**Hipotenusa : Journal of Mathematical Society**
Volume 6 Issue 2 Year 2024
ISSN: 2716-3156
Website: https://ejournal.uinsalatiga.ac.id/index.php/hipotenusa/index

# Harnessing Artificial Intelligence in Mentimeter Based Interactive Learning Media to Enhance Students' Numeracy Literacy

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DOI: 10.18326/hipotenusa.v6i2.2744

Article submitted: September 17, 2024
Article reviewed: November 26, 2024
Article published: December 30, 2024

**Abstract**

According to the 2022 PISA results, Indonesia's mathematical literacy score dropped by 13 points to 366, placing it 106 points below the global average. This decline is closely tied to students' numerical literacy skills. To address this, learning should encourage students to solve mathematical problems through critical, logical, and creative thinking. Interactive learning media that meets students' needs is essential to enhance numerical literacy. The objective of this study is to develop artificial intelligence-based interactive learning media, specifically using Mentimeter, to improve students' numerical literacy skills. The research follows the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation), with data collected through questionnaires and tests. The success indicators for the media include a minimum of valid for validity, practical for practicality, and high for effectiveness. The results show that the Artificial Intelligence-based interactive learning media was successfully developed. The validity test averaged 93.74% in the "very valid" category, the practicality test averaged 90.14% in the "very practical" category, and the effectiveness test yielded an N-Gain Score of 0.71 (71.09%), classified as "high." These findings demonstrate that AI-based interactive learning media can significantly improve students' numeracy literacy skills.

**Keywords**: artificial intelligence, interactive learning media, numeracy literacy, students' skills, mentimeter

## INTRODUCTION

The level of numerical literacy skills can be seen based on the Program for International Student Assessment (PISA) results. Indonesia's ranking in PISA 2022 rose 5-6 positions compared to 2018. Based on the 2022 PISA results, Indonesia recorded an average score of 359 on reading ability, 117 points behind the global average score of 476 and down 12 points from the previous edition in 2018 (Organization for Economic Co-operation and Development, 2023). The decline in scores in this subject has been the most

significant in the last five editions. Regarding mathematical literacy, Indonesia's average score fell 13 points to 366 from the previous edition of 379. This figure is 106 points behind the global average score (Organization for Economic Co-operation and Development, 2023). The number is indeed related to students' numerical literacy abilities, which are the subject of this PISA assessment.

Literacy and numeracy skills are essential for providing better access to quality education. Individuals with high numerical literacy skills have a better chance of obtaining decent and quality work. Numerical literacy ability is a person's ability to analyze and understand information through activities in manipulating symbols or language found in everyday life into oral and written form to solve a problem (Ekowati et al., 2019; Mahmud & Pratiwi, 2019; Fajriyah et al., 2019). Numerical literacy refers to the understanding and skill in applying numbers and symbols associated with basic mathematics to address real-life problems across various situations, interpreting data presented in graphs, tables, charts, and other formats, and using the analysis of the results to make predictions and informed decisions (Han et al., 2017).

People with high numerical literacy tend to participate more in economic and social activities, increasing productivity, innovation, and sustainable development. Numerical literacy skills also help individuals solve everyday problems and make appropriate and wise decisions. Numerical literacy skills go beyond the ability to read and count; they also involve applying acquired knowledge in daily life and being aware of technology and the surrounding environment (Faiz, 2022). Numerical literacy is based on the same knowledge and skills as mathematical competence.

Mathematics should be seen as a conceptual tool for building and reshaping knowledge, refining and developing the critical thinking skills essential for solving real-life problems. Understanding mathematical concepts will make it easier for students to learn mathematics better at the next level. Inviting students to solve mathematical problems through critical, logical, and creative thinking can help students increase speed, understanding, organization, solving, and logical discovery in mathematics (Annurwanda & Winata, 2021). Teaching mathematics is not just about using textbooks. However, educators must also create learning that attracts students' attention through learning media.

