OASE
Proceeding the Overseas Academic Study Exchange Program
ISSN 2686-4312 □ 2025 □ Volume 7(4), 936–940. □ DOI: xxx xxx

Literature Synthesis: Benefits and Challenges of Technology Integration In Mathematics Learning Evaluation

Eko Supriyanto[1*]

ABSTRACT
ABSTRACT The rapid advancement of digital technology has changed the landscape of mathematics education evaluation, which is critical to measuring the comprehension and quality of learning. The limitations of traditional methods for measuring 21st-century skills are driving the adoption of technology-based evaluations. This study aims to synthesize the literature on the benefits and challenges of technology integration in mathematics learning evaluation. This research, through a systematic literature synthesis from Scopus-indexed articles (2019-2025), identified benefits such as increased conceptual understanding, development of critical thinking, increased student engagement and inclusivity, evaluation efficiency, and the potential for increased digital achievement and competence. However, implementation also faces significant challenges related to digital access gaps, low digital literacy, lack of educator readiness, methodological challenges, limited resources, and evaluation validity. This synthesis concludes that although challenges need to be addressed, the integration of technology has great potential to improve the quality of mathematics evaluation and learning. A comprehensive understanding of these benefits and challenges is essential for stakeholders to develop effective implementation strategies.

Keywords: Digital Technology, Mathematics Learning Evaluation, Benefits, Challenges, Literature Synthesis

73 Introduction

The rapid advancement of digital technology has significantly changed the evaluation of mathematics education [1], [2], [3], and it is important to measure the understanding and quality of learning [4], [5], [6]. The limitations of traditional methods encourage the integration of digital technologies to assess 21st-century skills [7], [8], offering interactive, adaptive, and data-driven evaluation solutions. Previous research has highlighted the benefits of technology integration, such as increased conceptual understanding and critical thinking [9], as well as the potential for increased student engagement and inclusivity [10]. However, its implementation is constrained by access gaps, low digital literacy, and educator readiness [1].

This study is a synthesis of literature that comprehensively analyzes research on the integration of technology in the evaluation of mathematics learning. The research aims to identify the benefits of technology for the effectiveness of assessment and exploration of challenges in implementation. In contrast to empirical research, this literature synthesis summarizes and interprets findings from various existing studies to present a structured picture of current research.

Therefore, this literature synthesis will likely provide useful information for educators, policymakers, and researchers in mathematics education. In addition, it supports the development

[1]Universitas Muhammadiyah Malang
[*]Alamat korespondensi: ae541ma@webmail.umm.ac.id

of effective implementation strategies, evidence-based decision-making, and the identification of advanced research areas for the improvement of mathematics education in the digital age. So that this research will be the foundation for creating mathematics learning that makes students and teachers happy.

74 Literature Review

The integration of technology becomes the foundation of modern education [11], with increasing relevance in the evaluation of mathematics learning in line with technological advances and the needs of students [12]. The utilization of apps and software has been shown to increase student engagement, digital competence, and understanding of math concepts. As GeoGebra facilitates the visualization of linear concepts significantly [13]. The quality of technology integration is positively correlated with students' behavioral engagement and digital competence [1]. In addition, apps like Photo Math can improve students' achievement in solving quadratic equations, although it is not easy to use; this is a challenge that must be overcome [14].

The application of technology in the evaluation of mathematics learning faces challenges such as the readiness and training of educators, as well as the availability of infrastructure. The skill level of math teachers in using learning management applications and systems varies[15] and teachers' time pressure often hinders the optimization of technology application [16]. Limited human resources, especially in supporting students with special needs, are also an obstacle [17].

The evaluation methodology is also an important aspect. The success of technology integration depends on learning strategies that integrate it into pedagogical frameworks, with alignment between content, pedagogy, and technological knowledge (TPACK) being of paramount importance [18]. Approaches such as Fuzzy Delphi can potentially optimize this alignment [19]. Technology integration in the evaluation of mathematics learning increases student engagement and achievement. Therefore, the development of technology skills for educators through continuous training and the use of e-learning is essential to maximize the benefits of technology in improving the quality of mathematics evaluation.

