JTAM (Jurnal Teori dan Aplikasi Matematika)
http://journal.ummat.ac.id/index.php/jtam
p-ISSN 2597-7512 | e-ISSN 2614-1175
Vol. 7, No. 4, October 2023, pp. 1118-1127

The Practicality and Effectiveness of E-Modules with an Inquiry Approach in Geometry Learning Courses for Elementary School Teacher Education Students

I Ketut Suastika
Mathematics Education, Universitas PGRI Kanjuruhan Malang, Indonesia
suastika@unikama.ac.id

Article History:
Received : 14-07-2023
Revised : 20-09-2023
Accepted : 28-09-2023
Online : 09-10-2023

Keywords:
Development;
E-modules;
Inquiry approach.

ABSTRACT

The focus of this research is to develop a teaching material product in the form of an e-module with an inquiry approach in geometry learning courses. In this development, researchers refer to the stages of Plomp & Neeven The stages of this research were: (1) preliminary research, (2) prototyping phases, and (3) assessment phases. This article will discuss the assessment phase, namely the test try e-module. The focus of the assessment on this test is to assess the practicality and effectiveness of the e-module. The evaluation for the practicality of the e-module uses the Lecturer Response Questionnaire, while the effectiveness assessment uses the Student Response Questionnaire and Teaching Material Mastery Test. The results of the lecturer response questionnaire were 3.530, the student response questionnaire results were 3.276, and the average test results for mastery of teaching materials were 91.595. The test results show that the e-module meets the criteria of practicality and effectiveness Based on the results of this implementation, e-module with an inquiry approach in geometry learning courses can be applied in lecture classes

https://doi.org/10.31764/jtam.v7i4.16543

A. INTRODUCTION

The Elementary School Teacher Education study program has five fields of knowledge that students must take. One of them is mathematics. One of the courses that must be taken in mathematics is the Geometry Learning course. This course is very important for students who will later become teachers in elementary schools, considering the content that contains concepts and how to teach geometry material in elementary schools. In addition, students get a good understanding of the concepts contained in the material in this course. Of course, this has to do with using teaching materials during lectures. Meanwhile, the researchers found observations that there were indeed lecturers who used textbooks in conveying geometry material. The presentation of the material in the textbook still needs to provide opportunities for students to find concepts, both the area concept of flat shape and the concept of volume shape.

Indonesia has entered the era of the Industrial Revolution 4.0, characterized by digitalization and automation. The rapid development of technology and communication in this era has impact on services to students. Students must be familiarized with technology in

learning. Learning in this era requires educators to master and utilize technology in the learning process (Fatmawati & Safitri, 2020). Modules are independent teaching materials that are systematically and contextually packaged (Căprioară, 2015; Triwahyuningtyas et al., 2022; Arif & Abdillah, 2018). E-modules are designed to be able to assist students in mastering learning experiences in accordance with predetermined learning objectives. E-module is one of the new or electronic modules using previously printed media technology (Istuningsih et al., 2018). E-module is a teaching material that demands students' independence to discover concepts (Serevina et al., 2018). E-Module is a form of presenting learning materials in electronic form that is designed attractively and systematically to achieve certain competencies (Suastika & Triwahyuningtyas, 2019). E-module enable students to learn independently to solve given problem (Brugar, 2019). E-modules are very effective because they can help students visualize, build, and associate in thinking processes (Nurwijayanti et al., 2018; Winatha & Abubakar, 2018). E-modul can attract students' attention because it has sound and moving image in the form of video (Khairi & Ikhsan, 2022). The use of e-modules in classroom learning will have an impact on student learning outcomes (Triwahyuningtyas & Suastika, 2020; Sidiq & Suhendro, 2021). E-modules help students build concepts independently (Susilo et al., 2018). The advantage of learning with e-modules is that students can repeat what they do not understand (Suastika & Wahyuningtyas, 2020).

Approach inquiry departs from the viewthat students as subjects and objects in the study havethe ability base for development in a manner optimal following the ability whichhas. The inquiry approach is independent learning that emphasizes the development of scientific thinking (Alameddine & Ahwal, 2016). Providing problems to be analyzed and solved is a characteristic of inquiry based learning (Slavit & Lesseig, 2017). Inquiry based learning is highly recommended because it is considered efficient in increasing curiosity and motivation and is able to develop students' critical thinking (Suárez et al., 2018). In the digital era, E-module-based inquiry become a solution for learning geometry (Suastika & Triwahyuningtyas, 2019). Based on this explanation, the researcher considers it necessary to carry out research on the development of electronic teaching materials to provide the best service for Elementary School Teacher Education Students, namely E-Modules with an Inquiry Approach in Geometry Learning Courses.