Learning media is an element of the educational system that serves to convey messages and stimulate students' thoughts, emotions, focus, and motivation, thus fostering the learning process. Learning media can help students improve understanding by presenting exciting and reliable data, facilitating data interpretation, and condensing information. One type of learning media that is able to accommodate students' needs is interactive learning media. Interactive learning media is designed to offer interactive learning in 3-dimensional form, graphics, sound, video, and animation, and create interaction. The objective of this research is to create interactive learning tools that will enhance students' numeracy skills. This study is important because it aims to boost students' numerical skills, which will have a positive impact on individuals as well as on society, the nation, and the state (Cohen Kadosh et al., 2013).

The essential characteristic of interactive learning media is that students not only pay attention to the presentation of the material but also are motivated to interact during

learning. Teachers need to be able to create engaging and innovative classroom activities, offering students an enjoyable experience to enhance the quality of the learning process (Annurwanda & Winata, 2021). Interactive learning media based on artificial intelligence will be developed in this research to support this. Artificial Intelligence (AI) in education is experiencing increasing interest from year to year. Between 2015 and 2019, the scientific articles on AI and education published on Web of Science and Google Scholar represented a significant share, making up 70% of all indexed scholarly articles (Chen et al., 2020). By leveraging the speed and accuracy of AI, students can enhance their time efficiency and focus on the creative and analytical aspects of their assignments. The advantages of AI in providing word suggestions, grammar corrections, and even additional content have made it an effective assistant in optimizing final outcomes (Lukman et al., 2023). Most students view Artificial Intelligence as a highly beneficial tool in enhancing their learning experience, with one of the main advantages being the ease of instant access to information and the ability for students to quickly retrieve various sources of information relevant to their courses (Putri et al., 2023). One way to enhance numeracy literacy skills through learning media is by utilizing interactive tools. This involves integrating digital platforms such as Quizizz, Kahoot, GeoGebra, or Mentimeter which offer engaging and interactive problem-solving activities. These platforms promote active participation and make the learning experience more enjoyable. As education develops, researchers try applying AI to interactive learning media using Mentimeter.

Mentimeter is an application that allows users to create interactive presentations. Mentimeter can help educators interact directly with students in a more dynamic, exciting way and gain information and opinions directly from students. This web 2.0 internet-based AI can design presentations and add surveys, quizzes, and word clouds, which can be accessed via smartphones, tablets, and computers (Gokbulut, 2020). Mentimeter can ensure that all participants in online presentations remain involved and actively participate, thereby creating a productive, interactive atmosphere. Mentimeter has been proven to increase student interest, participation, class interaction, and engagement in learning (Hill & Fielden, 2017; Rudolph, 2018; Gokbulut, 2020; Mohin et al., 2022). Mentimeter's ability to conduct polls, direct interaction with participants in real-time, and ease of accessing the application are vital in increasing student activity, participation, and interest in learning (Mohin et al., 2022). Utilizing Mentimeter in educational settings led to a notable rise in student attentiveness and engagement, while also fostering inclusivity and dedication to the learning process. Mentimeter positively impacted online teaching, with students showing more enjoyment and active participation in classroom activities (Pichardo et al., 2021).

Factors that influenced children’s use of interactive technology focused on (a) collaboration, (b) ability, (c) use of a stylus, (d) maturity, and (e) teachers’ skill level. A factor known to influence children’s use of interactive technology was their affinity for collaboration (Miller, 2018). One approach to enhancing literacy and numeracy is by focusing on reasoning and problem-solving throughout the learning process. Strengthening these skills involves improving students' abilities to comprehend information, represent objects, solve problems, reason logically, provide explanations, and interpret results effectively (Amuda et al., 2024). The results of previous research