75 Research Methods

This research applies a systematic synthesis of literature to identify, analyze, and interpret relevant research on the benefits and challenges of technology integration in evaluating mathematics learning. Scopus became the main base for searching for relevant literature [11]. This process involves a Systematic Literature Review through the extraction of data from scientific databases using keywords: "technology integration", "evaluation of mathematical learning", "benefits", and "challenges". The search is limited to English-language articles published between 2019 and 2025 (held April 21 - May 1, 2025). Data analysis was carried out with the help of scite.ai and scispace to identify findings related to the benefits and challenges of technology integration in evaluating mathematics learning. The results of the analysis are then interpreted as research findings.

76 Result and Discussion

The results of this study are based on the analysis of Scopus-indexed scientific articles from 2019 to 2025, which identified and analyzed the benefits and challenges of technology integration in evaluating mathematics learning.

Table 15: Benefits and Challenges of Technology Integration in Mathematics Learning

Benefit	**Challenge**
1. Improve conceptual understanding (children) [13][9]	1. Access Gap and Digital Divide [18]
2. Developing 21st Century Skills [7]	2. Low Digital Literacy [15]
3. Increase Engagement and Motivation [10][11]	3. Low Teacher Readiness [16]
4. Developing Digital Competencies [1]	4. Methodological and Pedagogical Challenges [20]
5. Evaluate more efficiently with quick feedback [21]	5. Limited Human Resources [17]
6. Potential to improve learning outcomes [14]	
7. Driving Inclusivity [17]	

This literature synthesis confirms the transformative potential of digital technology in the evaluation of mathematics learning. This is in line with the demands of the 21st century and the personalization of learning. In addition, it also brings significant benefits such as improving conceptual understanding [9] [13]Develop Critical Thinking [7], and increase student engagement [1] [10] demonstrate the effectiveness of technology in evaluation.

However, its implementation faces crucial challenges related to access [18], Digital Literacy [15], educator readiness [16], and methodology [20]. As with the use of GeoGebra visualization [13] to improve understanding of concepts, it can be constrained by teachers' digital literacy [15]. Collaboration between educators (through practical training), policymakers (through infrastructure investment and addressing gaps), and educational technology developers is needed to address existing barriers.

77 Conclusion

The integration of technology in the evaluation of mathematics learning promises to improve the quality of mathematics education despite the challenges in its implementation. As a basis for developing effective implementation strategies to optimize the use of technology in supporting student learning, a deep understanding of its benefits and challenges is needed. Further research is needed to develop a valid and reliable technology-based evaluation methodology, as well as to explore its long-term impact. Ongoing training programs for educators and infrastructure investments by policymakers are also crucial for equitable implementation.

References

1 T. Consoli, M. L. Schmitz, C. Antonietti, P. Gonon, A. Cattaneo, and D. Petko, "Quality of technology integration matters: Positive associations with students' behavioral engagement and digital competencies for learning," Educ. Inf. Technol., vol. 30, no. 6, pp. 7719–7752, 2024, doi: 10.1007/s10639-024-13118-8.

2 H.-G. Weigand, J. Trgalova, and M. Tabach, "Mathematics teaching, learning, and assessment in the digital age," ZDM – Math. Educ., vol. 56, no. 4, pp. 525–541, Aug. 2024, doi: 10.1007/s11858-024-01612-9.

3 A. Balbi, S. Berrutti, M. Tejera, E. Gonzalez, and M. Bonilla, "Tecnologías Digitales y Evaluación Formativa en Clases de Matemática: una revisión de la literatura," Bolema Bol.

