Artikel Jurnal Elemen

by Retno Marsitin

Submission date: 02-Nov-2022 12:53AM (UTC+0700)
Submission ID: 1941594070
File name: tin_Article_Jurnal_Elemen_untuk_terbit_Januari_2023_-revisi.docx (415.69K)
Word count: 4277
Character count: 27449

Jurnal Elemen, 9(1), 1-10, January 2023
https:/doi.org/10.29408/jel.v9i1.XXXX

e- ISSN: 2442 - 4226

Check for updates

Developing Problem Based Learning E-Module with Mathematical Literacy to Grow Student's Reasoning

Retno Marsitin [1] *, Nyamik Rahayu Sesanti [2]

[1] Mathematics Education Department, Universitas PGRI Kanjuruhan Malang, East Java, Indonesia

[2] Primary Teacher Education Department, Universitas PGRI Kanjuruhan Malang, East Java, Indonesia

* Correspondence: mars_retno@unikama.ac.id

Abstract

Problem Based Learning e-module with mathematical literacy is indispensable in learning both offline and online to improve students' mathematical reasoning abilities. The research aims to develop a Problem Based Learning e-module with mathematical literacy to improve students' valid, effective, and feasible mathematical reasoning. The method of development in this research with stages: analysis, planning, development, and evaluation. Before the research trial, validation assessments were carried out on the e-module: material assessment, learning assessment, and design assessment. The data collection were validation assessment sheets, mathematical reasoning test results, and questionnaire results in response to the e-module. Data analysis was carried out in a qualitative descriptive. E-module was developed by using sigil software application in mathematics learning. The results showed that the responses to the e-module were in accordance with the student's needs: providing convenience, being practical and having attractiveness so that it was not boring. The research concludes that the Problem Based Learning e-module with mathematical literacy is valid, very effective and very feasible, and can improve students' mathematical reasoning abilities. E-module Problem Based Learning with mathematical literacy can be implemented in learning mathematics, especially in online teaching and learning activities.

Keywords: e-module; mathematical literacy; mathematical reasoning; problem based learning

How to cite: Marsitin Retno, Sesanti Rahayu N. (2023). Developing Problem Based Learning E-Module with Mathematical Literacy to Grow student's Reasoning. *Jurnal Elemen, 9*(1), 1-10. https://doi.org/10.29408/jel.v9i1.XXXX

Received: Date Month Year | Revised: Date Month Year

Accepted: Date Month Year | Published: Date Month Year

Introduction

Reasoning is a student's thinking ability that must be developed to focus more on definition, logical proof, logical and creative reasoning mindset (Akkus, 2016; NCTM, 2009; Rogers & Steele, 2016). Reasoning is a mental or cognitive activity through logical and analytical thinking (Hidayah et al., 2020; Subanji & Nusantara, 2016). Reasoning is a thought adopted to produce statements and reach conclusions on problem solving that is not always based on formal logic, so it is not limited to evidence (Bergqvist & Lithner, 2012; Lithner, 2017). In this regard, reasoning in mathematics is indispensable for solving mathematical problems.

Mathematical reasoning is a process of solving problems by identifying mathematical problems, giving reasons, and concluding. Mathematical reasoning is a process of drawing conclusions in solving problems (Harel & Fuller, 2013; Herbert et al., 2015; Norqvist, 2018; Williams et al., 2020). Solving mathematical problems requires not only the ability to count but also reasoning, critical, and creative abilities. In this regard, mathematical reasoning plays a significant role in solving problems. Solving mathematical problems is not just a problem or routine problem but also problems faced in real life.

The ability to solve mathematical problems in real life is a mathematical literacy ability. Mathematical literacy is knowing and applying basic mathematics in real life (Haara et al., 2021; Ojose, 2011). Mathematical literacy can be interpreted to formulate, use, and interpret mathematics in various contexts (OECD, 2017). Mathematical literacy abilities include communication, mathematization, restatement, reasoning, and reasoning, using problem solving strategies, symbols, formal language, and techniques using mathematical tools (Hardianti & Zulkardi, 2019; Utari et al., 2019). Literacy skills can be developed by making learning innovations. Learning innovation that can facilitate mathematical reasoning and literacy skills is Problem Based Learning (PBL).