show that the use of Quizizz as a learning medium can enhance students' numeracy literacy skills in both female and male learners. This is attributed to the proven effectiveness of Quizizz in supporting the learning process, as it has been shown to improve focus, foster cognitive development, and stimulate creative thinking (Saefurohman et al., 2023). The literacy and numeracy skills of students in both chemistry and biology can be enhanced through augmented reality game-based learning (ARGBL). This demonstrates that ARGBL has a notable influence on high school students' literacy and numeracy abilities. Research indicates that students in the experimental group, who engaged with mobile technology for learning, achieved higher average scores compared to those in traditional classroom settings (Cahyana et al., 2023). If explored further, numerical literacy skills can also be improved through flipbook learning media, learning videos, and the use of used goods (Winarni et al., 2021; Mumpuni et al., 2022; Sandy et al., 2022). Based on previous research findings, the researcher is interested in exploring how the integration of Artificial Intelligence in Mentimeter-based interactive learning media affects students' numeracy literacy skills. Therefore, the researcher aims to conduct a study on enhancing numeracy literacy skills through the development of Mentimeter-based interactive learning media.

## METHODS

This research is the development research using ADDIE design. ADDIE design consists of 5 stages namely Analyzing, Designing, Development, Implementation, and Evaluation. Through this development design, it allows researchers to obtain feedback based on continuous assessment during the development of interactive learning media (Nadiyah & Faaizah, 2015; Dwitiyanti et al., 2020; Ranuharja et al., 2021). The focus of this research is the development of artificial intelligence-based interactive learning media using Mentimeter to improve students' numeracy literacy skills. Based on the research focus, the location of this research is the junior high schools in Landak district, West Kalimantan. The number of State Junior High Schools (SMPNs) in Landak Regency is 70 across 13 sub-districts. The small-scale pilot test was conducted in all SMPNs in Ngabang sub-district with 12 schools.

The methods used for data collection included observation, surveys, tests, and interviews. The research instruments include 1) observation sheet: to analyze the need for developing interactive learning media; 2) interactive learning media validation sheet: to measure validity; 3) interactive learning media implementation sheet: to measure practicality; 4) test sheet: to measure students' numeracy literacy skills; 5) interviews: to validate the results of developing interactive learning media. Validation using content validity was carried out by 1 lecturer and 2 mathematics teachers. The practicality of the interactive learning media was evaluated by three observers, while the effectiveness of the learning media was measured using the N-Gain test, based on the results of the numeracy literacy test. Through the N-Gain test, researchers can find out the extent of the difference between students' initial and final test results.

The assessment results obtained are categorized based on the validity, practicality, and effectiveness category tables according to Table 1, 2, and 3 below.

Table 1. Validation Criteria

| Validity Score | Category |
|---|---|
| 86% to 100% | Very Valid |
| 71% to 85% | Valid |
| 51% to 70% | Invalid |
| 0% to 50% | Very invalid |

Table 2. Practical Criteria

| Practical Score | Category |
|---|---|
| 86% to 100% | Very practical |
| 71% to 85% | Practical |
| 51% to 70% | Impractical |
| $0\% < x \leq 50\%$ | Very impractical |

Table 3. Effectiveness Criteria

| N-gain Score | Category |
|---|---|
| $g \geq 0{,}70$ | High |
| $0{,}30 \leq g < 0{,}70$ | Moderate |
| $g < 0{,}30$ | Low |

The indicators for the success of developing interactive learning media are based on the aspects shown in Table 4:

Table 4. Success Indicators

| Success Aspect | Success Indicators | Success Category |
|---|---|---|
| Validity Level | Content | Minimum Valid |
| | Language | |
| Practicality Level | Ease of use of media | Minimally Practical |
| | Time efficiency of use | |
| | Media appearance and appeal | |
| Effectiveness Level | N-Gain | High |

Students who are not accustomed to working on PISA model questions experienced difficulties so the PISA score was low. One of the causes is that Indonesian students lack practice in contextual problem-solving, delivering argumentation, and expressing creativity in solving them (Merta et al., 2017). PISA questions require students to possess problem-solving, critical thinking, creativity, reasoning abilities, and decision-making skills. This is what is now called the Higher Order Thinking Skill (HOTS). Regarding the students' HOTS skills, we need to understand the indicators to measure them. The indicators to measure HOTS (Suwarma & Apriyani, 2022) are shown in Table 5.