Educ. Matemática, vol. 38, 2024, doi: 10.1590/1980-4415v38a230045.
4 N. Dehbozorgi and M. T. Kunuku, "An LLM-based Reflection Analysis Tool for Identifying and Addressing Challenging Topics," in Proceedings of the 55th ACM Technical Symposium on Computer Science Education V. 2, New York, NY, USA: ACM, Mar. 2024, pp. 1618–1619. doi: 10.1145/3626253.3635601.
5 F. Xu, "Education Teaching and Evaluation Under Data Mining Algorithm," Adv. Intell. Syst. Comput., vol. 1343, pp. 983–987, 2021, doi: 10.1007/978-3-030-69999-4_147.
6 A. Septiana, I. I. Amin, J. Soebagyo, and I. Nuriadin, "STUDI LITERATUR: PENDEKATAN PENDIDIKAN MATEMATIKA REALISTIK DALAM PEMBELAJARAN MATEMATIKA," Teorema Teor. dan Ris. Mat., vol. 7, no. 2, p. 343, Sep. 2022, doi: 10.25157/teorema.v7i2.7090.
7 N. Grecea Pasaribu, G. Budiman, and I. Dyah Irawati, "Auto Evaluation for Essay Assessment Using a 1D Convolutional Neural Network," IEEE Access, vol. 12, pp. 188217–188230, 2024, doi: 10.1109/ACCESS.2024.3515837.
8 D. Sale, "Assessing Twenty-First Century Competencies," Cogn. Sci. Technol., pp. 263–289, 2020, doi: 10.1007/978-981-15-3469-0_8.
9 N. G. Nyoman, "Pentingnya Filsafat Dalam Matematika Bagi Mahasiswa Pendidikan Matematika," J. Arts Educ., vol. 2, no. 1, 2022, doi: 10.33365/jae.v2i1.64.
10 A. Malekjafarian and M. Gordan, "On the Use of an Online Polling Platform for Enhancing Student Engagement in an Engineering Module," Educ. Sci., vol. 14, no. 5, p. 536, May 2024, doi: 10.3390/educsci14050536.
11 Z. Kohen, "Informed integration of IWB technology, incorporated with exposure to varied mathematics problem-solving skills: its effect on students' real-time emotions," Int. J. Math. Educ. Sci. Technol., vol. 50, no. 8, pp. 1128–1151, Nov. 2019, doi: 10.1080/0020739X.2018.1562119.
12 A. Munfarikhatin and I. Natsir, "ANALISIS KEMAMPUAN LITERASI MATEMATIKA SISWA PADA KONTEN SPACE AND SHAPE," HISTOGRAM J. Pendidik. Mat., vol. 4, no. 1, p. 128, May 2020, doi: 10.31100/histogram.v4i1.569.
13 U. I. Ogbonnaya and M. Mushipe, "The efficacy of geogebra-assisted instruction on students' drawing and interpretations of linear functions," Int. J. Learn. Teach. Educ. Res., vol. 19, no. 9, pp. 1–14, 2020, doi: 10.26803/ijlter.19.9.1.
14 P. Kusi, F. O. Boateng, and E. Teku, "The effect of technology integration on college of education students' achievement in quadratic equations: The perspective of photo math utilization," Eurasia J. Math. Sci. Technol. Educ., vol. 21, no. 1, pp. em2561–em2561, 2025, doi: 10.29333/ejmste/15799.
15 A. Mukuka and J. K. Alex, "Profiling mathematics teacher educators' readiness for digital technology integration: evidence from Zambia," J. Math. Teach. Educ., vol. 28, no. 2, pp. 315–339, 2024, doi: 10.1007/s10857-024-09657-z.
16 B. Zunica, "Technology everywhere! But who's got the time? The influence of time pressures on technology integration in Australian secondary mathematics," Discov. Educ., vol. 2, no. 1, 2023, doi: 10.1007/s44217-023-00071-w.
17 S. Suripah, Z. Zetriuslita, A. Sthephani, M. E. Putri, and E. Desvianti, "Technology integration to improve numeracy skills of dyscalculia students: Obstacles of inclusion schools in Indonesia," Edelweiss Appl. Sci. Technol., vol. 8, no. 6, pp. 6589–6599, 2024, doi: 10.55214/25768484.v8i6.3411.
18 A. Hidayat and P. Firmanti, "Navigating the tech frontier: a systematic review of technology integration in mathematics education," Cogent Educ., vol. 11, no. 1, p., 2024, doi: 10.1080/2331186X.2024.2373559.
19 C. Chua, A. M. Kosnin, and K. J. Yeo, "Fuzzy Delphi method for A-level mathematics technological pedagogical and content knowledge module," Int. J. Eval. Res. Educ. , vol. 13, no. 1, pp. 441–453, 2024, doi: 10.11591/ijere.v13i1.25982.

20 A. Hidayat et al., “Development and Application of an Intelligent Assessment System for Mathematics Learning Strategy among High School Students—Take Jianzha County as an Example,” Cogent Educ., vol. 11, no. 19, p. 12265, Dec. 2022, doi: 10.3390/su141912265.
21 S. Radović, “Is it only about technology? The interplay between educational technology for mathematics homework, teaching practice, and students’ activities,” J. Comput. Educ., vol. 11, no. 3, pp. 743–762, 2024, doi: 10.1007/s40692-023-00277-9.

CITATION:

Eko Supriyanto (2025). Literature Synthesis: Benefits and Challenges of Technology Integration In Mathematics Learning Evaluation. *OASE, 7*(4), 936–940.