Designing Worksheets for Circle Material to Improve Students' Numeracy Skills

Siti Magfiroh[1*], Nafida Hetty Marhaeni[2]
[1]Mathematics Education, Universitas Mercu Buana Yogyakarta, Indonesia
[2]Mathematics Education, Universitas Mercu Buana Yogyakarta, Indonesia
*Email: smagfiroh576@gmail.com

ABSTRACT

Numeracy is the ability to use numbers, data, and mathematical symbols, as well as knowledge and skills in making decisions related to real-life problems. In the current learning era, students are challenged to enhance their numeracy skills. Therefore, instructional materials that can accommodate this need are essential. Hence, the purpose of this research is to develop student worksheets on the circle to improve the numeracy skills of eleventh-grader students in a public school in Yogyakarta. This study employs a research and development approach using the ADDIE model (Analyzing, Designing, Developing, Implementing, and Evaluating). Data collection techniques include interviews, observations, questionnaires, numeracy skills tests, expert material validation questionnaires, and expert media validation questionnaires. The sources of data in this study are eleventh-grader students in a public school in Yogyakarta, Indonesia, two material expert validators, and two media expert validators. The curriculum, learning model, learning resources, and student characteristics become the objects of this research. The results of this study indicate that: (1) students' numeracy skills are in the medium category, necessitating an analysis of the need for students worksheets to improve these skills; (2) the researched developed student worksheets containing covers, introductions, learning achievement, learning objectives, content, bibliography, and authors identity; (3) the media design results were then validated by material and media experts, indicating that all experts stated that the media is in the good category, making it valid for use. This research will proceed to the implementation and evaluation stages.

Keywords: *Students worksheet, numeracy skills, circle material*

INTRODUCTION

Numeracy is one of the skills established by UNESCO in 2006 as a determinant of a nation's progress (Kemendikbud, 2017). Baharuddin et al. (2021) define numeracy as the knowledge and skill of using various types of numbers and symbols related to basic mathematics to solve practical problems in various contexts of everyday life, analyze information presented in various forms (graphs, tables, maps, etc.), and use interpretation to predict and make decisions. Meanwhile, Ekowati et al. (2019) state that numeracy is the ability of an individual to formulate, apply, and interpret mathematics in various contexts, including the ability to reason mathematically, use concepts, procedures, and facts to describe, explain, or estimate phenomena/events. Numeracy skills are highly important for students because these skills are closely related to solving mathematical problems in everyday life (Pangesti, 2018).

The importance of numeracy skills for the sustainability and progress of a nation necessitates the enhancement of students' numeracy abilities. However, the significance of students' numeracy skills does not align consistently with the results of studies or research related to the numeracy abilities of students in Indonesia. The PISA study results indicate that the numeracy skills of Indonesian students are still relatively low, placing Indonesia at 72 out of 79 participating countries. The test results show that the average scores of students are 371 in reading, 379 in mathematics, and 396 in science. These scores are below the average of the 79 participating PISA countries, which are 487 for reading ability, and 489 for mathematics and science abilities (OECD, 2017).

Challenges faced by students in improving their numeracy skills include several factors, such as: (1) Difficulty in Linking Mathematical Concepts to Daily Life: Students find it challenging to relate mathematical concepts to everyday life, making mathematics an abstract subject that is difficult to

understand. (2) Lack of Understanding of Basic Mathematical Concepts: Insufficient understanding of fundamental mathematical concepts such as addition, subtraction, multiplication, and division impedes students from grasping complex materials. (3) Differences in Learning Styles: Variations in students' learning styles within the classroom; some students are more effective when learning through visual approaches, while others excel with hands-on, practical methods. (4) Limitations in Teaching Methods: Monotonous and non-interactive teaching methods make it more difficult for students to understand mathematical concepts and may diminish their interest in learning mathematics.

Various efforts are made by teachers to address these issues. One of the efforts that teachers can undertake to enhance students' numeracy skills is by creating engaging and interactive teaching methods and instructional materials. One instructional material that can be used to improve numeracy skills is Student Worksheets (LKPD). LKPD is a learning tool consisting of a series of questions and information designed to understand complex ideas, guiding students to regularly carry out activities (Effendi et al., 2021). Meanwhile, according to Khotimah et al. (2015), LKPD not only contains questions but also a collection of activities within the learning process. Thus, it can be concluded that student worksheets are sheets containing materials, explanations, work steps, and exercises that should be completed by students. LKPD becomes an alternative to enhance students' numeracy skills (Miftah & Setyaningsih, 2022). The presentation of LKPD can be developed through various innovations (Intannia & Usmeldi, 2022).