Table 5. HOTS Indicators

| Competence | Description |
|---|---|
| Analyzing | Examining incoming information and breaking it down into smaller segments to uncover patterns or connections. |
| | Identifying and differentiating causes and effects within a complex situation. |
| | Identifying or formulating questions involves recognizing areas of uncertainty, curiosity, or need for clarification and crafting specific, focused questions that guide exploration, deepen understanding, or help solve a problem |
| Evaluating | Evaluating solutions, ideas, and methods by applying relevant criteria or established standards to confirm their effectiveness or worth. |
| | Hypothesizing, criticizing, and testing |
| | Evaluating a statement by either accepting or rejecting it based on set criteria |
| Creating | Making a broad assumption or conclusion about something |
| | Creating a method to address the problem |
| | Assembling components into a new structure that has not existed previously |

The numeracy literacy skills measured based on HOTS (Higher Order Thinking Skills) indicators, as outlined in Table 5, are designed to ensure that students not only understand numbers and data but are also capable of processing them to make informed decisions.

Analysis in numeracy literacy involves the ability to comprehend information presented in the form of data, graphs, tables, or numerical texts. The method for assessing analytical skills includes data comprehension tests and contextual questions. Data comprehension tests are conducted by providing students with graphs, tables, or diagrams and asking them to explain patterns, trends, or anomalies observed. For contextual questions, students are presented with real-world problems, such as analyzing household expenditures based on a budget table.

Evaluation in numeracy literacy refers to the ability of students to assess the accuracy of data, verify information, or determine the validity of numerical arguments. The method for measuring evaluative competence includes case studies, where students are given scenarios with correct or incorrect data and asked to evaluate their validity.

Creation in numeracy literacy involves the ability of students to use data to generate new solutions, make predictions, or develop plans based on numerical information. The method for measuring creative competence involves problem-based projects, where students are tasked with creating graphs or models based on specific scenarios.

## RESULTS AND DISCUSSION

The first stage in developing interactive learning media is the analysis phase. The initial analysis focused on students, aiming to understand their characteristics to ensure

the media aligns with their needs and effectively measures higher-order thinking skills. The competencies targeted in this media include analyzing, evaluating, and creating. The second analysis was curriculum-based and was conducted to align learning outcomes and objectives with the Independent Curriculum. Researchers identified general learning outcomes for students in Phase D. The third analysis involved the content. This material analysis ensures the interactive learning media aligns with the specific achievements for Phase D, particularly in data and probability analysis. The selected material for this media covers data and diagram interpretation.

The second stage in developing interactive learning media is the design phase. During this stage, the researcher defines the specifications, creates storylines, drafts scripts, and incorporates features aligned with the learning objectives. The media is designed to be accessible to both teachers and students on laptops and mobile devices. Additionally, the interactive learning media includes features such as word cloud, polling, open-ended questions, scales, ranking questions, and pin it questions. All of these features are available with a subscription to the Basic version of Mentimeter. The results of the development of interactive learning media based on Mentimeter are shown in Figure 1 below.

