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The Development of Animation-Based Learning Media on Students' Mathematical Literacy Ability

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Abstract. *This research aims to develop animation-based learning media on students' mathematical literacy abilities at MAN Bantaeng and evaluate its validity, practicality, and effectiveness. This research uses the ADDIE model consisting of analysis, design, development, implementation, and evaluation. Research instruments include validation sheets, student and teacher response questionnaires, student activity observation sheets, teacher ability observation sheets in managing learning, and mathematical literacy tests. The test subjects were 21 students. The validity of this media is in the very valid category. Practicality was assessed as very positive, with teacher responses reaching 86.11% and the teacher's ability to manage learning reaching 4.51 in the very high category. The results of the effectiveness analysis are included in the very positive category, with student responses reaching 86%, student activity during learning reaching 60% in the good category, and the level of completion of the mathematics literacy test reaching 66.67%. Thus, animation-based learning media can be used in learning because it meets the validity, practicality, and effectiveness criteria.*

Keywords: *animation, learning media, mathematical literacy*

1. Introduction

Education plays a vital role in improving the quality of existing human resources because it acts as a basis for personal, professional, and social development. The quality and competence of human resources can be obtained in various situations and conditions in society through education, which must be genuinely maintained so that a nation can prioritize education. The Indonesian Minister of Education, Culture, Research and Technology is very concerned about improving Indonesia's education quality. The country is experiencing a crisis and inequality in learning, which the COVID-19 pandemic has exacerbated over the past two years. In 2022, the Ministry of Education, Culture, Research, and Technology approved three curriculum policy options to overcome learning loss and restore learning: using the 2013 Curriculum in full, the Emergency Curriculum, or the Merdeka Curriculum.

In the Merdeka Curriculum, learning outcomes are determined by learning objectives. Educators or teachers are free to determine parameters for achieving learning objectives, which must follow the competency characteristics of the learning objectives and planned learning activities (Kemendikbudristek, 2022). One implementation of the Merdeka Curriculum is the National Literacy Movement, which aims to develop a culture of literacy in families, schools, and communities. The goal is to improve the quality of life throughout life in the education ecosystem in Indonesia (Kemendikbud, 2017).

The Ministry of Education and Culture has launched six types of literacy, one of which is numeracy literacy, which is related to mathematical literacy. This literacy ability is essential to the skills needed in the 21st century, such as critical thinking and problem-

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solving abilities. Therefore, mathematical literacy skills are critical because they can be applied in everyday life. However, based on the results of the PISA (Program for International Student Assessment) organized by the OECD (Organization for Economic Co-operation and Development) in 2018, the mathematical literacy abilities of Indonesian students have decreased compared to 2015 (Tohir, 2019). Indonesia is ranked low in mathematical literacy skills based on the results of the PISA assessment 2018, with an average score of 371 compared to the international average score of 555. It can also be seen in the TIMSS assessment 2019, where Indonesia is ranked 44th out of 49 countries with a mean score of 397 for class IV. These two assessments indicate the need for significant improvements in mathematics literacy skills in Indonesia (Prastyo, 2020). The results of tests carried out by PISA and TIMSS show that the mathematical literacy abilities of Indonesian students still need to improve.

One of the causes of students' low mathematical literacy skills is the need for more support from appropriate learning media. In the learning context, the role of learning media is vital because choosing suitable media can increase the efficiency and effectiveness of the learning process (Pambudi et al., 2018). Media use can arouse curiosity about new things and is expected to help effectively convey messages and goals (Mutia & Mulyawati, 2021).

Various types of learning media, including animation-based media, have become important in the 21st century. One tool that is often used to develop learning media is Microsoft PowerPoint. This program is commonly used by educators, making it easier for them to create and adapt learning materials, as in the case of this research. Many teachers and students with laptops already know how to use PowerPoint, making it a great educational tool (Ugwu, 2021). Mathematics subject matter, such as matrices, requires the support of learning media because students often have difficulty understanding it. This difficulty can be influenced by internal factors (such as interest, motivation, and intelligence). PowerPoint helps present these materials more interestingly and can help overcome difficulties experienced by students. Research published previously developed multimedia-based learning media for matrix learning, which was declared suitable for use as a mathematics learning media based on validation by experts and student responses (Junia et al., 2019). Then, for external factors, such as factors from the environment where social relations are not good (Khairunnisa & Slamet, 2021). Therefore, understanding students' learning difficulties in mathematics is essential for educators to use as input in improving the teaching and learning process in the classroom (Jamal, 2014).