B. METHODS

In this development, researchers refer to the stages of Plomp & Neeven (2013). These stages are (1) *preliminary research,* (2) *prototyping phase*, and (3) *assessment phase*. The development procedures related to this research are presented at Figure 1.

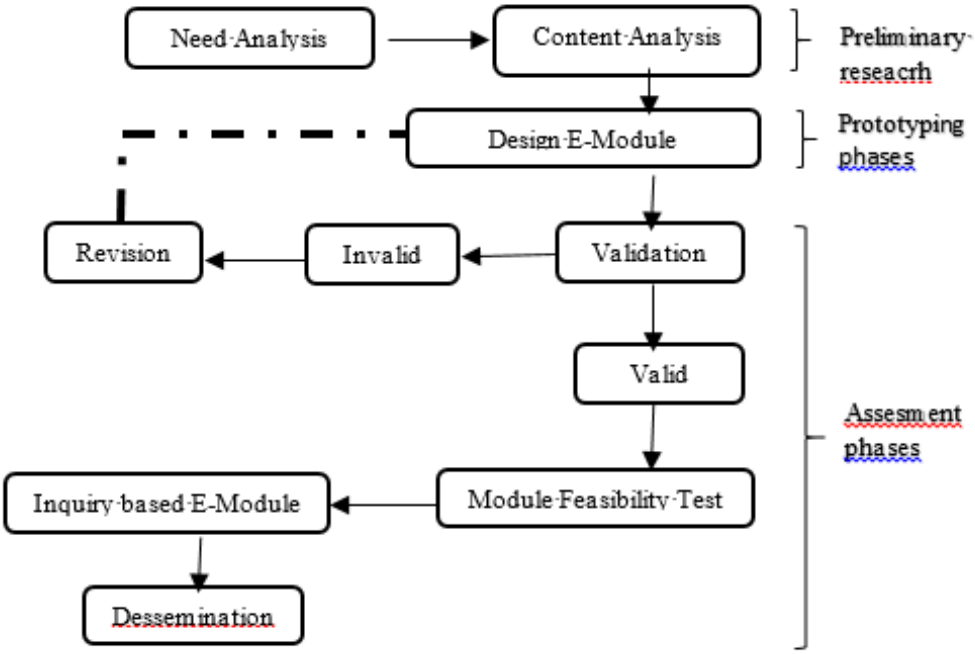

Figure 1. Procedure of Inquiry Based E-Modul Development

This article will discuss the assessment phase, namely the test try e-module. The trial was conducted after the validator stated that the e-module was valid. The test subjects were 232 Elementary School Teacher Education Study Program student from eight East Java universities. The focus of the assessment on the test this test is to assess the practicality and effectiveness of the e-module. Assessment of the e-module uses the Lecturer Response Questionnaire by ticking one of the available assessment options, namely: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The score criterion is 4 for Strongly Agree, 3 for Agree, 2 for Disagree, and 1 for Strongly Disagree. Besides this assessment method, the researcher also provided space for the respondents (lecturers) for their suggestions and comments. The e-module is practical if: (a) each statement item gets a minimum average score of 3, and (b) the average score for the lecturer's response questionnaire is at least 3.

To assess the effectiveness of the e-module using the Student Response Questionnaire and Teaching Material Mastery Test. To assess student response questionnaires, check one of the available options, namely: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The score criterion is 4 for Strongly Agree, 3 for Agree, 2 for Disagree, and 1 for Strongly Disagree. Besides this assessment method, the researcher also provided space for respondents (students) for suggestions and comments. Meanwhile, student responses are positive if: (a) each statement item gets an average score of at least 3; and (b) the average score for the student response questionnaire is at least 3. The Teaching Materials Mastery Test uses exam questions already in the e-module. E-module is effective if: (a) the student response is positive; and (b) the average student mastery test score is at least 80.

C. RESULT AND DISCUSSION

Researchers carried out product trials in the Elementary School Teacher Education Study Program at eight universities in East Java. They are the Elementary School Teacher Education Study Program at Universitas PGRI Adi Buana Surabaya, STKIP PGRI Sidoarjo, Universitas PGRI Madiun, Universitas Nusantara PGRI Kediri, Universitas Bhinneka PGRI Tulungagung, STKIP PGRI Trenggalek, Universitas Islam Maulana Malik Ibrahim Malang, and Universitas PGRI Kanjuruhan Malang.