Project Based Learning can help students understand problems and find solutions to meaningful learning (Etherington, 2011; MacLeod & van der Veen, 2020). Problem Based Learning (PBL) is learning by grouping in small groups, then working together provides motivation for ongoing involvement in complex tasks and increases opportunities for joint investigation and dialogue, as well as for the development of social skills (MacLeod & van der Veen, 2020; Merritt et al., 2017; Schettino, 2016).

E-module is an online electronic teaching material (Chen et al., 2015; Letchumanan & Tarmizi, 2010) stating that technological developments need to be developed electronic teaching materials and online learning so that students from anywhere can attend the lecture. The advantages of online learning are that students can study anywhere and anytime with an internet connection and students are more interested in using e-books to help complete their assignments (Fernández et al., 2020; Owston et al., 2008). In addition, various information on the internet which aims to improve the teaching and learning of mathematics is continuous (Bozkurt & Ruthven, 2017; Mailizar & Fan, 2020). The research results by (Keengwe & Georgina, 2012) state that technological developments provide changes to the implementation of teaching and learning. In this regard, an e-module development innovation was carried out

on multivariable calculus. Problem Based Learning e-module with mathematical literacy in multivariable calculus was developed using the sigil application. Sigil is a technology application that is applied in mathematics teaching materials in the form of e-modules. The advantage of sigil is that writing can be converted into modules or digital books that can be accessed anywhere with devices such as computer, laptop, or smartphone.

The virtue of developing online learning e-variable calculus modules is in the form of modules developed in electronic modules with Problem Based Learning with mathematical literacy. The specifications of the developed e-module products are e-modules that are designed systematically with material arranged in simple and clear sentences. E-modules provide implementation instructions as a guide for lecturers and students, contain learning activities to improve understanding of concepts, are designed with an attractive design display, and are easy to apply. In this regard, this research generally aims to develop a Problem Based Learning e-module with mathematical literacy that is valid, effective, and feasible to improve student reasoning.

Methods

This research is development research using the development design of (Richey et al., 2011), namely: analysis (analysis), planning (design), development (development), and evaluation (evaluation). The development model of (Dick et al., 2009) includes identifying the learning objectives, analysis of learning, formulating specific objectives, developing assessment instruments, developing learning strategies, developing, and selecting materials, revising learning materials, designing, and carrying out evaluations. Product validation is material validation, learning, and product design. Furthermore, a research trial was conducted, with the subject of research involving students of Mathematics Education at the University of PGRI Kanjuruhan Malang. They were or had taken the multivariable calculus course, a total of 17 students in the small group test and 35 students in the large group test.

The data obtained in the subsequent research activities were analyzed descriptively and qualitatively. Descriptive analysis is used to determine the effectiveness and feasibility of the developed e-module Qualitative analysis determines what needs to be revised from the e-module developed on the multivariable calculus material. The stages of the Problem Based Learning e-module development procedure with mathematical literacy are as follows: (1) Analyzing: the development model in the first step by identifying, and the second step is learning analysis; (2) Planning: the development model in the third step by determining the implementation time. The fourth step by compiling instruments (test questions, student worksheets, and questionnaires as responses from both lecturers and students). The fifth step is designing the web, product specifications, and e-content structures -module (draft e-module problem-based learning with mathematical literacy); (3) Developing: the development model in the sixth step is developing e-module components, producing e-module drafts, testing e-modules, and producing e-module drafts with final revisions. E-module developed in the multivariable calculus course. Next is the seventh step by developing materials and conducting validation, then the ninth step by designing valid, effective, and feasible products for the

developed e-module; (4) Evaluating: the development model in the tenth step is evaluating and analyzing data on the validity, effectiveness, and feasibility of the Problem Based Learning e-module with mathematical literacy through the e-module product test, which includes a mathematical reasoning test and a questionnaire as a response to both students and lecturers. The mathematical reasoning test with three description questions on the multivariable calculus material. While the questionnaire with 15 questions related to responses to the multivariable calculus Problem Based Learning e-module with mathematical literacy. The test results refer to the mathematical reasoning ability with the indicators shown in Table 1.