In previous research, the analysis results showed that students' difficulties in learning matrix material were due to not understanding the questions given by the teacher, not being able to memorize formulas, and difficulties in calculating or operating matrices (Sitepu et al., 2022). Based on observation, students experience challenges in understanding matrix material, where around 40-50% of students in class XI have not mastered the material. It is caused by a lack of habituation and a lack of media that supports understanding of matrix material. Even though there are efforts to link matrix material to daily life through several related questions, students' mathematical literacy abilities still need further focus. So, the researchers provide problem-solving by developing animation-based learning media on matrix material to improve students' mathematical literacy skills.

2. Method

This Research and Development (R&D) uses the ADDIE model. The development model consists of five stages: analysis, design, development, implementation, and

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evaluation. This research uses data collection techniques in the form of validation sheets, student and teacher response questionnaires, observation, and mathematical literacy ability tests. Observation is used to monitor student activities and learning implementation. Validation sheets are used to assess the validity of products developed by validator experts. Questionnaires collect students' and teachers' views on learning media. The mathematical literacy ability test measures student learning achievement. This technique helps researchers evaluate the effectiveness of animation-based learning media in improving students' mathematical literacy skills. The data obtained using the instruments mentioned is then analyzed quantitatively. Three types of data analysis are appropriate to the data that will be collected in this research: validity, practicality, and effectiveness data analysis.

3. Results and Discussions

a. Analysis Stage

At this stage, the researchers collected data about students' learning needs and considered the characteristics of students. In this study, researchers first analyzed the curriculum used by schools to teach matrix material. Next, researchers conducted interviews with teachers who taught matrix material. The results of teacher interviews show that the learning method used is discussion. However, teachers face obstacles because only some students are active in discussions, especially those who are more competent. Researchers also conducted interviews with students. The results show that the discussion learning method is less effective because teachers rarely explain the material clearly. The learning media is limited to textbooks, and assignments are given via WhatsApp with certain processing time limits.

Researchers also conducted a literature analysis of related research. Several relevant studies show that using animation in the learning process is more effective in improving students' mathematical literacy skills than conventional learning (Umbara & Nuraeni, 2019). Apart from that, the research results conducted by Anggraeni and Rahardi (2021) stated that developing interactive learning media based on PowerPoint on a matrix is suitable for use in mathematics learning activities. Then, finally, the researchers collected initial data that could help identify students' strengths and weaknesses in understanding and applying mathematical concepts related to matrix material.

b. Design Stage

This stage involves researchers in ensuring the suitability of learning media and mathematical literacy tests to the needs and characteristics of students. The process begins with designing learning media and preparing a mathematical literacy test.

c. Development Stage

Validation Result Data

Researchers validated the learning media and research instruments developed with a team of experts. The validation results are used as a basis for making revisions based on input from the expert team so that the media and instruments can be refined before being used more widely.

1) Material Validation

In the initial stage of material validation, the material validators provide suggestions to the researchers. Revisions were made to the learning media materials based on the criticism and suggestions received. After revision, the material validator provides a re-evaluation of the material that has been developed. Data from material validation results can be seen in Table 1.

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Table 1. Learning Material Validation Results

Validation Sheet	Indicator	Score	Annotation
Learning material	Learning Aspect	3.8	Very Valid
	Content Aspect	3.75	Very Valid
Average Total Validity of Learning Materials		3.78	Very Valid

From Table 1, the average validation score by experts for learning material is 3.8 for the learning aspect and 3.75 for the content aspect. The total validity of the learning media is 3.78, indicating that this learning material is very valid.

2) Validation of Learning Media

In the learning media validation stage, the validators provide suggestions to the author, which are then used to make revisions. After the revision is complete, the validators provide a re-evaluation of the media that has been developed. Data from media validation results can be seen in Table 2.

