e-ISSN: 2549-5070
p-ISSN: 2549-8231

Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang
Volume 8, No. 3, 2024, pp.417-429

https://doi.org/10.31331/medivesveteran.v8i3.3198

Development of Open Ended Learning Based Mathematics E-Modules on Social Arithmetic Material

*Marzemah[1], Dwi Ivayana Sari[2]
[1, 2] STKIP PGRI Bangkalan
*marsyaelail@gmail.com

Received: *July 2024.* ***Accepted***: *August 2024.* ***Published***: *September 2024.*

ABSTRACT

The application of conventional learning using generally circulated books without paying attention to students' conditions and traditional teaching methods is one of the triggers for students not being effective in understanding and internalizing social arithmetic concepts well. Therefore, it is necessary to develop teaching materials in the form of e-modules by implementing learning that is oriented towards student active learning, one of which is open ended learning. The aim of this research is to describe the development of open ended learning based mathematics e-modules on social arithmetic material. This research is development research using the 4-D method with the Define, Design, Develop, Disseminate stages. The test subjects for this research were class VII of Attaufiqiyah Middle School. The data collection techniques used in this research are validation, response questionnaires and tests. This research produces open ended learning based mathematics e-modules that are valid, practical and effective. It is said to be valid because based on the results of material analysis an average score of 3,915 was obtained and the design analysis results obtained an average score of 3,975. This shows that open ended learning based mathematics e-modules are valid to use. It is said to be practical because the average score for teacher and student responses is 3,982. It is said to be effective because the teacher's ability to manage learning during 2 meetings and student activities is in the very good category, and students' learning is classically complete.
Keywords: *development, e-module, open ended, social arithmetic.*

How to Cite: Marzemah, M., & Sari, D. (2024). Development of Mathematics E-Modules Based Open Ended Learning on Social Arithmetic Material. *Journal Of Medives : Journal Of Mathematics Education IKIP Veteran Semarang, 8*(3).

INTRODUCTION

Mathematics is a discipline of science that is highly needed in the development of knowledge and technology. Mathematics also serves as the foundation for various other disciplines. In addition, mathematics is taught at all levels of formal education, from elementary school to university (Turnip & Karyono, 2021). Furthermore, Tambunan & Tambunan (2023) state that mathematics is a universal science that serves as the foundation for modern technology, and plays a crucial role in various fields, emphasizing human thinking abilities. This is because mathematics is a highly beneficial science for human life and serves as the foundation for other branches of knowledge (Nugraha et al., 2022) The application of mathematics in various fields can optimize processes, make predictions, and provide a basis for informational and more accurate decision making.

Mathematics is not just a collection of formulas and calculations, but it is a subject that shapes critical thinking skills and problem-solving abilities. In line with this, Rahmadhani et al., (2021) state that mathematics education aims to train students to develop problem-solving skills and critical thinking abilities, logical reasoning, abstract analysis, systematic thinking, and creativity. In each concept, mathematics teaches students to break down, analyze, and formulate solutions. As the learning progresses, students are expected not only to understand how to implement formulas but also to develop a deeper understanding of the underlying patterns, structures, and mathematical relationships.

The subject of mathematics builds the foundation of mathematical skills that are essential in everyday life. One of the topics in mathematics that explains activities in everyday life is social arithmetic. This is because social arithmetic is a branch of mathematics that is closely related to complex issues in social life, thus it is necessary to clearly demonstrate to students the significance of learning social arithmetic (Friantini et al., 2020). The scope of social arithmetic material focuses on discussions that are connected to everyday life patterns, such as percentages, ratios, cost calculations, and problem-solving in real-life contexts. Therefore, understanding social arithmetic material is crucial in supporting problem-solving processes in everyday life due to its relevance to the world of economics.

However, students face difficulties in understanding and applying concepts in social arithmetic material. (Nurhayati, 2020) stated in her research that student learning outcomes related to social arithmetic material are still relatively low.

The factors causing student difficulties are the implementation of conventional learning using widely circulated books without considering students' conditions and traditional teaching methods, which become one of the triggers for students' ineffectiveness in understanding and internalizing the concepts of social arithmetic well (Aprianka et al., 2021). This condition leads to students' low problem-solving abilities. This is in line with Heldawati et al., (2023) who stated that students feel lazy to solve problems due to their lack of knowledge to solve them.