Table 1. Mathematical Reasoning

Indicator	Sub Indicator
Making inferences in problems	Identifying problems Mentioning the question in the problem
Providing mathematical manipulation	Determining steps/strategies for solving problems
Giving an argument or reason as the truth of the answer/solution	Using the steps/strategy set out to solve the problem Providing an explanation of the relationship between the steps/strategies used in solving problems
Drawing conclusions/generalizing	Obtaining answers/completion of steps/strategies that have been applied in solving problems Provide conclusions from the answers / solutions that have been obtained in solving problems

In the Problem Based Learning e-module with the developed mathematical literacy process, it can be seen in Table 2.

Table 1. Problem Based Learning Syntax with mathematical literacy process

Problem Based Learning Syntax	Mathematical Literacy Process
Orientation to problems	Formulating (identifying problems)
Organizing for learning	Formulating (identifying problems) Applying (applying mathematical concepts)
Guiding individual or group investigations	Applying (applying mathematical concepts) Interpreting (explaining the solution)
Developing and presenting the work	Applying (applying mathematical concepts) Interpreting (explaining the solution)
Analyzing and evaluating the problem solving process	Interpret (explaining the solution)

Before implementing the product test, three validators first conducted an evaluation of the validation of the e-module product, namely: an assessment of the material by a material expert, an assessment of learning by a learning expert and an assessment of product design by a design expert. In addition, an assessment of the validation of research instruments was also carried out by an expert on research instruments. After the validation assessment and declared valid, the product test was carried out in small and large groups. The qualification of validity is in Table 3.

Table 3. E-Module Validity Qualification

Description	Qualification
$80\% \leq r \leq 100\%$	Very valid without correction
$60\% \leq r < 80\%$	Valid with correction
$40\% \leq r < 60\%$	Fairly valid with correction
$20\% \leq r < 40\%$	Less valid with correction
$r < 20\%$	Invalid

In addition, the developed e-modules were also analyzed with the effectiveness qualifications in Table 4.

Table 4. Qualifications of E-Module Effectiveness

Description	Qualification
$80\% \leq r \leq 100\%$	Very Effective (the e-module is very effective)
$60\% \leq r < 80\%$	Effective (the e-module is effective)
$40\% \leq r < 60\%$	Quite Effective (the e-module is quite effective)
$20\% \leq r < 40\%$	Less Effective (the e-module is less effective)
$r < 20\%$	Ineffective (the e-module is not effective)

The analysis of research data with eligibility qualifications is shown in Table 5.

Table 5. E-Module Eligibility Qualifications

Description	Qualification
$80\% \leq r \leq 100\%$	Very Eligible (the e-module is very feasible)
$60\% \leq r < 80\%$	Eligible (the e-module eligible)
$40\% \leq r < 60\%$	Fairly Eligible (the e-module is decent enough)
$20\% \leq r < 40\%$	Less Eligible (the e-module less feasible)
$r < 20\%$	Not Eligible (the e-module is not eligible)

Developed Problem Based Learning e-module with mathematical literacy also utilizes technology using the sigil application. Converting module files in word to module files uses the sigil application, with the first step using word processing, and then using sigil with file formats are html and epub. The results of the e-module can be accessed via computer, laptop, or smartphone.

Results

The research implemented several stages. The analysis stage was carried out by identifying and analyzing the learning objectives. The learning activity used a book, thus the students still difficult understanding the concept of the material, students' mindset of problem solving was not optimal, there is no multivariable calculus book in the form of an e-module, and students' reasoning abilities were still not maximized. The results of the analysis showed that students need electronic teaching materials in the form of e-modules to provide motivation and assistance to students in reasoning on multivariable calculus to be able to answer problems correctly. One of the efforts to achieve multivariable calculus competence was the need for

learning materials in the form of Problem Based Learning e-modules with mathematical literacy to grow student reasoning.