1. Result of the Practicality of the E-Module

Eight lecturers from each tertiary institution filled out a lecturer response questionnaire. The results of filling out the questionnaire by the lecturer are in Table 1, while the results of calculating the average lecturer response questionnaire are in Table 2.

Table 1. Lecturer Response Questionnaire Results

No.	Statement	Answer Choices				Total
		S A	A	D	SD	
1	Learning indicators are under learning outcomes.	5	2	1	0	8
2	Material according to learning indicators	5	3	0	0	8
3	Presentation of the material according to the inquiry approach	2	6	0	0	8
4	Systematic presentation of material	4	4	0	0	8
5	Messy presentation of material	6	2	0	0	8
6	Deep material presentation	3	5	0	0	8
7	Example questions according to the material.	5	3	0	0	8
8	The use of sentences does not create a double meaning	5	3	0	0	8
9	The image is in harmony with the material	5	3	0	0	8
10	Videos on the E-Module support understanding of the material	6	2	0	0	8
11	The E-Module instructions are clear	3	5	0	0	8
12	The placement of the use of buttons corresponds to the appearance of the E-Module.	3	5	0	0	8

Based on the data at Table 1, calculations were then carried out to obtain the score for each statement item in the questionnaire and also the average score for the overall questionnaire items. The calculation results obtained are presented at Table 2 below.

Table 2. Average Results of Lecturer Response Questionnaires

No.	Statement	Answer Choices				Total	Average
		S A (4)	A (3)	D (2)	SD (1)		
1	Learning indicators are under learning outcomes.	20	6	2	0	28	3,500
2	Material according to learning indicators	20	9	0	0	29	3,625
3	Presentation of the material according to the inquiry approach	8	18	0	0	26	3,250
4	Systematic presentation of material	16	12	0	0	28	3,500

5	Messy presentation of material	24	6	0	0	30	3,750
6	Deep material presentation	12	15	0	0	27	3,375
7	Example questions according to the material.	20	9	0	0	29	3,625
8	The use of sentences does not create a double meaning	20	9	0	0	29	3,625
9	The image is in harmony with the material	20	9	0	0	29	3,625
10	Videos on the E-Module support understanding of the material	24	6	0	0	30	3,750
11	The E-Module instructions are clear	12	15	0	0	27	3,375
12	The placement of the use of buttons corresponds to the appearance of the E-Module.	12	15	0	0	27	3,375
	Average						3,531

Table 2 shows that the average results of the lecturer's response questionnaire for each item statement and as a whole are greater than 3. It indicates that the development of the E-module by the researcher meets the practicality criteria.

2. Results of the Effectiveness of the E-module

Student response questionnaires came from 232 Elementary School Teacher Education Study Program students from eight East Java universities who passed the eye Geometry Learning course. Table 3 presents the results of the student response questionnaire, and Table 4 presents the results of calculating the average student response questionnaire.

Table 3. Student Response Questionnaire Results

No.	Statement	Answer Choices				Total
		S A	A	D	SD	
1	Writing material on systematic E-Modules according to the scope of learning	76	155	1	0	232
2	E-modules use language that is easy to understand	95	128	9	0	232
3	E-modules can be used easily	69	154	29	0	232
4	The text and displays on the E-Module are easy to read	86	140	6	0	232
5	The images used in the E-Module are attractive and easy to read	84	138	10	0	232
6	The presentation of Images on the E-Module is under the material	92	137	3	0	232
7	This e-module provides an opportunity to find concepts for the material being studied	82	142	8	0	232
8	This e-module uses video illustrations to understand the material	79	147	6	0	232
9	The questions used in this E-module are under the material	83	142	7	0	232
10	The E-Module material presented in the module is coherent.	79	143	10	0	232
11	The E-Module does not use sentences that have double meanings in this module.	65	150	17	0	232
12	I am very interested in using this E-module.	54	165	13	0	232

13	With illustrations at the beginning of each material, it can motivate to study geometry material	76	153	3	0	232
14	The module's student activities and practice questions help me develop my math skills.	87	141	4	0	232
15	The E-Module makes it easier for me to study independently	79	144	9	0	232
16	Instructions on the E-Module are explained clearly	75	149	8	0	232
17	The placement of the use of buttons corresponds to the appearance of the E-Module	68	155	9	0	232
18	The E-Module is easy to use	73	137	22	0	232

Based on the data at Table 3, calculations were then carried out to obtain the score for each statement item in the questionnaire and also the average score for the overall questionnaire items. The calculation results obtained are presented at Table 4 below.