The conditions above show how important the learning resources that must be used in mathematics learning are, one of which is the module. The module itself contains the material studied and learning methods that suit student needs. Azhari (2022) states that

a learning module is a learning unit or set of teaching materials that discusses certain topics in a structured and systematic manner so that users can learn, both with teachers and studying. Furthermore, Firdaus et al., (2023) said that modules or teaching materials need to be prepared systematically and interestingly and include material content, methods and evaluation that can be used by students independently. Modules or teaching materials ideally contain learning materials and processes, assessment systems, and expected competencies (Kosasih et al., 2022).

Based on the context of educational innovation in the current digital era, the use of e-modules is one solution. E-modules, as a form of learning media based on information and communication technology (ICT) which have great potential in improving the quality of mathematics learning, including social arithmetic material. ¬E-modules can be used to improve conceptual understanding of the material presented by teachers to students (Turnip & Karyono, 2021). E-modules can also be designed to be more interactive and allow for a more conceptual learning approach.

According to Wirandika et al., (2017) e-module or electronic module is a form of data in the form of a book that is displayed electronically using a hard disk, diskette, CD or flash disk and can be read using a computer or computer. E-modules are very good to use to increase participant participation in the learning process. The use of teaching materials in the form of e-modules is used as a substitute for books or printed materials (hardcopy), the use of which is not reduced according to its function, namely a source of information (Romayanti et al., 2020). E-modules can also be defined as a form of presenting independent teaching materials for teachers and students which are systematically arranged into certain learning units in electronic format. The advantages of e-modules compared to printed modules are that their interactive nature makes it easier to navigate, presents video tutorials, animations and audio and is equipped with formative tests/quizzes that allow immediate automatic feedback (Devianaa & Sulistyani, 2021). Interactive e-modules can be used to increase students' learning motivation, literacy, learning outcomes, independence and critical thinking abilities (Wulandari et al., 2021)

Based on the explanation above, e-modules need to be developed to help students learn. Apart from that, there is a need for a mathematics learning approach that is able to increase students' interest in learning and is able to increase students' understanding of concepts. One of these learning approaches is open ended learning. Utami et al., (2020) stated that the characteristic of the open ended approach is that it gives students the freedom to have many solutions to get answers to the questions they face. An open-ended approach can also encourage students to think critically, look for creative solutions, and develop a deep understanding of mathematical concepts. The open-ended approach teaches students not only to provide solutions to the problems given, but also to defend their stance and explain how they arrived at that conclusion (Yuni & Suryana, 2020). The combination of e-modules and open learning approaches in social arithmetic material can be an alternative to increase students' understanding and involvement in the learning process.

The results of (Maryam, 2019) research entitled development of an

open-ended based mathematics e-module on two-variable linear equation systems material for class VIII shows that a guided open-ended based e-module is effective in improving student learning outcomes which can be seen from the assessment of material experts who obtained an average score of an average of 3.33 and media experts 3.27 which includes very valid criteria, for valid criteria seen from the practicality questionnaire assessment, students show an average score of 3.28 which is included in very practical criteria, and seen from the effective criteria seen from the learning outcomes test students who show a completion percentage of 68% which is included in the effective criteria.

Based on the description above, this research was conducted to develop an e-module based on open ended learning on social arithmetic material in order to understand and master social arithmetic concepts more effectively. This research will be designed by identifying student needs so that the e-module developed meets expectations. Thus, the development of e-modules based on open ended learning in social arithmetic material is expected to be an important contribution in the development of learning methods that are innovative and oriented towards student experience, so that they can improve the quality of mathematics education in schools.

METHOD

This research is a type of research and development (R&D). Research and development is used to produce certain products, and test the effectiveness of these products (Sugiyono 2015). The development model used in this research is a modified Four-D model from Thiagarajan, Semmel and Semmel. The stages in this development are define, design, develop and disseminate. This research was conducted at Attaufiqiyah Middle School. This research uses validity tests, practicality tests and effectiveness tests.

The validity of open-ended learning based mathematics e-modules is said to be valid if the e-module is declared interesting or suitable for use with or without revision by the validator. The validators in this research consisted of 2 validators, namely a mathematics education lecturer and a mathematics study teacher.

Practicality in this research was determined by teacher and student response questionnaires. The response questionnaire was used to determine user responses to open ended learning based mathematics e-modules. An e-module is said to be practical if the teacher gives a minimally interesting response to the e-module and students also give a minimally interesting response to the e-module.