The planning stage was done by determining the implementation, compiling instruments, designing product specification designs, and the contents' structure of the e-module. It begins with compiling instruments, including mathematical reasoning test questions, questionnaires as lecturers' and students' responses, students' worksheets, and then designing product specifications and the contents' structure of the e-module. The researchers compiled mathematical reasoning tests for obtaining data about the effectiveness of the Problem Based Learning e-module with mathematical literacy and compose questionnaires to obtain data about students and lecturers' response on the feasibility of Problem Based Learning e-module with mathematical literacy.

The development stage was carried out by validating the developed e-module Problem Based Learning with mathematical literacy. The validator's assessment suggested improvement for material with examples and exercises that need to be considered so that the questions are easier to understand, and the appearance of the e-module is less attractive in explaining formulas/concepts. The researchers revised the e-modules according to the suggestions given by the validators. In addition to e-modules, research instruments that had been validated were declared valid. However, suggestions were given by the validators for instruments improvement, including the correction of the question's language to avoid confusion about the questions, suggestions for improving questionnaires for lecturers' and students' responses where the core statements for responses need to be considered since there were statements that had the same meaning.

In the fourth stage, namely, evaluation was product testing which included product testing. The product testing was implemented in small and large groups to obtain students' and lecturers' responses to the developed Problem Based Learning e-module with mathematical literacy, also evaluating and analyzing the effectiveness and feasibility of the e-module.

The research was done in four stages obtaining validation of research instruments and e-modules. The validated product for the Problem Based Learning e-module with mathematical literacy shows that it is valid and can be applied for the research. The validation of e-modules can be seen in Table 6.

Table 6. E-module Validation

Description	Percentage
Material	77
Learning	73
Product Design	75

The recap of validated students' worksheets, mathematical reasoning tests, and questionnaires for student and lecturer responses is in Table 7.

Table 7. Recap of Validation of Research Instruments

Description	Percentage
Student Worksheet	77
Mathematical Reasoning Test	73
Questionnaire for students	75
Questionnaire for lecturers	75

The research instruments in the form of mathematical reasoning tests, questionnaires for students' and lecturers' responses, and students' worksheets that have been validated show that the instruments are valid and can be applied in research. The results of the research product test in small groups with 17 mathematics education students are shown in Table 8.

Table 8. Recap of Test Results and Questionnaires

Description	Percentage
Mathematical reasoning test	63.37
Questionnaire for students	74.25
Questionnaire for lecturers	73.37

The mathematical reasoning test in the small group product test obtained a recap of the data that the effectiveness of the Problem Based Learning e-module with mathematical literacy was 63.37%, which can be said to be effective. In addition, the results of the questionnaire for e-module responses obtained a data recap that the feasibility of the Problem Based Learning e-module with mathematical literacy with a questionnaire for student responses was 74.25%. The questionnaire results for lecturer responses were 73.37%, so the average feasibility of 73.81% can be said to be feasible. The product trial results show that the online learning of the Problem Based Learning e-module with mathematical literacy can be declared valid, effective, and feasible in the small group product test. The results of the research product test in large groups with 35 mathematics education students are shown in Table 9.

Table 9. Recap of Test Results and Questionnaires

Description	Percentage
Mathematical reasoning test	81.77
Questionnaire for students	83.55
Questionnaire for lecturers	82.25

The product test for mathematical reasoning test in the large group obtained recap data that the effectiveness of the Problem Based Learning e-module with mathematical literacy was 81.77%. Mathematical reasoning test results had increased from 63.37% to 81.77%, so it could be said to be very effective. In addition, the results of the questionnaire for e-module responses obtained a data recap that the feasibility of the Problem Based Learning e-module with mathematical literacy for students' responses was 83.55%, and the results of questionnaires for lecturers' responses were 82.25%. Therefore, the average feasibility is 82.9% very feasible. The product trial results showed that the online learning of e-module Problem Based Learning with mathematical literacy could be declared very valid, very effective, and very feasible in large

group product testing. The Problem Based Learning e-module with mathematical literacy is shown in Figure 1.