Two-way learning-based student worksheets (Reciprocal Teaching) can help students in improving their numeracy skills. In this approach, students are required to be more active in classroom learning and are expected to comprehend complex materials, enabling them to explain the understood material to their peers. Subsequently, students can draw conclusions from the learning process. The plan to use two-way learning-based student worksheets as teaching materials to enhance students' numeracy skills received a highly positive response from the students. Therefore, the objective of this research is to validate the development of student worksheets on circle materials to enhance students' numeracy skills.

METHOD

This research is a research and development study following the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The aim of this study is to analyze students' needs for teaching materials that can facilitate an improvement in mathematical numeracy skills and to determine the validity of the product. The data sources for this research include 36 students from the 11th grade at SMA N 4 Yogyakarta, Indonesia, two expert content validators, and two expert media validators. The research was conducted between October and November 2023. Data collection techniques involved interviews, observations, questionnaires, numeracy ability tests, media expert validation questionnaires, and content expert validation questionnaires. Observations took place within the classroom during the learning process, while interviews were conducted with mathematics teachers of the 11th grade at SMA N 4 Yogyakarta regarding the curriculum, teaching methods, student characteristics, challenges during mathematics lessons, and the need for mathematical teaching materials. Tests were carried out to assess students' numeracy skills. Questionnaires were used to determine the teaching materials used by students during lessons and their preferences. Validation questionnaires were used to assess the validity score of the developed product, where if the total score falls within the good category, the product is considered valid. The research will proceed to the implementation and evaluation phases.
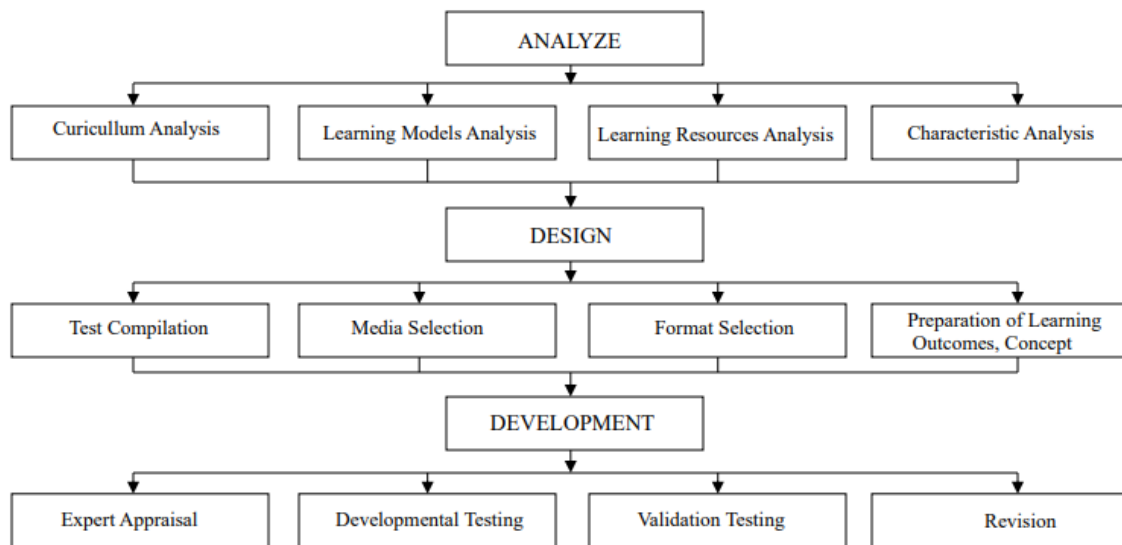
Figure 1. Development Course

RESULT AND DISCUSSION

The development model utilized in this research is the ADDIE model. The ADDIE model is one of the systematic learning models. The selection of this model is based on the consideration that it is regularly developed and grounded in learning design theory. This model consists of five steps: 1) analysis, 2) design, 3) development, 4) implementation, and 5) evaluation. Here are the findings of the research.