Effectiveness in this research is determined by the teacher's ability to manage learning using e-modules, student activities in learning using e-modules and student learning outcomes after implementing learning using e-modules. Mathematics e-modules based on open ended learning are said to be effective if the teacher's ability to manage learning is at least within good criteria, student activity in learning is at minimum good criteria and student learning outcomes are classically complete.

The instruments used in this study include learning material validation sheets, design validation sheets, teacher and student response questionnaires, teacher's ability observation sheets in managing learning, student activity observation sheets, and test questions. For instruments such as teacher and student response questionnaires,

teacher's ability observation sheets in managing learning, student activity observation sheets, and test questions, validity was also conducted by 2 expert validators before the instrument sheets were used to collect data. The data analysis technique in this study consists of:

1. **Analysis of Validation Results from Material Experts and Design Experts**

   The data resulting from the expert assessment is analyzed by considering input, comments and suggestions from validators. The results of this analysis are used as guidelines for revising the e-module. The open-ended learning-based mathematics e-module is declared valid if the average score given by the validator is in the Worthy or very worth it category. The average score categories are as follows:

Table 1. Product Validity Criteria

Score	Criteria
$3{,}26 < \bar{x} \leq 4{,}00$	Very Valid
$2{,}51 < \bar{x} \leq 3{,}26$	Valid
$1{,}76 < \bar{x} \leq 2{,}51$	Less Valid
$1{,}00 < \bar{x} \leq 1{,}76$	Invalid

Based on the validation results above, the e-module is considered valid if it meets the criteria of being valid or very valid. Thus, if the validation results do not meet the appropriate or very appropriate criteria in this research, it will be taken into consideration for revising the e-module.

2. **Analysis of teacher and student response questionnaires**

   Teacher and student response data obtained through questionnaires were analyzed using averages. Teacher and student responses are said to be practical if the average score is within the criteria of being practical or very practical. The average score categories are as follows:

Table 2. Product Practicality Criteria

Score	Criteria
$3{,}26 < \bar{x} \leq 4{,}00$	Very Practical
$2{,}51 < \bar{x} \leq 3{,}26$	Practical
$1{,}76 < \bar{x} \leq 2{,}51$	Less Practical
$1{,}00 < \bar{x} \leq 1{,}76$	Impractical

Teacher and student responses are said to be practical if they meet the criteria of being practical or very practical. Thus, if the results of teacher and student responses do not meet the criteria of being practical or very practical, the e-module will be considered for revision.

3. **Analyze the teacher's ability to manage learning**

   Data on teachers' abilities in managing learning was analyzed using averages. The teacher's ability to manage learning is said to be effective if the average score is in the good or very good criteria. The average score criteria are as follows:

Table 3. Product Effectiveness Criteria

Score	Criteria
$3{,}26 < \bar{x} \leq 4{,}00$	Very Good
$2{,}51 < \bar{x} \leq 3{,}26$	Good
$1{,}76 < \bar{x} \leq 2{,}51$	Enough
$1{,}00 < \bar{x} \leq 1{,}76$	Less

4. Analysis of student activities in learning

Student activity data in learning is analyzed using averages. Student activities in learning are said to be effective if the average score is in the good or very good criteria. The average score criteria are as follows:

Table 4. Average Score Criteria

Score	Criteria
$3{,}26 < \bar{x} \leq 4{,}00$	Very Good
$2{,}51 < \bar{x} \leq 3{,}26$	Good
$1{,}76 < \bar{x} \leq 2{,}51$	Enough
$1{,}00 < \bar{x} \leq 1{,}76$	Less

5. Analysis of student learning test results

Analysis of student learning outcome data aims to describe student learning completeness. The data analyzed are learning outcomes test scores. Each student is said to have completed their studies if there are as many students who get a score of ≥70 as 80% of the total students (classical student learning completeness is achieved).

RESULTS AND DISCUSSION

Define

In the product development process, at the Define stage, things that need to be done include; (1) Front-end Analysis, researchers found problems in mathematics subjects and the media used where data obtained from interviews were not structured by mathematics teachers at Attaufiqiyah Middle School. The results of the analysis showed that educators had difficulty and felt that the discussion was insufficient in providing students with an understanding of mathematics material if they only taught from curriculum books and regular books. And many students complain that they don't understand and feel bored, so they need media as a tool.