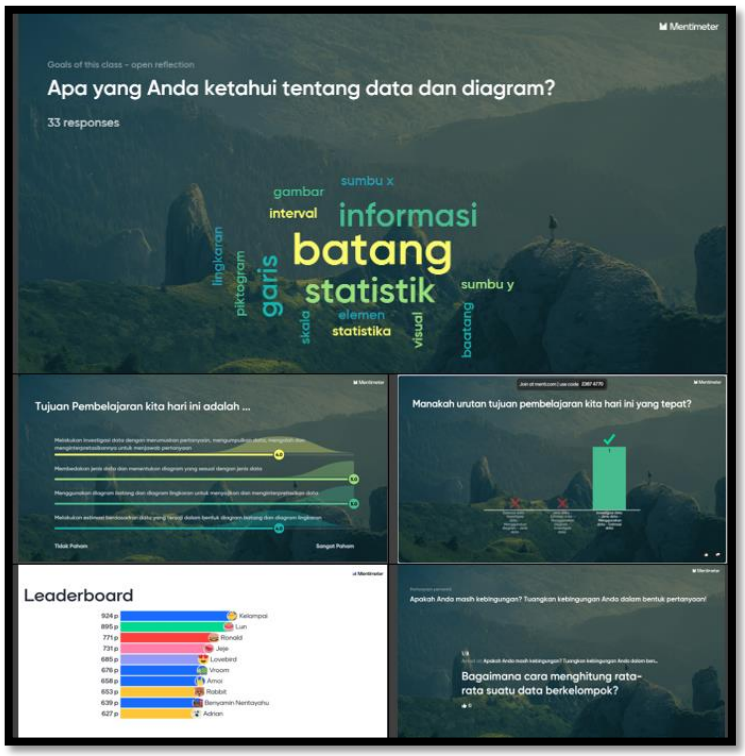


Figure 1. From top: Features of word cloud, scales, multiple choice, leaderboard, and Q&A in Mentimeter

Mentimeter can present data in real-time based on students' responses. It also features an attractive design, which effectively captures students' attention and encourages them to follow the slides on Mentimeter. By optimizing its features such as word clouds, polling, open-ended questions, scales, ranking questions, and pin-it questions, Mentimeter can enhance students' engagement and interest during the learning process.

The third stage in developing interactive learning media is the development phase. At this stage, the researcher tested the validity of the content with three validators: two mathematics teachers and one lecturer in information systems. The mathematics teachers served as material experts, while the information systems lecturer was the media expert. The developed learning media was evaluated and revised to meet the necessary standards. Researchers made revisions based on the suggestions and feedback provided by each validator.

The Mentimeter-based interactive learning media has been evaluated based on three key aspects: validity, practicality, and effectiveness. The results of the validity test are shown in Table 6 below.

Table 6. Test Results for the Validity Aspects of Interactive Learning Media.

| No | Validator | Percentage |
|---|---|---|
| 1. | Material Expert I | 95.83% |
| 2. | Material Expert II | 89.58% |
| 3. | Media Expert | 95.83% |
| | Average | 93.74% |
| | Category | Very Valid |

Based on Table 6, the developed learning media is deemed highly valid and appropriate in terms of content, including criteria such as material presentation, language, and visual design. Additionally, the media is considered appropriate from a technical perspective, covering criteria like media suitability, usability, presentation, and layout design. These results were derived from the validation questionnaire scores provided by the validators following two rounds of revisions.

The fourth stage in developing interactive learning media is the implementation phase. During this stage, researchers conducted small group trials and field tests. The small group trials, involving three observers, were used to assess the practicality of the interactive learning media. The field test included sixteen observers and twenty-eight students to evaluate the media's effectiveness. The effectiveness test measured the N-Gain Score by administering pretests and posttests. The test results for the practicality aspect are shown in Table 7 below.

Table 7. Test Results for the Practical Aspects of Interactive Learning Media.

| No | Test | Total Score | Percentage | Criteria |
|---|---|---|---|---|
| 1. | Small Group Test | 256 | 88.88% | Very Practical |
| 2. | Field Test | 1.404 | 91.40% | Very Practical |
| | Total Score | | 1.660 | |
| | Average | | 90.14% | |
| | Category | | Very Practical | |

Based on Table 7, the developed learning media is considered highly practical in terms of effectiveness, interactivity, and efficiency. The small group test involved three observers, while the field test was conducted with sixteen observers. The test results for the effectiveness aspect are presented in Table 8 below.