- Analyze

  The analysis stage conducted by the researcher aimed to analyze the curriculum used, teaching methods, learning resources, and the characteristics of 11th-grade students at SMA N 4 Yogyakarta. To gather the necessary data to maximize this analysis stage, the researcher conducted interviews, observations, surveys, and administered a preliminary test to assess the students' numeracy skills. During the observation stage, the researcher observed the students during the mathematics learning process. Interviews were conducted with mathematics teachers to understand the curriculum, student characteristics, and challenges during mathematics lessons. Questionnaires were given to identify the teaching materials used by students and their preferred learning media. Furthermore, administering the test involved presenting problems related to circle topics to assess the students' numeracy levels.

- Curiculum Analysis

  According to Law Number 20 of 2003 regarding the National Education System, the curriculum refers to a set of plans and arrangements concerning objectives, content, teaching materials, and methods used as guidelines for organizing learning activities to achieve specific educational goals. The curriculum is a crucial aspect influencing the progress and success of education. A good and appropriate curriculum facilitates the attainment of educational goals and targets, whether they are formal, informal, or non-formal. The purpose of this curriculum analysis is to understand the curriculum used during the learning process. Based on the interviews and observations conducted by the researcher, it was determined that the curriculum utilized in the 11th grade at SMA N 4 Yogyakarta, Indonesia, follows the 'Merdeka' curriculum. In practice, teachers create teaching modules containing lesson plans, learning outcomes, and educational objectives. Based on the curriculum in use, here are the learning outcomes for the circle topics of 11th-grade students at SMA N 4 Yogyakarta.

Table 1. The Learning Outcomes

| No	Learning Outcomes
1.	Developing students' ability to identify patterns, create hypotheses, and provide proof-based arguments through topics related to the theorems associated with circles.
2.	Applying circle theories in solving related problems.

- Learning Model Analysis

  Based on the observation results, the teaching method utilized involves lectures and question-answer sessions. From the interview findings, it's evident that this teaching model cannot be considered as an effective teaching method yet, as students are still relatively passive in responding to posed questions. Thus, it can be concluded that the current teaching method is not entirely effective in enhancing students' numeracy skills.

- Analysis of Learning Resources

  Based on the observations and interviews, it's noted that the teaching materials used in the mathematics learning process are student and teacher handbooks issued by the government, alongside modules as supplementary books. However, both these materials are not quite effective in enhancing the numeracy skills of the students.

- Analysis of Student Characteristics

  The analysis of student characteristics was conducted to understand the traits, activities, and challenges students face during the mathematics learning process. Based on interviews with teachers, the researcher discovered that students tend to be passive and easily bored during mathematics lessons. They exhibit a lack of focus throughout the learning process. Additionally, according to survey results, 81% of students found mathematics challenging to understand.
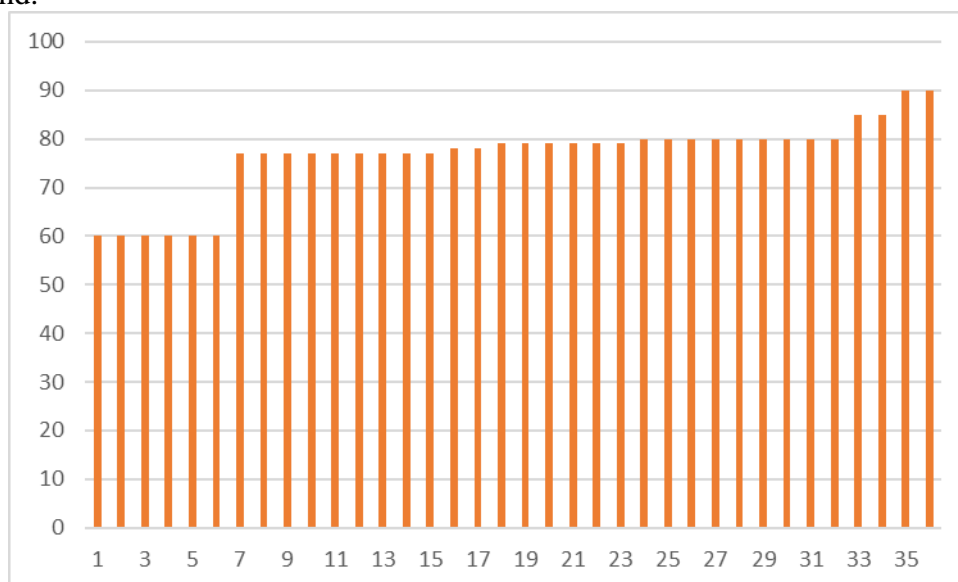
Figure 2. Result of Test Scores Numerasi