Table 2. Learning Media Validation Results

Validation Sheet	Indicator	Evaluation	Annotation
Learning Media	Display Aspect	3.9	Very Valid
	Programming Aspect	3.67	Very Valid
Average Total Validity of Learning Media		3.79	Very Valid

The learning media validation results in Table 2 show that this media is very valid, with a total validity value of 3.79. This confirms that animation-based learning materials and media to improve mathematical literacy skills are suitable for use.

3) Validation of Research Instruments

At this stage, the instrument expert validator assesses the learning media instrument. The following table is data from the validation of research instruments by experts.

Table 3. Research Instrument Validation Results

Validation Sheet	Indikator	Evaluation	Annotation
Student Response Questionnaire	1. Instructional Aspect	4	Very Valid
	2. Language Aspect	3.83	Very Valid
	3. Content Aspect	4	Very Valid
	Average	3.95	Very Valid
Teacher Response Questionnaire	1. Instructional Aspect	4	Very Valid
	2. Language Aspect	3.75	Very Valid
	3. Content Aspect	4	Very Valid
	Average	3.92	Very Valid
Student Activities	1. Instructional Aspect	4	Very Valid
	2. Language Aspect	4	Very Valid
	3. Content Aspect	4	Very Valid
	Average	4	Very Valid
Teacher Activity to Manage Learning	1. Instructional Aspect	4	Very Valid
	2. Language Aspect	3.78	Very Valid
	3. Content Aspect	4	Very Valid
	Average	3.93	Very Valid
Mathematical Literacy Test	1. Matrix Concept	4	Very Valid
	2. Matrix Operations	3.67	Very Valid
	3. Matrix Properties	3.67	Very Valid
	4. Determinants (Sarrus Method)	4	Very Valid
	5. Determinants (Cofactor dan Inverse Method)	4	Very Valid
	Average	3.87	Very Valid
Average Instrument Validity		3.93	Very Valid

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As seen in Table 3, the assessment results by experts show that all indicators for each instrument sheet used are categorized as very valid. Each aspect of the device type achieves an average above 3.93.

Product Revision

The revision stage of the matrix learning media was carried out to improve its quality by overcoming typing errors, improving animation movements, and correcting navigation button problems based on suggestions from a team of expert validators. The goal is so that students can learn mathematics well in matrix material.

d. Implementation Stage

Trials of learning media developed by researchers were carried out at MAN Bantaeng in 7 meetings. The trial was carried out in class XI MIA with 21 students. The trial aims to determine the practicality and effectiveness of the learning media being developed.

The Practicality of Learning Media

1) Teacher observation sheet in managing learning
   Based on the analysis of the learning management observation sheet, the total average result for each aspect of learning activities is 4.51, meaning that the teacher can manage learning well using learning media as expected.
2) Teacher response questionnaire sheet
   Based on the teacher response questionnaire sheet, it is known that the percentage of teacher responses obtained was 86.11% in the very positive category. Based on the results of this analysis, it can be shown that learning media meets practical criteria.

Effectiveness of Learning Media

1) Student activity observation sheet
   The activities carried out by students during the learning process, which are directly observed by observers, consist of 2 activities. Based on the results of the analysis of student activity, it was found that the average percentage of overall student activity was 60%, which means that student activity was in the good category.
2) Student response sheet
   Student response questionnaires are given after the entire series of learning activities have been carried out. Based on the analysis of student responses, an average of 58.33 was obtained with a percentage of 86% which means that student responses were very positive.
3) Mathematical literacy test
   The mathematical literacy ability test is carried out using a written test, and the results are then checked based on the assessment rubric that has been prepared previously. The results of the analysis of the mathematical literacy written test were obtained as follows:

Table 4. Mathematical Literacy Test Completion Percentage

Score	Category	Frequency	Percentage
$\geq$ **75**	Complete	14	66.67%
$<$ **75**	Incomplete	7	33.33%

Table 4 shows that 14 students took the test and were declared complete, with an

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average percentage of 66.67%. As many as seven students who took the test were declared incomplete, with an average percentage of 33.33% of the total students who took the mathematical literacy written test.

e. Evaluation Stage

At this stage, an evaluation is based on input after the learning media trial process. Only minor revisions are made to the learning media to improve deficiencies during the testing process. Thus, there are no major changes to the learning media at this stage.