Table 4. Average Student Response Questionnaire Results

No.	Statement	Answer Choices				Total	Average
		S A (4)	A (3)	D (2)	SD (1)		
1	The material written on the E-Module is systematic according to the scope of learning.	304	465	2	0	771	3,323
2	E-modules use language that is easy to understand	380	384	18	0	782	3,370
3	E-modules can be used easily	276	462	58	0	796	3,431
4	The text and displays on the E-Module are easy to read	344	420	12	0	776	3,345
5	The images used in the E-Module are attractive and easy to read	336	414	20	0	770	3,319
6	The images on the E-Module are presented according to the material	368	411	6	0	785	3,384
7	This e-module provides an opportunity to find concepts for the material being studied.	328	426	16	0	770	3,319
8	This e-module uses video illustrations to understand the material.	316	441	12	0	769	3,315
9	The questions used in this E-module are under the material	332	426	14	0	772	3,328
10	The E-Module material presented in the module is coherent.	316	429	20	0	765	3,297
11	The E-Module does not use sentences that have double meanings in this module.	260	450	34	0	744	3,209
12	I am very interested in using this E-module.	216	495	26	0	737	3,177

13	Illustrations at the beginning of each material can motivate students to study geometry.	304	459	6	0	769	3,315
14	The module's student activities and practice questions helped me develop my math skills.	348	423	8	0	779	3,358
15	The E-Module makes it easier for me to study independently.	316	432	18	0	766	3,302
16	Instructions on the E-Module are explained clearly	300	447	16	0	763	3, 289
17	The placement of the use of buttons corresponds to the appearance of the E-Module.	272	465	18	0	755	3,254
18	The E-Module is easy to use	292	411	44	0	747	3,219
	Average						3, 276

Furthermore, students' test scores will be presented after completing learning using E-Modules with an Inquiry Approach. Because there are 232 subjects so it requires a very long table. In this article only presents the total score from each university. The results are presented at Table 5.

Table 5. Results of the Teaching Material Mastery Test

No.	**Study Program**	**Number of Students**	**Total Score**
1	Elementary School Teacher Education Universitas PGRI Kanjuruhan Malang	41	3720
2	Elementary School Teacher Education Universitas PGRI Adi Buana Surabaya	24	2130
3	Elementary School Teacher Education Universitas PGRI Madiun	17	1540
4	Elementary School Teacher Education Universitas Nusantara PGRI Kediri	12	1050
5	Elementary School Teacher Education UIN Maulana Malik Ibrahim Malang	21	1990
6	Elementary School Teacher Education Universitas Bhinneka PGRI Tulung Agung	42	3830
7	Elementary School Teacher Education STKIP PGRI Sidoarjo	43	3950
8	Elementary School Teacher Education STKIP PGRI Trenggalek	32	3040
Amount		232	21250
Average			91.595

The result in Table 4 show that the average for both each statement item and overall is more than 3. That states that the student's response to the development of the e-module is "positive." Meanwhile, Table 5 presents the results of student tests on mastery of teaching materials. Table 5 show that average student test result is 91,595. Based on Table 4 and Table 5 it can be said that the development of this e-module meets the criteria for effectiveness because the student response is "positive," and the average score of the student mastery test is more than 80.

Based on the trials, the developed e-module meets the criteria of practicality and effectiveness. The results of this study indicate that the development of e-modules by researchers gives positive results on student test results. It happens because this module is designed to be attractive and equipped with pictures and videos that support the presentation of the material. The application of e-modules in learning can make students interested because the e-modules are equipped with moving images (animated videos) and also material summary videos so that students are enthusiastic about learning (Oktari et al., 2020). Students' interest in learning with e-modues is because e-modul are made in communicative, unambiguous, and easy to understand language (Roskos et al., 2017). Learning by using e-modules, students can understand material more quickly and can increase student interaction with teachers, this is because students are already well equipped with the material being discussed. E-modules provide images and text that are easy to understand, so that students remember them more easily (Laili et al., 2019). The activities made in the e-module can guide students in discovering concepts when studying geometry material (Tan et al., 2019).