Furthermore, based on the numeracy test results consisting of 3 essay questions, it was found that the numeracy skills of the students fell into the moderate category. The average score obtained for the numeracy skills test was 79.03, which fell within the moderate category. With the Minimum Mastery Criteria (KKM) set by the school at 70, it can be said that, on average, the students' numeracy skills fall into the high category. However, according to interviews with several students, they still perceive mathematics topics as challenging to comprehend. Based on the student responses, it was found that 61% of the students were interested in using Reciprocal Teaching-based worksheets (LKPD) as teaching materials to enhance students' numeracy skills.

1. Design

   The design phase is where the researcher creates a product design based on the analysis conducted earlier. In this stage, the researcher selects the product to be developed, which is a worksheet (LKPD) on circle topics. Then, the researcher creates the framework and content of the worksheet is aligned with the learning outcomes that have been established. The student worksheet includes concept comprehension indicators such as interpreting, summarizing, exemplifying, classifying, and comparing. Draft 1 represents the initial design outcome.

a. Cover

The cover is titled "Student Worksheets; circle material for Senior High School; Grade XI." The student worksheets are designed with numeracy skill indicators for circle material in Grade XI of Senior High School. The cover is depicted in Figure 3.

b. Learning outcomes and objectives

Learning outcomes and objectives that students need to achieve are based on the curriculum analysis. These learning outcomes can be seen in Figure 4.

c. Triggering questions and materials

Triggering questions and material are aligned with the sub-topics being discussed. These can be seen in Figure 5.

d. Material

The material is aligned with the teaching model used by the researcher. This can be seen in Figures 6-8.

e. Exercises

The exercises are tailored to numeracy skill indicators as shown in Figures 9 and 11.

f. Discussion

Discussions are aligned with numeracy skill indicators as shown in Figure 10.

g. Author's identity

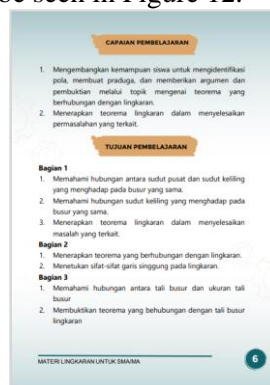The author's identity can be seen in Figure 12.

Figure 3. Cover

Figure 4. Learning Outcomes

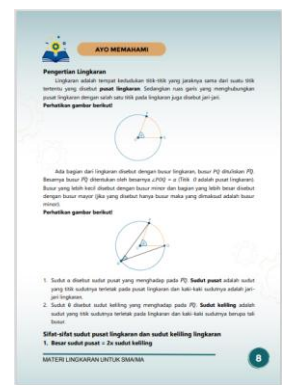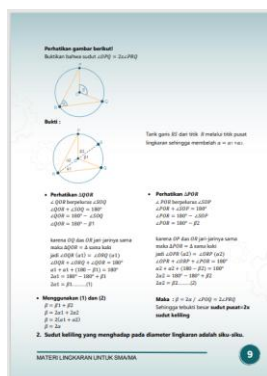**Figure 5. Materials and Triggering Questions**

Figure 6. Materials

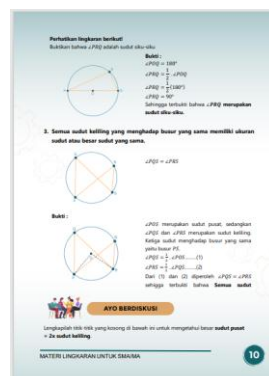**Figure 7. Materials**

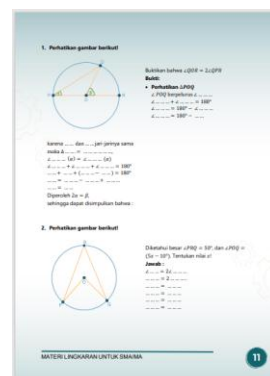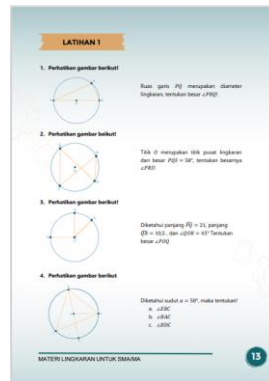**Figure r 8. Materials and discussion**