Quality of Learning Media

The Validity Level

Based on the validator's assessment, this learning media was declared valid for development with an average score for all validity aspects of 3.93 in the very valid category. From the validity score obtained by previous research, the level of validity of learning media is in the very valid category. From research conducted by Damayanti dan Qohar (2019), the results of the validity level analysis were obtained for the validity of the learning media developed that met the valid criteria. The media developed is PowerPoint-based interactive mathematics learning media on cone material. From the validation results by media experts, an assessment showed it was valid, which means it was suitable for use. The results of the media validity analysis in research conducted by Anggraeni dan Rahardi (2021) meet the very valid criteria based on the results of the validator assessment. The research developed is PowerPoint-based interactive learning media on matrices for class XI high school mathematics learning.

This animation-based learning media is designed to achieve learning objectives to improve students' mathematical literacy skills. Learning media that can be used in the trial stage first goes through an assessment stage by the validator.

The Practicality Level

From the teacher response questionnaire results, the researchers obtained a percentage of 86.11%, which was in the very positive category. The media's practicality level is measured based on the teacher's response and the teacher's ability to manage learning.

Therefore, it is practical based on the assessment of teacher responses and the teacher's ability to manage learning. This is in line with research conducted by Mutia dan Mulyawati (2021), where the results of validation of the practicality of learning media by experts were in the practical category. The product that was developed was learning media on three-dimensional space material via PowerPoint.

The Effectiveness Level

The analysis results show that student activity reaches 60%, which is included in the good category. Student responses reached 86%, included in the very positive category. Teachers' ability to manage learning averages is 4.51, included in the very high category. The analysis results of students' mathematical literacy tests show that of the 21 students, 66.67% completed this test, while the remaining 33.33% did not complete it. The effectiveness of learning media is assessed based on data analysis of student activities, student responses, and mathematical literacy ability tests. The same thing was explained by Hanafiah dan Suhana (2014), who said that the effectiveness of learning media will be measured based on the analysis of student activity observations, student responses, and tests of students' mathematical literacy abilities.

Research conducted by Amalia et al. (2021), developed e-books on mathematics learning to improve students' mathematical literacy skills, which were able to improve

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students' mathematical literacy skills. Apart from that, research conducted by Umbara dan Nuraeni (2019) examined the implementation of RME based on Adobe Flash Professional CS6 in improving mathematical literacy skills. In research conducted using Adobe Flash Professional CS6, one animation creation software improved students' mathematical literacy skills.

The results of tests on the validity, practicality and effectiveness of animation-based learning media in matrix material show that this media meets the established criteria. Therefore, this learning media is considered quality or suitable for use in the learning process to improve mathematical literacy skills.

This research indicates that the animation-based learning media developed for matrix material has followed a good development process using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. This model is an iterative instructional design method where the instructional designer can return to previous steps based on formative evaluations conducted during the process (Aldoobie, 2015). The ADDIE model is often used to design training learning, and development programs in institutions (Vullpen, 2023). Through this development process, it can be seen based on its validity, practicality and effectiveness to determine the feasibility of the learning media being developed (Syafmen & Indri, 2023).

The validity of this media is very high, as evidenced by the average value of 3.93 from the validator team's validation, which is in the very valid category with a value range of 3.5 to 4. Validity is an important concept in research, which refers to how accurately a method measures what you want to measure. High validity means the research provides results corresponding to real properties, characteristics and variations in the physical or social world (Middleton, 2019). Apart from that, this media also shows very good practicality, with a positive response from teachers (86.11%) and high implementation (1.52 points), indicating that this media has been successfully implemented. A learning media is suitable for use if it is practical and easy to use (Saputra, Abidin, Ansari, & Hidayat, 2018).