(2) student analysis, the researcher analyzed the condition or characteristics of class VII students while participating in learning analysis activities, (3) Concept Analysis, the researcher revealed the concept of speed and discharge material which will be explained in the product content with a systematic arrangement of relevant concepts (4) analysis task, the researcher carries out content analysis of the material required for the learning activity process related to student skills according to the curriculum (5) analysis objectives, the researcher prepares learning activity objectives according to the concept analysis and analysis tasks that have been completed.

Design

This stage focuses on designing e-module products. For the preparation of material and practice questions, they are formulated based on competencies and indicators. Compilation of material from various sources based on Basic Competencies (KD) and indicators in social arithmetic material and e-module

design designed on a modular website then creating several screens adjusted to the desired appearance. After the design on the screen is complete, the next step is to enter the block section to connect several screens and buttons that will be used. The final step is to export the project into an application.

Figure 1. Design of e-module products

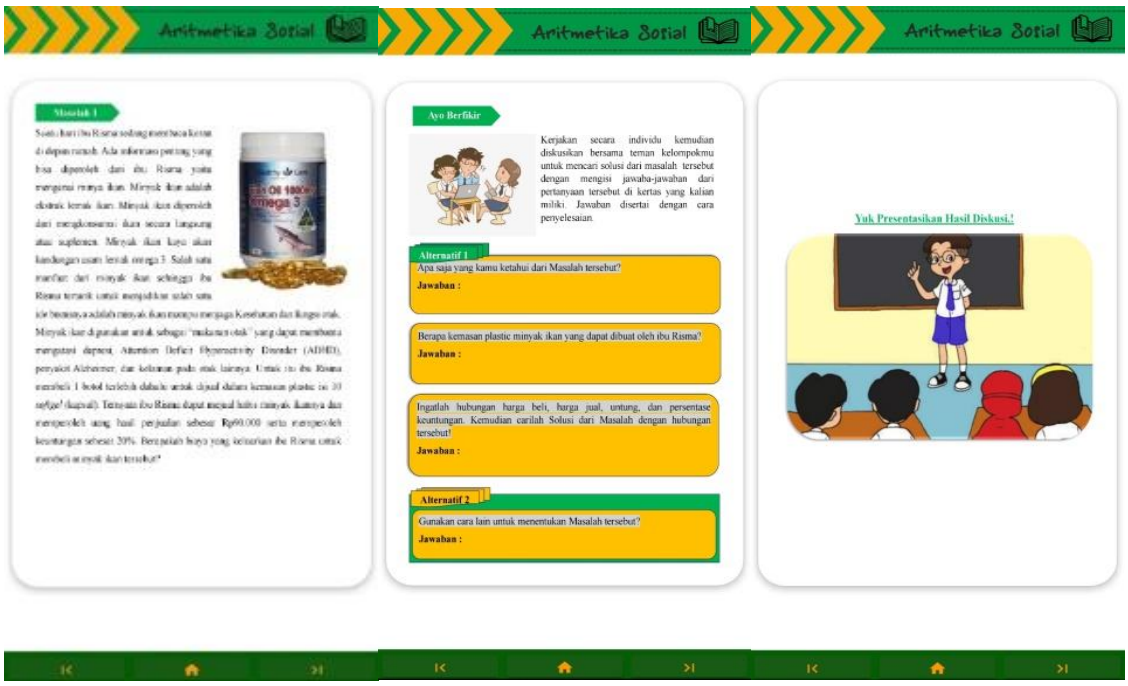

Figure 2. Display of the e-module using an open ended learning approach

Development

At this stage the researcher tested the e-module product that had been developed to determine the validity, practicality and effectiveness of the e-module.

1. E-Module Validation Results

There are two validators who are experts in e-module material and design, namely lecturers in the mathematics education study program STKIP PGRI Bangkalan and mathematics teachers. The validation results are presented in Table 5 below.

Table 5. Material Expert Validation Results

Validators	Total Score	Score Value	Average
Validators 1	70	3,89	3,915
Validators 2	71	3,94	

Based on the material validation results in Table 5 above, it shows that the total score obtained from validator 1 was 70 with a score value of 3,89 and the total score from validator 2 was 71 with a score value of 3,94. Thus, an average score of 3,915 was obtained, which means the e-module can be used without revision.