Table 8. Test Result for the Effectiveness Aspects of Interactive Learning Media

| No | Score | Average |
|---|---|---|
| 1. | Pretest Score | 68.30 |
| 2. | Posttest Score | 90.63 |
| | N Gain Score | 0.71 |
| | Percentage | 71.09% |
| | Category | High |

Table 8 shows that the N-Gain Score results from the effectiveness test are high. This test was conducted with twenty-eight students using pretest and posttest assessments. The Mentimeter-based interactive learning media developed has met the three key aspects: validity, practicality, and effectiveness. The first aspect, validity, achieved an average validity percentage of 93.74%, classified as very valid. The second aspect, practicality, recorded an average percentage of 90.14%, placing it in the very practical category. The third aspect, effectiveness, showed an average N-Gain Score of 0.71, with an N-Gain Score percentage of 71.09%, categorized as high.

The final stage in developing interactive learning media is the evaluation phase. During this stage, the researcher evaluated the media based on the results of the validity, practicality, and effectiveness tests. Mentimeter has proven to be an effective digital tool in higher education, fostering active participation by enabling students to contribute anonymously and engagingly. This feature enhances democratic involvement in individual sessions as well as throughout the entire course (Gokbulut, 2020; Mayhew et al., 2020; Pichardo et al., 2021)

## CONCLUSION

The results of this study indicate that Mentimeter effectively fosters student participation by allowing anonymous and enjoyable engagement, enhancing their democratic involvement. Consequently, students show greater engagement and collaboration in a relaxed environment compared to traditional passive learning settings. The evaluation of Mentimeter-based interactive learning media, which encompasses three aspects: validity, practicality, and effectiveness. In the validity aspect, the average percentage was 93.74%, categorized as very valid. For practicality, the average percentage was 90.14%, which is classified as very practical. In terms of effectiveness, the average N Gain Score was 0.71, with an N Gain Score percentage of 71.09%, placing it in the high category.

The media expert validator's assessment showed a percentage of 95.83%, also categorized as very valid. Assessments by two material expert validators returned percentages of 95.83% and 89.58%, both within the very valid category. The small group test, conducted by three observers, resulted in an average percentage of 88.88%, classified as very practical. In the field test, sixteen observers provided an average score of 91.40%, also classified as very practical. The student assessments for effectiveness showed an average N Gain Score of 0.71 and an N Gain Score percentage of 71.09%, both categorized as high. The satisfaction reported by students who participated in the educational use of Mentimeter encourages us to consider exploring other functionalities.

Future research could consider comparing the benefits provided by Mentimeter-based learning media with other free or paid learning media, to help teachers make informed decisions in utilizing ICT as a learning tool.

**Acknowledgements**

Pradipta Annurwanda and Wike Ellissi from the Mathematics Education Department, Faculty of Education and Teacher Training, Universitas Katolik Santo Agustinus Hippo, prepared this journal article based on the report titled "Harnessing Artificial Intelligence in Interactive Learning Media to Enhance Students' Numeracy Literacy". This work has been fully funded by the Directorate General of Higher Education, Research, and Technology (DGHERT) of the Ministry of Education, Culture, Research, and Technology under the 2024 Penelitian Dosen Pemula (PDP) Grants program. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the funding agency.

## REFERENCES

Amuda, S., Yusuf, F. M., & Latjompoh, M. (2024). Learning Tools on Literacy and Numeracy to Enhance Students' Critical Thinking Skills. *International Journal of Research and Review*, *11*(10), 280–289. https://doi.org/10.52403/ijrr.20241026

Annurwanda, P., & Winata, R. (2021). Students' Perception towards The Use of Google Classroom for Mathematics Online Learning viewed from Students' Readiness. *Kalamatika: Jurnal Pendidikan Matematika*, *6*(2), 195–206. https://doi.org/10.22236/kalamatika.vol6no2.2021pp195-206