Furthermore, the analysis results show that this learning media effectively improves students' mathematical literacy skills. Student responses were very positive, with a percentage reaching 86%, and student activity during the learning process was in a good category, reaching 60%. In addition, the completion rate of the mathematics literacy test reached 66.67%, showing a significant increase in understanding of matrix material. Based on research conducted by Efendi, Supriadi and Nuraini (2021, p. 65) stated that using animation media in PowerPoint was more facilitative than before using this media. This is because PowerPoint animations provide illustrations to students, which make it easier for them to understand the material presented. Then, the same thing was expressed by Istyadji, Sauqina, Hafizhah, and Fahmi, (2022:482) that PowerPoint animation learning media can illustrate the material more clearly. A learning media can be considered suitable for use if its suitability has been evaluated and declared appropriate (Risdianto et al., 2022)

Animation-based learning media for matrix material has proven high quality because it meets the validity, practicality and effectiveness criteria. This media can be a very useful tool in the learning process, helping students improve their mathematical literacy skills and providing effective support to teachers in managing learning.

4. Conclusions

Research on developing animation-based learning media for matrix material on

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students' mathematical literacy abilities follows the ADDIE model. The development process starts from problem analysis, media design, development, and implementation to evaluating the feasibility of using media in learning. Based on the assessment by the validator, animation-based learning media for matrix material on students' mathematical literacy abilities was declared a very valid category. Practicality was evaluated based on teacher responses in the very positive category and teachers' ability to manage learning in the very high category). Effectiveness is assessed through student activities in the good category), student responses in the very positive category, and the results of the mathematics literacy test (66.67% completed the test). In conclusion, animation-based learning media for matrix material has proven valid, practical, and effective in improving students' mathematical literacy skills at MAN Bantaeng.

5. References

Aldoobie, N. (2015). ADDIE Model. American International Journal of Contemporary Research, 5(6). Retrieved from www. aijcrnet.com/journals/Vol_5_No_6_December_2015/10.pdf

Amalia, R., Fadilah, F., Komarudin, M., & Kusuma, J. W. (2021). Development of Mathematics E-Books in Improving Mathematical Literacy and Entrepreneurial Spirit. AL-ISHLAH: Jurnal Pendidikan, 13(3), 2425–2434. https://doi.org/10.35445/alishlah.v13i3.987

Anggraeni, K. N., & Rahardi, R. (2021). Pengembangan Media Pembelajaran Interaktif Berbasis Powerpoint pada Matriks untuk Pembelajaran Matematika Siswa SMA Kelas XI. Prosiding Seminar Nasional Matematika dan Pembelajarannya, 314–321. Retrieved from http://conference.um.ac.id/index.php/snmp/article/view/3024

Damayanti, P. A., & Qohar, A. (2019). Pengembangan Media Pembelajaran Matematika Interaktif Berbasis Powerpoint pada Materi Kerucut. Kreano, Jurnal Matematika Kreatif-Inovatif, 10(2), 119–124. https://doi.org/10.15294/kreano.v10i2.16814

Efendi, D. N., Supriadi, B., & Nuraini, L. (2021). Development of the powerpoint animation learning media on the heat topic. Gravity : Jurnal Ilmiah Penelitian Dan Pembelajaran Fisika, 7(2), 61–67. https://doi.org/10.30870/gravity.v7i2.10820

Hanafiah, N., & Suhana, C. (2014). Konsep Strategi Pembelajaran (H. Sofiyanto, Ed.). Bandung: Refika Aditama.

Istyadji, M., Sauqina, Hafizhah, D., & Fahmi. (2022). Validity and Practicality of Prezi Learning Media on the Role of Soil and Soil Organisms for Life Sustainability for Junior High School Students. Jurnal Penelitian Pendidikan IPA, 8(2), 481–488. https://doi.org/10.29303/jppipa.v8i2.1158

Jamal, F. (2014). Analisis Kesulitan Belajar Siswa Pada Materi Peluang | 18. Jurnal MAJU (Jurnal Pendidikan Matematika), 1(1), 18–36. Retrieved from https://ejournal.stkipbbm.ac.id/index.php/mtk/article/view/579

Junia Sandy, R., & Murtiyasa, B. (2019). Developing a multimedia-based learning media for learning matrix transformation. Journal of Physics: Conference Series, 1265(1). https://doi.org/10.1088/1742-6596/1265/1/012020