Figure 9. Discussion Questions

Figure 10. Discussion Method

Figure 11. Exercise Questions　　**Figurer 12. Author's Identity**

2. Development

In the development phase, the researcher carried out design specifications in the physical form, resulting in the development product as student worksheets to enhance numeracy skills. Aside from developing the product, the researcher also devised instruments for subject matter expert validity, media expert validity , student response questionnaire, as well as pretest and posttest instruments for numeracy skills. Based on the validation results by validators, both media and subject matter experts confirmed the instruments as valid and suitable for use. Subsequently, the researcher continued with the worksheet (LKPD) validation. Below are summarized feedback and suggestions outlined in Tables 2 and 3.

Table 2. Feedback and Suggestions from Material Expert and Follow-Up

No	Feedback and Suggestions	Follow-Up
1.	Worksheet for Sub-Chapter 1 are supplemented with material	Material has been provided
2.	Provided example Questions	Example quostions have been given
3.	Aligned with the learning objectives	Adjusted accordingly
4.	Improve inappropriate wording	Improved

Table 3. Feedback and Suggestions from Media Expert and Follow-Up

No	Feedback and Suggestions	Follow-Up
1.	The cover presentations should be more diverse	Made more diverse
2.	Entarge the title of the worksheet	Enlarged
3.	Enhance supportive images	Made more supportive
4.	Bolden sub headings	Boldened
5.	Ensure proportional numbering and ilustrations	Improved

The results of the assessment of worksheet (LKpd) design validation were obtained from the validation of instructional media design using the Likert Scale. The Likert Scale is used to measure a particular issue. After validating the obtained results, they are then compared to the ideal assessment criteria in Table 4 for content and Table 5 for media..

Tabel 4. Ideal assessment Criteris for Material

No	Score	Criteria
1	Very Less	$X \leq 77$
2	Less	$77 < X \leq 112$
3	Enough	$112 < X \leq 146$
4	Good	$146 < X \leq 181$
5	Very Good	$181 < X \leq 216$

Tabel 5. Ideal assessment Criteris for Media

No	Score	Criteria
1	Very Less	$X \leq 47$
2	Less	$47 < X \leq 68$
3	Enough	$68 < X \leq 88$
4	Good	$88 < X \leq 109$
5	Very Good	$109 < X \leq 130$

The validation results of the worksheet (LKPD) design were conducted by two media experts, namely Dr. Suharno and Ardhika Fajar Ramadhan, S.Pd. Meanwhile, the subject matter expert validators were Sevina Indriani, S.Pd, and Krisna Wardhani, S.Pd. The validation results from these four experts are presented in Tables 6 and 7.

Tabel 6. Result of Validation from Material Expert

Validator	Position	Score	Criteria
Krisna Wardhani, S.Pd	Teacher at SMA N 4 Yogyakarta	171	Good
Sevina Indriani, S.Pd	Teacher at SMKS Muhammadiyah Sungailiat	177	Good
Number of Score		**348**	
Average Score		**174**	
Criteria		**Good**	

Tabel 7. Result of Validation from media Expert

Validator	Position	Score	Criteria
Dr. Suharno, S.Pd., S.Pd.T., M.Pd	Lecturer at Mercu Buana University Yogyakarta	116	Good
Ardhika Fajar Ramadhan, S.Pd	Learning Media Expert	90	Good
Number of Score		**206**	
Average Score		**103**	
Criteria		**Good**	

In Tables 6 and 7, the design of the LKPD development product is deemed valid as all aspects fall within the good category. As a result, this learning media can be utilized by students to enhance their numeracy skills.

