material validity, media usability, and language clarity. Experts evaluated the module's alignment with curriculum objectives, its interactive design, and the clarity of instructional language to ensure accessibility for students. A Likert scale was used to quantify expert feedback, which helped refine the module before implementation.

During implementation, students interacted with the E-Module, and their engagement was observed to assess usability and effectiveness in facilitating learning. Feedback was gathered through questionnaires and informal discussions to determine whether the module enhanced their understanding of solid geometry concepts. The study revealed several challenges, including technical barriers, as some students struggled with limited access to devices and initial unfamiliarity with the software. Additionally, some teachers required further training to effectively integrate the E-Module into their instruction. The limited timeframe of the study also posed constraints on evaluating the long-term impact of the module on student learning outcomes.

These challenges highlight the need for greater infrastructure support and teacher professional development programs to ensure successful implementation of digital learning tools. Future studies should consider a longer evaluation period to measure the sustained effects of interactive E-Modules on student engagement and conceptual understanding. Despite these limitations, the study provides valuable insights into the feasibility of using flipbook-based E-Modules in mathematics instruction and contributes to the ongoing efforts to modernize teaching practices in Indonesia.

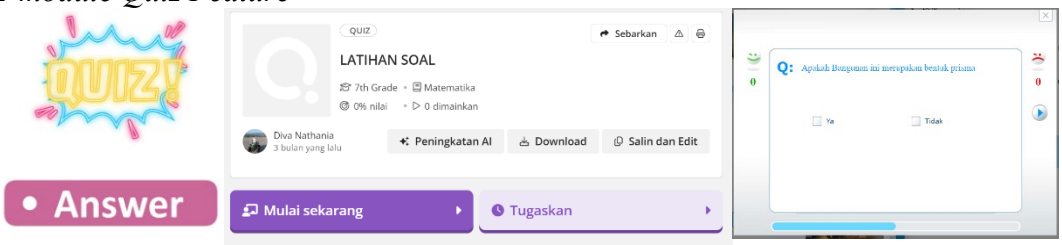
3. Result and Discussion

The preliminary studies identified significant gaps in students' understanding and engagement with mathematics at SMPN 50 Jakarta Timur. Observations and interviews with mathematics teachers revealed that students often struggled to grasp the abstract concepts required in solid geometry, a subject that relies heavily on spatial visualization skills. Without access to interactive tools, students found it challenging to visualize and manipulate three-dimensional shapes, resulting in low comprehension and engagement levels. Traditional teaching methods, which primarily involve lectures and printed diagrams, appeared insufficient for facilitating the level of conceptual

understanding required in this subject (Rahman & Utomo, 2020; Setiawan & Nurdin, 2020). Teachers noted that while students could follow basic formulas, they lacked a deeper understanding of how these formulas apply to various real-world problems.
In addressing this gap, the study aimed to clarify the learning objectives for solid geometry in the seventh-grade curriculum. Solid geometry requires students to achieve foundational knowledge in both two-dimensional and three-dimensional spatial relationships, an essential skill in mathematics and other STEM disciplines (Lin et al., 2019). These objectives emphasize skills like identifying geometric properties, calculating area and volume, and applying formulas in problem-solving scenarios. However, limited exposure to interactive resources had hindered students' development in these areas, leading to the conclusion that a more dynamic learning tool, such as an interactive E-Module, could significantly enhance students' comprehension by offering interactive, visually engaging experiences that align with these goals (Cheng & Su, 2020).

The E-module, developed using Flip PDF Professional, incorporated multimedia elements tailored to support the identified learning objectives for solid geometry. This tool leveraged various features, such as 3D model animations, interactive quizzes, and video tutorials, to enable students to actively engage with the material. Following Mayer's Multimedia Learning Theory (2021), the module aimed to enhance understanding through multiple representations of content, allowing students to interact with shapes in ways that static diagrams could not offer. By including animations that show rotations and transformations, the E-Module allowed students to gain a more intuitive grasp of three-dimensional concepts, which has been shown to improve spatial reasoning skills in mathematics (El-Sabagh, 2021). The features can be seen by the figure below.

Figure 1
E-module Quiz Feature



The interactive E-Module integrates various multimedia features designed to enhance student engagement and understanding of solid geometry. Figure 1 illustrates the E-Module's quiz feature, which allows students to test their comprehension of geometric concepts through interactive multiple-choice questions. This feature provides immediate feedback, helping students identify areas where they need improvement.

Figure 2
E-module Audio Feature

Figure 2 presents the audio feature, which includes narrated explanations of key concepts to support auditory learners and reinforce textual content. This feature is particularly beneficial for students who prefer verbal instruction alongside visual elements.