Khairunnisa, K., & Slamet, H. W. (2021). Analisis Kesulitan Siswa Kelas XI Pada Materi Matriks Dalam Pembelajaran Online di SMA Negeri 4 Pekalongan Tahun Ajaran

Proceeding of ICMR 6(1), 43-51 DOI: https://doi.org/10.32672/picmr.v6i1.749

2020/2021. Retrieved from http://eprints.ums.ac.id/id/eprint/90908%0Ahttp://eprints.ums.ac.id/90908/1/NASKAH PUBLIKASI kirana.pdf

Middleton, F. (2019). Reliability vs. Validity in Research Difference, Types and Examples.

Mutia, W. S., & Mulyawati, I. (2021). Pengembangan Media Pembelajaran Matematika Pada Materi Bangun Ruang Melalui Animasi Power Point Terhadap Siswa Kelas V Sdn Parung Panjang 06. Elementary School: Jurnal Pendidikan Dan Pembelajaran Ke-SD-An, 8(2), 351–360. https://doi.org/10.31316/esjurnal.v8i2.1514

Pambudi, D., Wulandari, A. N., & Sutopo. (2018). Upaya Meningkatkan Kemampuan Guru SD dalam Pembuatan Media Pembelajaran Interaktif Berbasis TIK untuk Meningkatkan Literasi Matematika Siswa. Jurnal Pendidikan Matematika Dan Matematika (JPMM) Solusi, 2(5), 371–376.

Prastyo, H. (2020). Kemampuan Matematika Siswa Indonesia Berdasarkan TIMSS. Jurnal Padegogik, 3(2), 111–117. https://doi.org/10.35974/jpd.v3i2.2367

Risdianto, E., Wachidi, W., Riyanto, R., Fathurochman, I., Yanto, M., & Asmara, A. (2022). Feasibility Test of Learning Media with Blended Learning Model and Augmented Reality-Assisted MOOCs. Jurnal Ilmiah Peuradeun, 10(1). https://doi.org/10.26811/peuradeun.v10i1.626

Saputra, M., Abidin, T. F., Ansari, B. I., & Hidayat, M. (2018). The feasibility of an Android-based pocketbook as mathematics learning media in senior high school. Journal of Physics: Conference Series, 1088. https://doi.org/10.1088/1742-6596/1088/1/012056

Sitepu, E., Vega, R. R., Mardiati, Sitepu, D. R., & Afni, K. (2022). Analisis Kesulitan Belajar Siswa dalam Pembelajaran Matematika pada Pokok Bahasan Matriks Siswa Kelas XI SMK Swasra Bintang Langkat. Jurnal Serunai Matematika, 14(2), 136–139. https://doi.org/https://doi.org/10.37755/jsm.v14i2.696

Syafmen, W., & Indri, S. (2023). Development of M-Learning Media Illustrated Crossword Puzzles to Increase Learning Motivation for Middle School Students. Journal of Educational Science and Technology, 9(2), 111–117.

Tohir, M. (2019). Hasil PISA Indonesia Tahun 2018 Turun Dibanding Tahun 2015. Paper of Matematohir, 2(1), 1–2. Retrieved from https://matematohir.wordpress.com/2019/12/03/hasil-pisa-indonesia-tahun-2018-turun-dibanding-tahun-2015/

Ugwu, P. (2021). Microsoft PowerPoint for Teaching and Learning. Retrieved January 8, 2023, from Lingked In website: https://www.linkedin.com/pulse/microsoft-powerpoint-teaching-learning-pat-ugwu-ii

Umbara, U., & Nuraeni, Z. (2019). Implementation of Realistic Mathematics Education Based on Adobe Flash Professional CS6 To Improve Mathematical Literacy. Infinity Journal, 8(2), 167. https://doi.org/10.22460/infinity.v8i2.p167-178

Vullpen, E. Van. (2023). Understanding the ADDIE Model: All You Need to Know. Retrieved January 8, 2023, from Academy to Innovate HR (AIHR) website: https://www.aihr.com/blog/addie-model/