Inquiry-based e-module-assisted geometry learning allows students to increase motivation and also independence in learning. This is in accordance with opinion of Suastika & Wahyuningtyas (2020), inquiry-based geometry e-modules can provide easy access to elementary school teacher education students. On the other hand, learning through searching and finding (inquiry) developed in this e-module causes students to use all their potential to find concepts so that their understanding of them lasts a long time. Knowledge obtained by discovery learning shows that knowledge lasts a long time, is remembered for a long time, or is easier to remember when compared to knowledge learned in other ways (Decker-Lange, 2018). Overall, students' reasoning and the ability to think independenly can increase with learning through discovery (Pedaste et al., 2015).

Based on a search of the comments made by the lecturer when filling out the questionnaire, the lecturer generally wrote the comments "the media is good" and "is appropriate". On the other hand, the lecturers still give some inputs, including: "Try that the e-module can improve critical thinking skills" and "should be added contextual questions". Meanwhile, in a search on the comments made by students when filling out the questionnaire, in general, students wrote comments "the use of e-modules is very helpful" and "learning e-modules is easy and fun".

D. CONCLUSION AND SUGGESTIONS

Development of this e-modul follows the stages of Plomp & Neeven (2013), namely: (1) preliminary research; (2) prototyping phases; and (3) assessment phases. Before being tested, this e-module has been declared valid by the validator. Based on the trials, that the average results of the lecturer's response questionnaire for each item statement and as a whole are greater than 3. It indicates that the development of the E-module by the researcher meets the practicality criteria. Furthermore, the average for both each statement item and overall is more than 3. Also the average student test result is 91,595 It indicates that the development of the E-module by the researcher meets the effectiveness criteria. Because the product of this development, namely "E-module with an inquiry approach in geometry learning course for elementary school teacher education students" has met the valid, practical, and effective

criteria, so this e-module can be use an alternative for lecturers when teaching geometry material in class.

ACKNOWLEDGEMENT

Kemendikbud Ristek is properly acknowledged for funding this research.

REFERENCES

Akker, J. V., Bannan, B., Kelly, A. E., Nieveen, N., & Plomp, T. (2013). *educational-design-research-part-a.pdf* (T. Plomp & N. Nieveen (eds.); a). Netherlands Institute for Curriculum Development (SLO).

Alameddine, M. M., & Ahwal, H. W. (2016). Inquiry Based Teaching in Literature Classrooms. *Procedia - Social and Behavioral Sciences*, *232*(1), 332–337. https://doi.org/10.1016/j.sbspro.2016.10.031

Arif, M. A., & Abdillah, A. (2018). Pengembangan Modul Belajar Mandiri LaTeX Beamer Sebagai Alternatif Media Presentasi Mahasiswa Program Studi Pendidikan Matematika. *JTAM | Jurnal Teori Dan Aplikasi Matematika*, *2*(2), 138. https://doi.org/10.31764/jtam.v2i2.716

Brugar, K. A. (2019). Inquiry By the Book: Using Children's Nonfiction as Mentor Texts for Inquiry. *The Social Studies*, *110*(4), 155–160. https://doi.org/10.1080/00377996.2019.1581724

Căprioară, D. (2015). Problem Solving - Purpose and Means of Learning Mathematics in School. *Procedia - Social and Behavioral Sciences*, *191*(1), 1859–1864. https://doi.org/10.1016/j.sbspro.2015.04.332

Decker-Lange, C. (2018). Problem- and inquiry-based learning in alternative contexts: Using museums in management education. *International Journal of Management Education*, *16*(3), 446–459. https://doi.org/10.1016/j.ijme.2018.08.002

Fatmawati, E., & Safitri, E. (2020). Kemampuan Literasi Informasi Dan Teknologi Mahasiswa Calon Guru Menghadapi Pembelajaran Di Era Revolusi Industri 4.0. *Edukasi: Jurnal Pendidikan*, *18*(2), 214–224. https://doi.org/10.31571/edukasi.v18i2.1863

Istuningsih, W., Baedhowi, B., & Sangka, K. B. (2018). The Use Of Electrinic Modules For Learning Effectiveness. *IJERE*, *03*(03), 75–85.