Table 6. Design Expert Validation Results

Validators	Total Score	Score Value	Average
Validators 1	91	3,95	3,975
Validators 2	92	4,00	

Based on the material validation results in Table 6 above, it shows that the total score obtained from validator 1 was 91 with a score value of 3,95 and the total score from validator 2 was 92 with a score value of 4,00. Thus, an average score of 3,975 was obtained, which means the e-module can be used without revision.

2. Results of Teacher and Student Response Questionnaires

Based on the teacher and student responses contained in the teacher and student response questionnaire, the following results were obtained.

Table 7. Results of Teacher and Student Response Questionnaires

Explanation	Total Score	Score Value	Average
Teacher	80	4,00	3,982
Student 1	71	3,93	
Student 2	72	4,00	
Student 3	72	4,00	

Based on the results of the questionnaire analysis in Table 7, an average score of 3,982 was obtained in the very practical category. Thus, the e-module developed by this researcher shows that open-ended learning based mathematics e-modules are said to be practical.

3. Results of the Observation Sheet on Teacher Ability in Managing Learning

The results of observations of teachers' abilities in managing learning using open ended learning based mathematics e-modules can be seen in Table 8 below.

Table 8. Observation Results of Teachers' Ability in Managing Learning

Observed aspects	Scores for Each Meeting	
	Part. 1	**Part. 2**
Carry out apperception activities	4	4
Providing motivation for students in learning	3	4
Convey learning objectives	4	4
Carrying out open question presentations	4	4
Guiding students in working on open questions individually in the e-module	4	4
Guiding group discussions on open questions	4	4
Carry out group discussions on open questions	4	4
Drawing conclusions on the teaching materials is in the e-module	4	4
Closing the learning process	4	4
Implement an open ended approach	4	4
Utilize media/tools using mathematics e-modules	4	4
Total Score	43	44
Average Score for Each Meeting	3,90	4,00
Average Trial Score	3,95	
Category	Very Good	

Based on Table 8 above, it can be seen that the average score of teachers' ability to manage learning during learning using the developed e-module is in the "very good" category with a score of 3,95.

4. Results of Student Activity Observation Sheet

The results of observations of student activities in learning during 2 meetings can be seen in Table 9 below.

Table 9. Results of Student Activity Observation Sheet

Observed aspects	Scores for Each Meeting	
	Part. 1	**Part. 2**
Pay attention to the teacher's explanation, ask opinions or answer the teacher's questions	3	4
Pay attention to teacher motivation	3	3
Record learning objectives	4	4
Listen to the teacher's explanation of open questions	4	4
Work on open questions in the e-module	4	4
Discuss with the group about the open questions in the e-module	4	4
Present the results of the discussion	4	4
Utilize media/tools using mathematics e-modules	4	4
Record the conclusions obtained	4	4
Total Score	34	35
Average Score for Each Meeting	3,77	3,88
Average Trial Score	3,825	
Category	Very Good	

Based on Table 9 above, it can be seen that the average score of student activities in trials during learning using the developed e-module is in the "very good" category with a score of 3,825.

5. Study Test Results

At the field trial stage, students were given a test to determine the effectiveness of the open-ended learning-based mathematics e-module that had been developed. The learning outcomes test sheet consists of 15 questions consisting of 10 multiple choice questions and 5 essay questions. The scores of students who took the learning outcomes test are presented in Table 10 below.

Table 10. Learning Outcome Test Results

Student's name	results	Explanation
S1	78	Completed
S2	76	Completed
S3	80	Completed
S4	83	Completed
S5	76	Completed
S6	85	Completed
S7	78	Completed
S8	66	Not completed
S9	76	Completed
S10	80	Completed
S11	70	Completed
S12	76	Completed
S13	88	Completed
S14	77	Completed
S15	60	Not completed
S16	86	Completed
S17	53	Not completed
S18	83	Completed
S19	57	Not completed
S20	87	Completed
S21	77	Completed
Average		75,809

Based on Table 10 above, it shows that the highest score on the student learning outcomes test is 88 and the lowest score on the student learning outcomes test is 53, and the value that often appears is 76 of all the grades in class VII. Meanwhile the average value is 75,809.

To find out students' classical learning completeness, see Table 11 below.