Figure 3
E-module Animation Feature

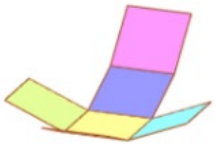


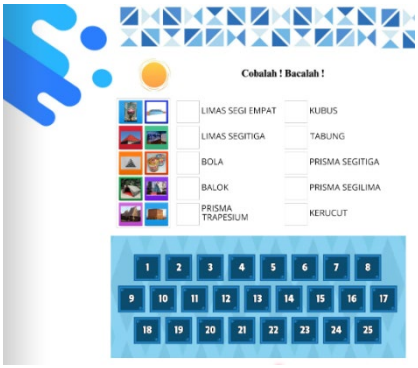
Figure 3 is an example of the animation feature, demonstrating dynamic 3D representations of geometric shapes. Through these animations, students can observe transformations such as rotations, reflections, and cross-sections, which are difficult to grasp using static images alone.

Figure 4
E-module Video Feature

Figure 4 highlights the video feature, where instructional videos provide step-by-step demonstrations of problem-solving techniques in solid geometry. These videos serve as an additional learning aid, allowing students to revisit explanations at their own pace. Collectively, these interactive elements contribute to a more engaging and effective learning experience, aligning with modern pedagogical approaches that emphasize multimedia-based instruction.
Furthermore, the E-Module incorporated gamified elements, including quizzes and progress tracking, to enhance motivation and engagement. Quizzes allowed students to test their understanding in real-time, while progress tracking provided visual indicators of advancement,

encouraging students to continue engaging with the material. Research supports the effectiveness of gamified elements in digital learning tools, highlighting their role in increasing student engagement, reducing anxiety around challenging subjects like mathematics, and fostering a sense of accomplishment (García-Santillán et al., 2021). Additionally, the module's design considered user-friendliness, ensuring that students could navigate seamlessly between sections and revisit topics as needed, which is essential in supporting self-directed learning (Karakas & Manisaligil, 2021). The gamified elements of the E-module can be seen on figure 5.

Figure 5
E-module Game



The development of the interactive E-Module based on flipbook technology demonstrated a significant improvement in students' engagement and understanding of solid geometry concepts. The module's multimedia features, including 3D animations and interactive quizzes, provided a more immersive learning experience that helped students visualize and grasp complex mathematical ideas more effectively. According to the validation process, the module was categorized as "Very Feasible," with positive feedback from both educators and students. The validation score can be seen from the table below.

Table 1.
Material Validation Score

Aspects	Indicator	V1	V2	Total Score	Average score
Content Feasibility	Compatibility with Learning outcomes and flow of learning objectives	15	11	26	4.33

	Learning Material Accuracy	25	20	45	4.5
	Material updates	10	8	18	4.5
	E-module features	25	15	40	4
	Ability to encourage creativity and independence	15	10	25	4.167
Presentation Feasibility	Concept Collapse	5	3	8	4
	Students Involvement	4	3	7	3.5
	Coherence	10	7	17	4.25
Contextual Assesment	Contextual Nature	10	8	18	4.5
	Contextual Component	34	27	61	4.357

In content validation, experts rated the module at an 80% feasibility level, categorizing it as "Feasible." Feedback emphasized the module's adherence to core geometry objectives, with experts highlighting the effectiveness of using 3D models to reinforce understanding. The module's alignment with curriculum goals and its inclusion of interactive elements were particularly noted as beneficial for student comprehension. Such feedback underscores the importance of content validity in educational technology, as well-validated content is critical to achieving meaningful learning outcomes in subjects that traditionally pose challenges for students (Mayer, 2021; Smith et al., 2021).

Table 2.

Media Validation Score

Aspects	Indicator	Validator 1	Validator 2	Total Score	Average score
Presentation Assessment	Interactivity	5	3	8	4

	Variation	5	5	10	5
	Clarity	5	3	8	4
	Efficiency	5	5	10	5
	Relevance	5	4	9	4.5
Graphical Assessment	Content size	10	8	18	4.5
	Cover Design	28	22	50	4.167
	Content Design	66	65	131	4.367
E-module features	Augmented Reality	8	7	15	3.75
	Video Animation	19	20	39	4.875
	Illustration	14	15	29	4.833
	Audio	10	10	20	5
	Game	17	20	37	4.625

Media usability received the highest validation score, with experts rating it at 91.8%, placing it in the “Very Feasible” category. The interactive features, such as quizzes and 3D animations, were praised for enhancing usability and providing an intuitive, engaging experience for students. Experts noted that the design’s interactivity enabled students to experiment and learn at their own pace, an approach that aligns with student-centered educational principles and promotes active learning (Bakar et al., 2021).