Discussion

The objective of this research is to develop learning media in the form of worksheets (LKPD) that are deemed valid for use by media and subject matter experts. During the assessment phase, the researcher considered input from students regarding media preferences that could enhance students' numeracy skills. Thus, the developed media contains stimulating questions, sample problems, and exercise questions tailored to students' preferences. In the development phase, the researcher sought opinions from two subject matter expert validators and two media expert validators. Subject matter experts provided input and suggestions: (1) Some images need clarification, (2) Some instruction sentences need to be more effective, (3) Some elements need tidying up. Based on these inputs, revisions were made after discussions with validators, rendering the product valid for use. Additionally, the two media expert validators suggestions provided: (1) More variety in the cover, (2) Consistency in elements, (3) Enlarging the title on the cover, (4) Ensuring proportional illustrations, (5) Reducing the size of numbering. These suggestions were also revised and improved. From the validators' perspective, the product has been declared valid for use. These considerations guided the researcher in designing worksheets (LKPD) to improve the numeracy skills of 11th-grade students. This decision was supported by similar research conducted by Mayang Vita Sara, Rusydi Ananda, Yahfizham (2022) entitled "Development of Reciprocal Teaching-Based Student Worksheets on Matrix Material for Grade XI," using the 4-D development model. The practicality test resulted in a percentage score of 82.8%, indicating practicality. Furthermore, the effectiveness test showed a classical learning completeness result of 80% (students scoring ≥ 75), with a 44% improvement in student learning outcomes. Thus, the use of Reciprocal Teaching-based LKPD is highly effective in learning.

CONCLUSION

Based on the research findings, it is indicated that (1) The numeracy skills of the students fall within the moderate category. However, based on interviews with students, they still perceive mathematics learning as challenging to comprehend. Hence, teaching materials (LKPD) were developed to improve numeracy skills. (2) The creation of teaching materials (LKPD) involves using Canva and then converting it to Word for completion. (3) LKPD includes a cover, introduction, content, exercises, and numeracy indicators covering information analysis, the use of mathematical symbols, and interpreting results to draw conclusions. (4) Validation results from subject matter experts and media experts indicate that the product is valid, with an average rating falling within the good category. The first subject matter expert scored 171, and the second scored 177. The first media expert scored 116, while the second media expert scored 90. The research will proceed to the implementation and evaluation stages.

REFERENCES

Baharuddin, M. R., Sukmawati, S., & Christy, C. (2021). Deskripsi Kemampuan Numerasi Siswa dalam Menyelesaikan Operasi Pecahan. *Pedagogy: Jurnal Pendidikan Matematika*, *6*(2), 90-101.

Basri, H., Kurnadi, B., Tafriliyanto, C. F., & Nugroho, P. B. (2021). Investigasi kemampuan numerasi mahasiswa calon guru matematika. *Proximal: Jurnal Penelitian Matematika Dan Pendidikan Matematika*, *4*(2), 72-79.

Cahyanovianty, A. D., & Wahidin, W. (2021). Analisis kemampan numerasi peserta didik kelas viii dalam menyelesaikan soal asesmen kompetensi minimum (AKM). *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(2), 1439-1448.

Dantes, N., & Handayani, N. N. L. (2021). Peningkatan literasi sekolah dan literasi numerasi melalui model blanded learning pada siswa kelas v sd kota singaraja. *Widyalaya: Jurnal Ilmu Pendidikan*, *1*(3), 269-283.

Effendi, R., Herpratiwi, H., & Sutiarso, S. (2021). Pengembangan LKPD Matematika Berbasis Problem Based Learning di Sekolah Dasar. *Jurnal Basicedu*, *5*(2), 920-929.

Eka, S. (2022). *Pengembangan bahan ajar modul berbasis literasi bahasa dan numerasi dikelas IV SD* (Doctoral dissertation, UIN Raden Intan Lampung).

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), 93-103.

Fauzanah, A. E. (2022). *Analisis kemampuan literasi numerasi siswa dalam menyelesaikan masalah pecahan* (Doctoral dissertation, Universitas Islam Sultan Agung Semarang).

Hidayati, B. N., & Zulandri, Z. (2021). Efektifitas LKPD Elektronik sebagai Media Pembelajaran pada Masa Pandemi Covid-19 untuk Guru di YPI Bidayatul Hidayah Ampenan. *Jurnal Pengabdian Magister Pendidikan IPA*, *4*(2).

Huda, N. (2017). Manajemen Pengembangan Kurikulum. *Al-Tanzim: Jurnal Manajemen Pendidikan Islam*, *1*(2), 52-75.