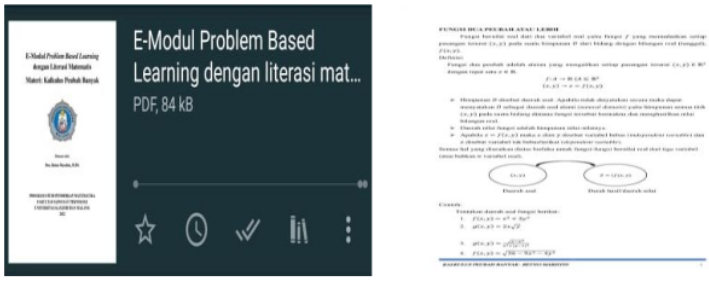

Figure 1. E-Module

The results of the research product test showed that the responses of students and lecturers were very good on the Problem Based Learning e-module with mathematical literacy and could improve the results of the mathematical reasoning ability.

Discussion

The developed and applied Problem Based Learning E-module with mathematical literacy in research includes: a) Science with scientific literacy, namely the ability to identify scientific information, apply it in reality, and determine solutions; b) Technology with technological literacy, namely skills in applying various technologies, analyzing, and technology development; c) Engineering with engineering literacy, namely the ability to develop technology designed to be more creative and innovative through the unification of various fields of science; d) Mathematics with mathematical literacy, namely the ability to analyze and convey ideas, and solve problems mathematically in its application. Student worksheets on the Problem Based Learning e-module with mathematical literacy are very helpful for students in understanding concepts and solving mathematical reasoning problems correctly and precisely. Problem Based Learning with mathematical literacy in the form of e-modules with student worksheets can be easily accessed by students via the internet either on a computer, laptop, or smartphone. Discussion in the online learning system established student interaction. This is in line with the opinion (Juandi & Tamur, 2021; Junianto & Wijaya, 2019; Utari et al., 2019) that Problem Based Learning with mathematical literacy helps motivate students to develop a mindset. (Çetinkaya, 2019; Juandi & Tamur, 2021) argue that Problem Based Learning with mathematical literacy combines learning with technology.

Problem Based Learning E-module with mathematical literacy developed by applying technology using the sigil application can be accessed through computers, laptops, or smartphones. The results of the study showed that the responses to the Problem Based Learning e-module with mathematical literacy were in accordance with the needs of students, namely having convenience, attractiveness, and usefulness, according to the opinion (de Mooij et al., 2020) that responses in a course are indirectly related to change in mathematical mindset and

mathematical confidence. It also agrees with (Choi & Walters, 2018) that online learning can further improve math performance. Mamolo (2022) argue that the type of online learning tools is very high depending on network connectivity. In line with the research conducted (Keengwe & Georgina, 2012; Mailizar & Fan, 2020) that explains that technology, with its development, provides innovative changes to the implementation of learning. Tezer et al. (2019) also explained that prospective teachers significantly increased their success in teaching with online learning. This shows that the Problem Based Learning e-module with mathematical literacy can be declared valid, very effective, and very feasible to be implemented in mathematics learning, and can improve students' mathematical reasoning abilities.

Conclusion

The results and discussion of the development of the Problem Based Learning e-module with mathematical literacy can be concluded that the Problem Based Learning e-module with mathematical literacy is declared valid, very effective and very feasible to be implemented in mathematics learning and can improve students' mathematical reasoning abilities. It is recommended in the application of online learning that use Problem Based Learning e-module with mathematical literacy to prepare all the necessary facilities, especially the readiness of a smooth internet signal so that learning goes well.

Acknowledgment

We would like to thank Universitas PGRI Kanjuruhan Malang for supporting the research.

Conflicts of Interest

Author one and author two states that there is no conflict of interest regarding the publication of this research paper. Ethical issues, including in relation to plagiarism, infringement, falsification and/or falsification of data, publication and/or double submission, and redundancies have been fully borne by the authors.