Table 11. Classical Learning Completeness

Explanation	The number of students	Percentage
Completed	17	75,809%
Not completed	4	19,047%

Based on Table 4.7 above, it can be seen that the number of students who have completed their learning is 17 students with a percentage of 75.809%, and 4 students who have not completed their learning with a percentage of 19.047%. Therefore,

the learning outcomes of the students can be considered as satisfactory/classical.

Disseminate

This stage is carried out by the researcher by uploading the e-module on a webpage or blog on the internet so that it can be easily downloaded. Additionally, by uploading the e-module, it can be easily disseminated. The e-module can be accessed by anyone on the following website, https://kolomoretan.blogspot.com/2024/03/pengembangan-e-modul-matematika.html

This research complements previous research findings, especially regarding the development of open-ended learning-based mathematics e-modules. This means that this research has produced an open-ended learning-based mathematics e-module for social arithmetic.

Furthermore, this research also complements previous research findings, particularly related to the development of instructional materials in social arithmetic. This means that this research has produced a learning media in the form of an open-ended learning based mathematics e-module.

E-module based on open-ended learning to teach social arithmetic is a product generated from this research. This product is considered to be good and can be used by practitioners to teach social arithmetic. The criteria for the goodness of this research product in the development stage are based on the teacher's ability to manage learning, student activities, and the responses of teachers and students, which indicate good criteria.

This is in line with the research conducted by Syaeruldinata et al., (2019), which found that cultivating high-level thinking skills through open-ended problems follows the steps of open-ended, which consist of: (1) orientation, (2) presentation of open-ended problems, (3) individual work on open-ended problems, (4) group discussion on open-ended problems, (5) presentation of group discussion results, and (6) conclusion. The success of implementing the open-ended learning approach in improving student learning outcomes cannot be separated from the role of teachers in managing the learning process. Therefore, if teachers have good management skills, students' activities will be directed. When students' activities are directed, they will be enthusiastic in participating in the learning process.

The result of this research is in line with the research conducted by Maryam (2019), which developed an open-ended learning-based e-module for the topic of systems of linear equations with two variables for grade VIII. However, the instructional materials developed in this research are for teaching social arithmetic. This indicates that this research complements some previous research findings related to the development of open-ended learning-based mathematics e-modules.

CONCLUSION

Based on the development process of the open-ended learning-based e-module in social arithmetic, the following conclusions can be drawn:

1. The research conducted is a Four-D model modification research by Thiagarajan, Semmel, and Semmel. The stages of this development are defining, designing, developing, and disseminating.
2. The research conducted resulted in a valid, practical, and effective e-module based on open-ended learning in social arithmetic.

3. This open-ended learning-based mathematics e-module is developed specifically for social arithmetic. Therefore, it is expected that future researchers can examine the effectiveness of the e-module using the open-ended learning approach or develop e-modules using other approaches.

ACKNOWLEDGMENT

In research writing, researchers cannot be separated from the support, guidance, and collaboration of various parties. Therefore, researchers express their gratitude to all parties who have assisted and supported the process of preparing this research.

REFERENCE

Aprianka, S., Setiani, A., & Imswatama, A. (2021). Validitas E–Modul Berbasis *Open ended* Meteri Sistem Persamaan Linear Dua Variabel Pada Pembelajaran Daring untuk Siswa SMK. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 5*(3), 3111-3122.

Azhari, M. N. (2022). Pengembangan modul pembelajaran Matematika berbasis Pesantren untuk meningkatkan self-efficacy santri (Doctoral dissertation). Diunduh dari https://j-cup.org/index.php/cendekia/article/view/2791

Deviana, T., & Sulistyani, N. (2021). Analisis Kebutuhan Pengembangan E-Modul Matematika HOTS Beroerintasi Kearifan Lokal Daerah di Kelas IV Sekolah Dasar. *Jurnal Pemikiran dan Pengembangan Sekolah Dasar (JP2SD), 9*(2), 158-172.

Firdaus, F., & Sari, D. I. (2023). Pengembangan Modul Berbasis Pesantren pada Materi Himpunan di MA Raudlatul Mutaqin. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 7*(3), 3177-3191.

Friantini, R. N., Winata, R., & Permata, J. I. (2020). Pengembangan modul kontekstual aritmatika sosial kelas 7 SMP. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 4*(2), 562-576.