Student feedback further reinforced these findings, with many expressing appreciation for the module’s visually engaging elements, particularly the animations that helped them better understand three-dimensional geometric concepts. Some students noted that the interactive quizzes made learning more enjoyable and allowed them to test their understanding immediately. However, a few challenges were also highlighted. Some students initially struggled with navigation due to

unfamiliarity with the interface, suggesting the need for a brief tutorial or onboarding guide to ease the transition. Others recommended incorporating additional practice exercises and real-world applications of solid geometry concepts to further enhance the learning experience.

The high usability score reflects research indicating that user-friendly designs in educational software increase student engagement and reduce cognitive load, enabling students to focus on content rather than navigation (Zhu & Han, 2020). By incorporating student feedback, future iterations of the E-Module could be refined to address usability concerns and further optimize its effectiveness in mathematics instruction.

Table 3.
Language Validation Score

Aspects	Indicator	Validator 1	Validator 2	Total Score	Average score
Language assesment	Proper and accurate use of Language rules	12	15	27	4.5
	Ease of Language for Students	19	20	39	4.875

Language clarity of the module scored an average of 88%, also within the "Very Feasible" category. Experts found that the instructional text was clear and appropriately structured for the targeted grade level. This high-rating on-language clarity is significant, as accessible language is essential for student comprehension, especially when introducing new and complex concepts. Studies emphasize that clear, age-appropriate language in educational tools contributes to higher learning efficiency and enables students to absorb content with less need for additional guidance (Rasheed et al., 2020; Johnson et al., 2017).

The success of the E-Module in this study suggests its potential application in other areas of mathematics education, where similar challenges in student engagement and comprehension are prevalent. The findings provide a strong case for incorporating digital learning tools into the curriculum to cater to the diverse learning needs of students.

The use of flipbook technology in the development of the interactive E-Module represents a significant shift from conventional teaching methods by integrating multimedia elements that enhance student engagement and comprehension. This approach aligns with modern educational strategies that emphasize interactive and student-centered learning environments. The combination of 3D animations, interactive quizzes, audio explanations, and gamified elements played a crucial role in improving learning outcomes. The 3D animations helped students visualize geometric transformations more effectively, reducing misconceptions about three-dimensional shapes. The interactive quizzes reinforced learning by providing immediate feedback, allowing students to assess their understanding in real-time. The audio explanations catered to auditory learners and

supported students who benefited from verbal reinforcement of concepts. Additionally, the gamified progress-tracking feature encouraged student motivation by allowing them to monitor their achievements and stay engaged with the learning process. According to Kurniawan (2019), students exhibit higher motivation when engaged in technology-enhanced learning compared to traditional methods, a finding that aligns with the positive student response to the E-Module's interactive features. By integrating these elements, the E-Module not only facilitated a deeper understanding of solid geometry but also provided a more engaging and personalized learning experience.

One of the key advantages of the flipbook-based E-Module is its ability to present content in a variety of formats, including videos, animations, and quizzes, which cater to different learning styles. This multimodal approach not only makes learning more engaging but also helps students retain information better by appealing to their visual and auditory senses. The study's results resonate with the findings of Winatha (2021), who emphasized the role of interactive visuals in enhancing students' understanding of abstract concepts.

Despite its success, the study also highlighted some challenges, such as the need for adequate digital infrastructure in schools and the training required for teachers to effectively integrate such tools into their teaching practices. Addressing these issues is crucial for the broader adoption of digital learning resources in educational institutions. The research suggests that ongoing professional development for teachers is essential to maximize the benefits of technology in education.

The interactive E-Module developed in this study not only addresses the immediate learning needs of students at SMPN 50 Jakarta Timur but also sets a precedent for future innovations in educational technology. By focusing on student engagement and interactive learning, this research contributes to the growing body of evidence supporting the use of digital tools in enhancing mathematics education.

4. Conclusion

The development of an interactive E-Module based on flipbook technology has proven to be a valuable addition to mathematics education, particularly in teaching solid geometry. The module's design, which incorporates multimedia elements and interactive features, effectively addresses the challenges students face in visualizing and understanding geometric concepts. As validated by experts, the E-Module is both feasible and practical for use in the classroom, offering a more engaging alternative to traditional learning methods.

This study concludes that integrating technology into the learning process can significantly improve students' motivation and performance in mathematics. The interactive nature of the E-Module allows students to engage with the material in a meaningful way, promoting a deeper understanding of solid geometry. These findings are consistent with the literature, which highlights the positive impact of digital learning tools on student outcomes.

Future research should explore the application of similar interactive modules in other areas of mathematics and science to determine their broader effectiveness. Additionally, efforts should be made to equip schools with the necessary technological infrastructure and provide training for teachers to facilitate the integration of digital tools in education.
Overall, the interactive E-Module based on flipbook technology represents a promising step forward in the use of educational technology to enhance student learning experiences and outcomes in mathematics.