Funding Statement

This work was supported by Universitas PGRI Kanjuruhan Malang [grant number 071/C2/I.3/DPPM-UK/VI.2022]

Author Contributions

RM as first author with contributions related to conceptualization, original draft writing, editing, visualization, formal analysis, and methodology, and **NRS** as second author with contributions related to writing by reviewing & editing, validation, and supervision.

References

Akkus, M. (2016). The common core state standards for mathematics. *International Journal of Research in Education and Science*, *2*(1). https://doi.org/10.21890/ijres.61754

Bergqvist, T., & Lithner, J. (2012). Mathematical reasoning in teachers ' presentations. *Journal of Mathematical Behavior*, *31*(2).

Bozkurt, G., & Ruthven, K. (2017). Classroom-based professional expertise: a mathematics teacher's practice with technology. *Educational Studies in Mathematics*, *94*(3). https://doi.org/10.1007/s10649-016-9732-5

Çetinkaya, L. (2019). The effects of problem based mathematics teaching through mobile applications on success. *Egitim ve Bilim*, *44*(197). https://doi.org/10.15390/EB.2019.8119

Chen, T.-Y., Wei, H.-W., Cheng, Y.-C., Leu, J.-S., Shih, W.-K., & Hsu, N.-I. (2015). Integrating an e-book Software with Vector Graphic Technology on Cloud Platform. *Procedia - Social and Behavioral Sciences*, *176*. https://doi.org/10.1016/j.sbspro.2015.01.572

Choi, J., & Walters, A. (2018). Exploring the impact of small-group synchronous discourse sessions in online math learning. *Online Learning Journal*, *22*(4). https://doi.org/10.24059/olj.v22i4.1511

de Mooij, S. M. M., Kirkham, N. Z., Raijmakers, M. E. J., van der Maas, H. L. J., & Dumontheil, I. (2020). Should online math learning environments be tailored to individuals' cognitive profiles? *Journal of Experimental Child Psychology*, *191*. https://doi.org/10.1016/j.jecp.2019.104730

Dick, W., Carey, L., & Carey, J. O. (2009). The Systematic Design of Instruction. In *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-006-9606-0

Etherington, M. (2011). Investigative primary science: A problem-based learning approach. *Australian Journal of Teacher Education*, *36*(9). https://doi.org/10.14221/ajte.2011v36n10.1

Fernández, C., Llinares, S., & Rojas, Y. (2020). Prospective mathematics teachers' development of noticing in an online teacher education program. *ZDM - Mathematics Education*, *52*(5). https://doi.org/10.1007/s11858-020-01149-7

Haara, F. O., Bolstad, O. H., & Jenssen, E. S. (2021). Research on mathematical literacy in schools - Aim, approach and attention. *European Journal of Science and Mathematics Education*, *5*(3). https://doi.org/10.30935/scimath/9512

Hardianti, S., & Zulkardi, Z. (2019). Students mathematical literacy abilities in solving PISA type math problem with LRT context. *Journal of Physics: Conference Series*, *1315*(1). https://doi.org/10.1088/1742-6596/1315/1/012016

Harel, G., & Fuller, E. (2013). Reid, D.A. and Knipping, C.: Proof in mathematics education: research, learning, and teaching. *ZDM*, *45*(3). https://doi.org/10.1007/s11858-013-0497-3

Herbert, S., Vale, C., Bragg, L. A., Loong, E., & Widjaja, W. (2015). A framework for primary teachers' perceptions of mathematical reasoning. *International Journal of Educational Research*, *74*. https://doi.org/10.1016/j.ijer.2015.09.005

Hidayah, I. N., Sa'dijah, C., Subanji, & Sudirman. (2020). CHARACTERISTICS of STUDENTS' ABDUCTIVE REASONING in SOLVING ALGEBRA PROBLEMS. *Journal on Mathematics Education*, *11*(3). https://doi.org/10.22342/JME.11.3.11869.347-362

Juandi, D., & Tamur, M. (2021). The impact of problem-based learning toward enhancing mathematical thinking: A meta-analysis study. *Journal of Engineering Science and Technology*, *16*(4).