Cahyana, U., Luhukay, J. R., Lestari, I., Irwanto, I., & Suroso, J. S. (2023). Improving Students' Literacy and Numeracy Using Mobile Game-Based Learning with Augmented Reality in Chemistry and Biology. *International Journal of Interactive Mobile Technologies*, *17*(16), 4–15. https://doi.org/10.3991/ijim.v17i16.42377

Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, *8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Cohen Kadosh, R., Dowker, A., Heine, A., Kaufmann, L., & Kucian, K. (2013). Interventions for Improving Numerical Abilities: Present and Future. *Trends in Neuroscience and Education*, *2*(2), 85–93. https://doi.org/10.1016/j.tine.2013.04.001

Dwitiyanti, N., Kumala, S. A., & Widiyatun, F. (2020). Using the ADDIE Model in Development of Physics Unit Convertion Application Based on Android as Learning Media. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *10*(2), 125–132. https://doi.org/10.30998/formatif.v10i2.5933

Ekowati, D. W., Astuti, Y. P., Utami, I. W. P., Mukhlishina, I., & Suwandayani, B. I. (2019). Literasi Numerasi di SD Muhammadiyah. *ELSE (Elementary School Education Journal) : Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, *3*(1), 93. https://doi.org/10.30651/else.v3i1.2541

Faiz, A. (2022). Pemanfaatan Pojok Baca Dalam Menanamkan Minat Baca Siswa Kelas 3 di SDN 1 Semplo. *Jurnal Lensa Pendas*, *7*(1), 58–66. https://doi.org/10.33222/jlp.v7i1.1714

Fajriyah, L., Nugraha, Y., Akbar, P., Bernard, M., Siliwangi, I., Terusan, J., Sudirman, J., Tengah, C., Cimahi, K., & Barat, J. (2019). Pengaruh Kemandirian Belajar Siswa SMP Terhadap Kemampuan Penalaran Matematis. *Journal on Education*, *5*(2), 12–20.

Gokbulut, B. (2020). The Effect of Mentimeter and Kahoot Applications on University Students' e-Learning. *World Journal on Educational Technology: Current Issues*, *12*(2), 107–116. https://doi.org/10.18844/wjet.v12i2.4814

Han, W., Susanto, D., Dewayani, S., Pandora, P., Hanifah, N., Miftahussururi, Nento, M. N., & Akbari, Q. S. (2017). *Materi Pendukung Literasi Numerasi* (L. A. Mayani, Ed.). Kementerian Pendidikan dan Kebudayaan .

Hill, D., & Fielden, K. (2017). Using Mentimeter to Promote Student Engagement and Inclusion. *Pedagogy in Practice Seminar*, 16–28.

Lukman, Agustina, R., & Aisy, R. (2023). Problematika Penggunaan Artificial Intelligence (AI) untuk Pembelajaran di Kalangan Mahasiswa STIT Pemalang. *Jurnal Madaniyah*, *13*(2), 242–255.

Mahmud, M. R., & Pratiwi, I. M. (2019). Literasi Numerasi Siswa Dalam Pemecahan Masalah Tidak Terstruktur. *KALAMATIKA Jurnal Pendidikan Matematika*, *4*(1), 69–88. https://doi.org/10.22236/kalamatika.vol4no1.2019pp69-88

Mayhew, E., Davies, M., Millmore, A., Thompson, L., & Bizama, A. P. (2020). The impact of audience response platform mentimeter on the student and staff learning experience. *Research in Learning Technology*, *28*, 1–16. https://doi.org/10.25304/RLT.V28.2397

Merta, D. K., Rosidin, U., Abdurrahman, & Suyatna, A. (2017). The Development of Higher Order Thinking Skill (Hots) Instrument Assessment In Physics Study. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *7*(1), 1–7. https://doi.org/10.9790/7388-070103XXXX

Miller, T. (2018). Developing Numeracy Skills using Interactive Technology in a Play-Based Learning Environment. *International Journal of STEM Education*, *5*(1), 1–11. https://doi.org/10.1186/s40594-018-0135-2