Heldawati, H., Yulianti, D., & Nurhanurawati, N. (2023). Pengembangan E-Modul Dengan Pendekatan Pendidikan Matematika Realistik (PMR) Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis. *Jurnal Teknologi Pendidikan: Jurnal Penelitian dan Pengembangan Pembelajaran, 8*(2), 356-363.

Kosasih, U. K., Saputra, S., & Supriadi, E. A. (2022). Pengembangan bahan ajar bentuk aljabar melalui pendekatan open-ended. *PERISAI: Jurnal Pendidikan dan Riset Ilmu*

Maryam, M. (2019). Pengembangan e-modul matematika berbasis *Open ended* pada materi sistem persamaan linear dua variabel kelas VIII (Doctoral dissertation). Diunduh dari http://repository.radenintan.ac.id/6203/1/SKRIPSI.pdf

Nugraha, R., Mudrikah, A., Saputra, S. (2022). Pengaruh Penerapan Model Connecting Organizing Reflecting Extending (CORE) terhadap Minat Belajar dan Peningkatan Kemampuan Berpikir Kritis Peserta Didik. *UJMES (Uninus Journal of Mathematics Education and Science).* 7(1) 54-62.

Nurhayati, A. S. (2020). Analisis Kesalahan Siswa SMP dalam

Menyelesaikan Soal pada Materi Aritmatika Sosial. *APOTEMA: Jurnal Program Studi Pendidikan Matematika, 6*(1), 54-66.

Rahmadhani, S., & Efronia, Y. (2021). Penggunaan E-Modul Di Sekolah Menengah Kejuruan Pada Mata Pelajaran Simulasi Digital. *Jurnal Vokasi Informatika*, 6-11, 2775 – 6807.

Romayanti, C., Sundaryono, A., & Handayani, D. (2020). Pengembangan E-Modul Kimia Berbasis Kemampuan Berpikir Kreatif Dengan Menggunakan Kvisoft Flipbook Maker. *Alotrop, 4(1),* 51–58. https://doi.org/10.33369/atp.v4i1.13709

Sugiyono. (2015). Metode penelitian dan pengembangan. Bandung. Riduwan. (2007). Skala pengukuran variabel-variabel penelitian. *Bandung: Alfabeta.*

Syaeruldinata, A., As'ari, A. R., & Abadyo, A. (2019). Menumbuhkan Keterampilan Berpikir Tingkat Tinggi melalui *Open ended* Problem. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *4*(8), 1008-1015.

Tambunan, L., & Tambunan, J. (2023). Pengembangan Bahan Ajar E-Modul Matematika Berbantuan Aplikasi Canva pada Materi Grafik Fungsi Eksponen dan Logaritma. *Jurnal Cendekia: Jurnal Pendidikan Matematika,* 7(2), 1029-1038.

Turnip, R. F., & Karyono, H. (2021). Pengembangan e-modul matematika dalam meningkatkan keterampilan berpikir kritis. *JEMS: Jurnal Edukasi Matematika dan Sains*, *9*(2), 485-498.

Utami, R. W., Endaryono, B. T., & Djuhartono, T. (2020). Meningkatkan Kemampuan Berpikir Kreatif Matematis Siswa Melalui Pendekatan Open-Ended. *Faktor: Jurnal Ilmiah Kependidikan*, *7*(1), 43-48.

Wirandika, K. D. S. A., ., Dr. Ketut Agustini, S.Si, M. S., & ., I Gede Partha Sindu, S.Pd., M. P. (2017). Pengembangan E-Modul Interaktif Berbasis Model Pembelajaran Problem Based Instruction Pada Mata Pelajaran Perakitan Personal Computer Kelas X Tkj Di Smk Ti Bali Global Singaraja. *Kumpulan Artikel Mahasiswa Pendidikan Teknik Informatika (KARMAPATI),* *6*(1), 192. https://doi.org/10.23887/karmapati.v6i1.9510

Wulandari, F., Yogica, R., & Darussyamsu, R. (2022). Analisis manfaat penggunaan e-modul interaktif sebagai media pembelajaran jarak jauh di masa pandemi covid-19. *Khazanah Pendidikan*, *15*(2), 139-144.

Yuni, Y., & Suryana, A. (2020). Open-Ended Problems for Junior High School Studentsâ€™ Mathematical Reasoning. *IndoMath: Indonesia Mathematics Education*, *3*(2), 88-99.