Indriani, S., Nuryadi, N., & Marhaeni, N. H. (2021, December). Student's worksheet design assisted with liveworksheets to improve student's concept understanding skills on quadrilaterals and triangles. In *Multidiscipline International Conference* (Vol. 1, No. 1, pp. 462-469).

Intannia, R., & Usmeldi, U. (2020). Pengembangan Lembar Kegiatan Peserta Didik Berbasis Masalah pada Mata Pelajaran Dasar Listrik dan Elektronika di SMK. *JTEV (Jurnal Teknik Elektro dan Vokasional)*, *6*(2), 279-284.

Jayanti, M. P., Zulkardi, M. I., Putri, R. I. I., & Hartono, Y. *Numerasi Pembelajaran Matematika Sd Berbasis E-Learning*. Bening Media Publishing.

Lestari, F., Muttaqien, A., & Hamamy, F. (2023). Upaya Guru dalam Meningkatkan Kemampuan Literasi Numerasi Pada Siswa Kelas V di SDN Lebaksari Sukabumi. *Indo-MathEdu Intellectuals Journal*, *4*(2), 705-713.

Miftah, R. N., & Setyaningsih, R. (2022). Pengembangan LKPD berbasis asesmen kompetensi minimum (AKM) pada materi geometri untuk meningkatkan kemampuan literasi numerasi. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(3), 2199-2208.

Nurhakim, L. (2023). *Analisis Kemampuan Numerasi Peserta Didik Dalam Menyelesaikan Soal Model Asesmen Kompetensi Minimum Ditinjau Dari Kecerdasan Emosional* (Doctoral Dissertation, Universitas Siliwangi).

Nurliawaty, L., Mujasam, M., Yusuf, I., & Widyaningsih, S. W. (2017). Lembar kerja peserta didik (LKPD) berbasis problem solving polya. *Jpi (jurnal pendidikan indonesia)*, *6*(1), 72-81.

Rayanto, Y. H. (2020). *Penelitian Pengembangan Model Addie Dan R2d2: Teori & Praktek*. Lembaga Academic & Research Institute.

Salvia, N. Z., Sabrina, F. P., & Maula, I. (2022, January). Analisis kemampuan literasi numerasi peserta didik ditinjau dari kecemasan matematika. In *ProSANDIKA UNIKAL (Prosiding Seminar Nasional Pendidikan Matematika Universitas Pekalongan)* (Vol. 3, No. 1, pp. 351-360).

Sara, M. V., & Ananda, R. (2022). Pengembangan Lembar Kerja Peserta Didik Berbasis Reciprocal Teaching Materi Matriks Kelas Xi. *Relevan: Jurnal Pendidikan Matematika*, *2*(3), 335-339.

Siskawati, F. S., Chandra, F. E., & Irawati, T. N. (2021). Profil kemampuan literasi numerasi di masa pandemi cov-19. *KoPeN: Konferensi Pendidikan Nasional*, *3*(1), 253-261.

Syaifudin, M. (2022). Efektivitas E-LKPD berbasis STEM untuk menumbuhkan keterampilan literasi numerasi dan sains dalam pembelajaran listrik dinamis di SMA Negeri 1 Purbalingga. *Jurnal Riset Pendidikan Indonesia*, *2*(2), 211-220.

Teresia, W. (2021). *Asesmen Nasional 2021*. Guepedia.

Tresnasih, I., Ratnaningsih, N., & Rahayu, D. V. (2022). Analisis Numerasi Matematis Peserta Didik dalam Menyelesaikan Soal AKM. *Prisma*, *11*(2), 478-486.

Trigita, W. N., Prayito, M., & Albab, I. U. (2023). Analisis Kemampuan Numerasi Siswa SMP Kelas VIII dalam Menyelesaikan Soal Bilangan Model Asesmen Kompetensi Minimum. *Imajiner: Jurnal Matematika dan Pendidikan Matematika*, *5*(2), 93-98.

Wandari, A., Kamid, K., & Maison, M. (2018). Pengembangan lembar kerja peserta didik (LKPD) pada materi geometri berbasis budaya Jambi untuk meningkatkan kreativitas siswa. *Edumatika: Jurnal Riset Pendidikan Matematika*, *1*(2), 47-55.