Mohin, M., Kunzwa, L., & Patel, S. (2022). Using Mentimeter to Enhance Learning and Teaching in a Large Class. *International Journal of Educational Policy Research and Review*, *9*(2), 48–57. https://doi.org/10.15739/ijeprr.22.005

Mumpuni, A., Azizah, S., Rahma, S. A., Utami, D., Indah Safitri, N., Aswat Tiana, F., Kartika Putri, D. A., & Aditya Pratama, A. (2022). Pemanfaatan Barang Bekas sebagai Media Pembelajaran untuk Meningkatkan Literasi Numerasi Peserta Didik di Sekolah Dasar. *JAMU : Jurnal Abdi Masyarakat UMUS*, *3*(01), 8–14. https://doi.org/10.46772/jamu.v3i01.748

Nadiyah, R. S., & Faaizah, S. (2015). The Development of Online Project Based Collaborative Learning Using ADDIE Model. *Procedia - Social and Behavioral Sciences*, *195*, 1803–1812. https://doi.org/10.1016/j.sbspro.2015.06.392

Organization for Economic Co-operation and Development. (2023). *PISA 2022 Results Factsheets Indonesia*. https://oecdch.art/a40de1dbaf/C108.

Pichardo, J. I., López-Medina, E. F., Mancha-Cáceres, O., González-Enríquez, I., Hernández-Melián, A., Blázquez-Rodríguez, M., Jiménez, V., Logares, M., Carabantes-Alarcon, D., Ramos-Toro, M., Isorna, E., Cornejo-Valle, M., & Borrás-Gené, O. (2021). Students and teachers using mentimeter: Technological innovation to face the challenges of the covid-19 pandemic and post-pandemic in higher education. *Education Sciences*, *11*(11), 1–18. https://doi.org/10.3390/educsci11110667

Putri, V. A., Carissa, K., Sotyawardani, A., & Rafael, R. A. (2023). Peran Artificial Intelligence dalam Proses Pembelajaran Mahasiswa di Universitas Negeri Surabaya. *Prosiding Seminar Nasional*, 615–630.

Ranuharja, F., Ramadhani Fajri, B., Prasetya, F., & Dwinggo Samala, A. (2021). Development of Interactive Learning Media Edugame Using ADDIE Model. *Jurnal Teknologi Informasi Dan Pendidikan*, *14*(1), 54–60. https://doi.org/10.24036/tip.v14i1

Rudolph, J. (2018). A Brief Review of Mentimeter: A Student Response System. *Journal of Applied Learning & Teaching*, *1*(1), 35–37. https://doi.org/10.37074/jalt.2018.1.1.5

Saefurohman, S., Maryanti, R., Azizah, N. N., Fitria, D., Husaeni, A., Wulandary, V., & Irawan, A. R. (2023). 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/xxxx.xxxx

Sandy, D. N., Cholily, Y. M., Zukhrufurrohmah, Z., & Ummah, S. K. (2022). Pengembangan Flipbook Bermuatan Literasi Numerasi untuk Meningkatkan Kemampuan Komunikasi Matematis. *Jurnal Tadris Matematika*, *5*(2), 135–148. https://doi.org/10.21274/jtm.2022.5.2.135-148

Suwarma, I. R., & Apriyani, S. (2022). Explore Teachers' Skills in Developing Lesson Plan and Assessment That Oriented on Higher Order Thinking Skills (HOTS). *Journal of Innovation in Educational and Cultural Research*, *3*(2), 106–113. https://doi.org/10.46843/jiecr.v3i2.66

Winarni, S., Kumalasari, A., Marlina, M., & Rohati, R. (2021). Efektivitas Video Pembelajaran Matematika Untuk Mendukung Kemampuan Literasi Numerasi dan Digital Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 574. https://doi.org/10.24127/ajpm.v10i2.3345