Khairi, M. A., & Ikhsan, J. (2022). Development of Guided Inquiry-Based Electronic Modules and Its Effects on Students' Chemical Literacy. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *7*(2), 181–193. https://doi.org/10.20961/jkpk.v7i2.62319

Laili, I., Ganefri, G., & Usmeldi, U. (2019). Efektivitas Pengembangan E-Modul Project Based Learning Pada Mata Pelajaran Instalasi Motor Listrik. *Jurnal Imiah Pendidikan Dan Pembelajaran*, *3*(1), 306–315. https://ejournal.undiksha.ac.id/index.php/JIPP/article/download/21840/13513

Nurwijayanti, A., Budiyono, B., & Fitriana, L. (2018). The Use of Interactive Media Ispring Suite 8 Supported by Google SketchUp to Improve Students' Geometry Skills Based on Hoffer's Theory. *Journal of Physics: Conference Series*, *1008*(1), 1–8. https://doi.org/10.1088/1742-6596/1008/1/012075

Oktari, B., Susilawati, S., & Copriady, J. (2020). Implementation of Oriented Literated Science E-Module to Improve Critical Skills Thinking About in Hydrocarbon Material. *Journal of Educational Sciences*, *4*(2), 347–356.

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*(1), 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Roskos, K., Brueck, J., & Lenhart, L. (2017). An analysis of e-book learning platforms: Affordances, architecture, functionality and analytics. *International Journal of Child-Computer Interaction*, *12*(1), 37–45. https://doi.org/10.1016/j.ijcci.2017.01.003

Serevina, V., Sunaryo, S., Raihanati, R., Astra, I. M., & Sari, I. J. (2018). Development of E-Module Based on Problem Based Learning (PBL) on Heat and Temperature to Improve Student's Science Process Skill. *TOJET: The Turkish Online Journal of Educational Technology –*, *17*(3), 26–36.

Sidiq, R., & Suhendro, P. (2021). Utilization of Interactive E-Modules in Formation of Students's Independent Characters in the Era of Pandemic. *International Journal of Educational Research and Social Sciences (IJERSC)*, *2*(6), 1651–1657. https://ijersc.org

Slavit, D., & Lesseig, K. (2017). The Development of Teacher Knowledge in Support of Student Mathematical Inquiry. *Primus (Problems, Resources, and Issues in Mathematics Undergraduate Studies)*, *27*(1), 58–74. https://doi.org/10.1080/10511970.2016.1183156

Suárez, Á., Specht, M., Prinsen, F., Kalz, M., & Ternier, S. (2018). A review of the types of mobile activities in mobile inquiry-based learning. *Computers and Education*, *118*(1), 38–55. https://doi.org/10.1016/j.compedu.2017.11.004

Suastika, I. K., & Triwahyuningtyas, D. (2019). Pengembangan E-Modul Berbasis Inkuiri Untuk Pembelajaran Geometri Pada Program Studi Pgsd. *Pi: Mathematics Education Journal*, *2*(2), 98–103. https://doi.org/10.21067/pmej.v2i2.3629

Suastika, I. K., & Wahyuningtyas, D. T. (2020). Inquiry-based E-module for geometry learning subject. *Universal Journal of Educational Research*, *8*(1), 243–248. https://doi.org/10.13189/ujer.2020.080130

Susilo, T., Sujadi, I., & Indriati, D. (2018). Developing A Media "Visual Design of Pop Up Mathematics Book" as a Supporting Tool in Inquiry-Based Learning for Learning Three-Dimensional Figures. In *Journal of Physics: Conference Series* (Vol. 1108, Issue 1, pp. 1–6). https://doi.org/10.1088/1742-6596/1108/1/012029

Tan, P., Lambert, R., Padilla, A., & Wieman, R. (2019). A disability studies in mathematics education review of intellectual disabilities: Directions for future inquiry and practice. *Journal of Mathematical Behavior*, *54*(1), 1–13. https://doi.org/10.1016/j.jmathb.2018.09.001

Triwahyuningtyas, D., Mahmuda, N. E., Santoso, L. R., & Sesanti, N. R. (2022). Addition and Subtraction of Fractions Module Based Project Based Learningfor Students of Elementary School. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *6*(1), 75. https://doi.org/10.31764/jtam.v6i1.5357

Triwahyuningtyas, D., & Suastika, I. K. (2020). Influence inquiry-based geometry e-module for primary school teacher education students. *Elementary Education Online*, *19*(3), 160–166. https://doi.org/10.17051/ilkonline.2020.03.113

Winatha, K. R., & Abubakar, M. M. (2018). The Usage Effectivity of Project-Based Interactive E-Module in Improving Students' Achievement. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *24*(2), 198–202. https://doi.org/10.21831/jptk.v24i2.20001