5. References

Agyei, D. D., & Voogt, J. (2019). Exploring the potential of digital technology to enhance mathematics teaching and learning. *Educational Technology & Society, 22*(2), 78-91.

Bakar, A., Embi, M. A., & Yunus, M. M. (2021). The effect of interactive multimedia in teaching mathematics: A systematic review. *International Journal of Educational Technology, 11*(3), 54-67.

Borg, W. R., & Gall, M. D. (2003). *Educational research: An introduction*. Allyn & Bacon.

Branch, R. M., & Dousay, T. A. (2015). *Survey of instructional development models* (5th ed.). Association for Educational Communications and Technology.

Cheng, H. N., & Su, C. H. (2020). Gamification in education: A systematic literature review. *Computers & Education, 144*, 103701.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research*. SAGE Publications.

Creswell, J. W., & Poth, C. N. (2017). *Qualitative inquiry and research design: Choosing among five approaches*. SAGE Publications.

El-Sabagh, H. A. (2021). Flipbook technology as an innovative tool in digital learning environments. *Interactive Learning Environments, 29*(4), 637-654.

García-Santillán, A., Escalera-Chávez, M. E., & Moreno-García, E. (2021). Enhancing student engagement in online learning through interactive modules. *Journal of Computer-Assisted Learning, 37*(5), 1302-1314.

Huda, A. I. N., & Abduh, M. (2021). *Media Visualisasi dalam Pembelajaran Geometri*. Geometric Education Studies.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (2017). *Cooperative learning: Improving university instruction by basing practice on validated theory*. Journal on Excellence in College Teaching, 25(4), 1-26.

Karakas, F., & Manisaligil, A. (2021). Online education during the COVID-19 pandemic: Lessons learned and future directions. *Journal of Educational Technology Systems, 49*(3), 355-377.

Kumar, R., & Vig, R. (2022). The impact of technology integration on teaching and learning. *International Journal of Instructional Media, 49*(2), 145-157.

Kurniawan, A. (2019). *Motivasi Belajar Siswa dalam Pembelajaran Berbasis Teknologi*. Journal of Educational Research.

Lin, C. Y., Chen, H. W., & Liu, Y. C. (2019). Multimedia learning in mathematics: An application of cognitive theory. *Educational Psychology, 39*(8), 1029-1046.

Malik, S., & Rizvi, S. (2021). The role of interactive learning tools in enhancing mathematics education. *Mathematics Education Research Journal, 33*(4), 793-809.

Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. Jossey-Bass.

Papanikolaou, K., Gouli, E., & Makri, K. (2020). User-centered design of interactive educational environments. *Computers & Education, 144*, 103738.

Patton, M. Q. (2015). *Qualitative research and evaluation methods* (4th ed.). SAGE Publications.

Rahman, S., & Utomo, D. (2020). Challenges in implementing digital learning in Indonesian schools: A case study of SMPN 50 Jakarta Timur. *Asian Journal of Education and e-Learning, 8*(2), 112-119.

Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Online learning in higher education amid the COVID-19 pandemic: Students' perspectives. *Journal of Computer Education, 23*(3), 109-122.

Richey, R. C., & Klein, J. D. (2014). Design and development research: Methods, strategies, and issues. *Routledge*.

Roblyer, M. D., Hughes, J. E., & Brady, K. P. (2018). Integrating educational technology into teaching. *Pearson Education*.

Rohman, R., Syaifudin, S., & Astiswijaya, N. (2021). *Interactive Learning Models for Mathematics*. Educational Technology Review.

Setiawan, A., & Nurdin, E. (2020). Enhancing spatial visualization through digital tools in solid geometry learning. *International Journal of Mathematics Education, 8*(2), 120-136.

Smith, J. A., Turner, L. R., & Campbell, N. C. (2021). Enhancing geometry instruction with digital tools: A comparative study. *Journal of Mathematics Education, 54*(1), 25-40.

Sugiyono. (2018). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Taber, K. S. (2018). The use of Likert scales in educational research: Limitations and recommendations. *Research in Education, 101*(1), 57-73.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2020). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review. *Educational Technology Research and Development, 68*(2), 475-491.

Winatha, K. (2021). *The Role of Visuals in Enhancing Mathematical Understanding*. Journal of Interactive Learning.

Zhang, L., & Lin, T. (2019). Cognitive engagement and multimedia in learning: Integrating instructional design. *Educational Technology Research and Development, 67*(6)

Zhu, C., & Han, Y. (2020). Strategies for teaching mathematics in the digital age: A review. *International Journal of Mathematics Education, 52*(7), 897-915.