Junianto, & Wijaya, A. (2019). Developing Students' Mathematical Literacy through Problem Based Learning. *Journal of Physics: Conference Series*, *1320*(1). https://doi.org/10.1088/1742-6596/1320/1/012035

Keengwe, J., & Georgina, D. (2012). The digital course training workshop for online learning and teaching. *Education and Information Technologies*, *17*(4). https://doi.org/10.1007/s10639-011-9164-x

Letchumanan, M., & Tarmizi, R. A. (2010). Utilization of e-book among university mathematics students. *Procedia - Social and Behavioral Sciences*, *8*. https://doi.org/10.1016/j.sbspro.2010.12.080

Lithner, J. (2017). Principles for designing mathematical tasks that enhance imitative and creative reasoning. *ZDM - Mathematics Education*, *49*(6). https://doi.org/10.1007/s11858-017-0867-3

MacLeod, M., & van der Veen, J. T. (2020). Scaffolding interdisciplinary project-based learning: a case study. *European Journal of Engineering Education*, *45*(3). https://doi.org/10.1080/03043797.2019.1646210

Mailizar, M., & Fan, L. (2020). Indonesian teachers' knowledge of ICT and the use of ICT in secondary mathematics teaching. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(1). https://doi.org/10.29333/ejmste/110352

Mamolo, L. A. (2022). Online Learning and Students' Mathematics Motivation, Self-Efficacy, and Anxiety in the 'new Normal'. *Education Research International*, *2022*. https://doi.org/10.1155/2022/9439634

Merritt, J., Lee, M. Y., Rillero, P., & Kinach, B. M. (2017). Problem-based learning in K-8 mathematics and science education: A literature review. *Interdisciplinary Journal of Problem-Based Learning*, *11*(2). https://doi.org/10.7771/1541-5015.1674

NCTM. (2009). Focus in High School Mathematics: Reasoning and Sense Making. *The Mathematics Teacher*, *106*(8).

Norqvist, M. (2018). The effect of explanations on mathematical reasoning tasks. *International Journal of Mathematical Education in Science and Technology*, *49*(1). https://doi.org/10.1080/0020739X.2017.1340679

OECD. (2017). PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving, revised edition. In *OECD Publishing*.

Ojose, B. (2011). Mathematics literacy : are we able to put the mathematics we learn into everyday use? *Journal of Mathematics Education*, *4*(1).

Owston, R. D., Sinclair, M., & Wideman, H. (2008). Blended learning for professional development: An evaluation of a program for middle school mathematics and science teachers. *Teachers College Record*, *110*(5). https://doi.org/10.1177/016146810811000503

Richey, R. C., Klein, J. D., & Tracey, M. W. (2011). The instructional design knowledge base: theory, research, and practice. In *Journal of Chemical Information and Modeling* (Vol. 53, Issue 9). https://doi.org/10.1017/CBO9781107415324.004

Rogers, K. C., & Steele, M. D. (2016). Graduate teaching assistants' enactment of reasoning-and-proving tasks in a content course for elementary teachers. *Journal for Research in Mathematics Education*, *47*(4). https://doi.org/10.5951/jresematheduc.47.4.0372

Schettino, C. (2016). Framework for problem-based learning: Teaching mathematics with a relational problem-based pedagogy. *Interdisciplinary Journal of Problem-Based Learning*, *10*(2). https://doi.org/10.7771/1541-5015.1602

Subanji, S., & Nusantara, T. (2016). Thinking Process of Pseudo Construction in Mathematics Concepts. *International Education Studies*, *9*(2). https://doi.org/10.5539/ies.v9n2p17

Tezer, M., Yildiz, E. P., Bozkurt, S., & Tangul, H. (2019). The influence of online mathematics learning on prospective teachers mathematics achievement: The role of independent and collaborative learning. *World Journal on Educational Technology: Current Issues*, *11*(4). https://doi.org/10.18844/wjet.v11i4.4361

Utari, T. S. G., Kartasasmita, B. G., & Julika, C. (2019). The application of situation-based learning strategy to improve literacy skills, mathematical problem-solving ability and mathematical self-efficacy at senior high school students. *International Journal of Innovation, Creativity and Change*, *6*(1).

Williams, J. J., Tunks, J., Gonzalez-Carriedo, R., Faulkenberry, E., & Middlemiss, W. (2020). Supporting Mathematics Understanding Through Funds of Knowledge. *Urban Education*, *55*(3). https://doi.org/10.1177/0042085916654523

Artikel Jurnal Elemen

ORIGINALITY REPORT

17%	13%	10%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	iss.internationaljournallabs.com Internet Source	1%
2	repository.unikama.ac.id Internet Source	1%
3	www.test.journal.unipdu.ac.id Internet Source	1%
4	Samsul Pahmi, Nanang Priatna, Jarnawi Afgani Dahlan, Arif Muchyidin. "Implementation the project-based learning using the context of Batik art in elementary mathematics learning", Jurnal Elemen, 2022 Publication	1%
5	Savin Baden, Maggi, Wilkie, Kay. "EBOOK: Challenging Research in Problem-based Learning", EBOOK: Challenging Research in Problem-based Learning, 2004 Publication	1%
6	Submitted to Universiti Teknologi Malaysia Student Paper	1%
7	Submitted to University of Greenwich	

	Student Paper	1 %
8	Enggar Tri Aulia, Rully Charitas Indra Prahmana. "Developing interactive e-module based on realistic mathematics education approach and mathematical literacy ability", Jurnal Elemen, 2022 Publication	1 %
9	Submitted to Western Washington University Student Paper	1 %
10	Submitted to UIN Raden Intan Lampung Student Paper	1 %
11	journalppw.com Internet Source	1 %
12	scitepress.org Internet Source	1 %
13	download.atlantis-press.com Internet Source	<1 %
14	ejournal.undiksha.ac.id Internet Source	<1 %
15	e-journal.hamzanwadi.ac.id Internet Source	<1 %
16	ejournal.unsri.ac.id Internet Source	<1 %

17	Pieter Sahertian, Umiati Jawas. "Culture and excellent leaders: case of indigenous and non-indigenous Indonesian leaders", Heliyon, 2021 Publication	<1 %
18	D Darmadi, S Sanusi. "Visual reasoning analysis of female students in solving mathematical problems", Journal of Physics: Conference Series, 2020 Publication	<1 %
19	Mitra Borji, Morteza Naserbakht, Ahmad Hajebi, Asal Fazeli, Zahra Khorrami, Helia Ranjbar, Amirali Hajebi. "Evaluation Of School Mental Health Promotion Program: A Qualitative Study", Research Square Platform LLC, 2022 Publication	<1 %
20	ejournal.radenintan.ac.id Internet Source	<1 %
21	journal.uinsgd.ac.id Internet Source	<1 %
22	www.cris.uns.ac.rs Internet Source	<1 %
23	www.e-iji.net Internet Source	<1 %
24	www.scholink.org Internet Source	<1 %

25	files.eric.ed.gov Internet Source	<1 %
26	journal.unj.ac.id Internet Source	<1 %
27	Puji Lestari, Mardiyana, I Slamet. "The need analysis of mathematics module based on problem-based learning to improve reasoning ability", Journal of Physics: Conference Series, 2021 Publication	<1 %
28	Sirwan, Kamal, Nurkhamid. "Developing E-module based on mobile learning as a preparation media", Journal of Physics: Conference Series, 2021 Publication	<1 %
29	ejournal.upbatam.ac.id Internet Source	<1 %
30	erie.pef.czu.cz Internet Source	<1 %
31	jurnal.peneliti.net Internet Source	<1 %
32	repository.uhamka.ac.id Internet Source	<1 %
33	talenta.usu.ac.id Internet Source	<1 %

34	www.amesa.org.za Internet Source	<1%
35	www.scribd.com Internet Source	<1%
36	"Research on e-Learning and ICT in Education", Springer Science and Business Media LLC, 2017 Publication	<1%
37	Mustafa Güler, Suphi Önder Bütüner, Şahin Danişman, Kadir Gürsoy. "A meta-analysis of the impact of mobile learning on mathematics achievement", Education and Information Technologies, 2021 Publication	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		