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The Geometry E-module Based on Numerical Literacy for the Fifth Grade of Elementary School

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Abstract

As a learning innovation, it is necessary to have e-module that brings an interesting learning atmosphere and increase student interests in learning mathematics. This research aims to develop a valid and practical geometry e-module based on numerical literacy for the fifth grade of elementary school. The method in development research uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. Data were collected using validation questionnaires and student questionnaires. Data were then analyzed using descriptive qualitative and quantitative techniques. The results showed that the validator's assessment obtained the valid criteria, with a percentage of 99% (media experts), 83% (material experts), and 87% (linguists). In the practicality test, the teacher got 96% (excellent) and the students got 94% (excellent). Based on the assessment results, the geometry e-module based on numerical literacy for the fifth grade of elementary school has met the eligibility and practicality criteria. Therefore, teachers can use this e-module as a companion book in distance learning.

Keywords: *geometry*, *e-module*, *numerical literacy*.

Abstrak

Sebagai inovasi pembelajaran, perlu adanya e-modul yang membawa suasana pembelajaran yang menarik dan meningkatkan minat siswa dalam belajar matematika. Penelitian ini bertujuan untuk mengembangkan e-modul bangun ruang berbasis literasi numerasi untuk kelas 5 sekolah dasar yang valid dan praktis. Metode dalam penelitian pengembangan menggunakan model ADDIE (*Analysis, Design, Development, Implementation, Evaluation*). Data dikumpulkan dengan menggunakan kuesioner validasi dan angket siswa. Data kemudian dianalisis menggunakan teknik deskriptif kualitatif dan kuantitatif. Hasil penelitian menunjukkan bahwa penilaian validator memperoleh kriteria valid dengan persentase 99% (ahli media), 83% (ahli materi), dan 87% (ahli bahasa). Pada uji kepraktisan, guru memperoleh 96% (sangat baik) dan peserta didik memperoleh 94% (sangat baik). Berdasarkan hasil penilaian tersebut, maka e-modul bangun ruang berbasis literasi numerasi untuk kelas 5 sekolah dasar dapat digunakan karena telah memenuhi kriteria kelayakan dan kepraktisan. Guru dapat menggunakan e-modul ini sebagai buku pendamping dalam pembelajaran jarak jauh.

Kata kunci: *bangun ruang, e-modul, literasi numerasi.*

INTRODUCTION

Entering the industrial revolution 4.0, the current era of education is closely related to the development of science and technology (Ramadhani & Fitri, 2020). The technology-based learning can make learning interactive, fun, and challenging. It can also motivate students to participate in developing their talents. Interest and creativity can affect the psychological development of students (Kemendikbud, 2020). As learning mathematics requires critical thinking skills, especially at the elementary school level, teacher creativity is needed in delivering mathematics learning innovatively to enhance the students' critical thinking skills (Septian et al., 2019). Therefore, to hone critical thinking skills and develop students' potential, learning mathematics can be supported using technology from the surrounding environment.

The results of research from Turel and Ozer Sanal (2018) revealed that the learning process using technology requires teaching materials that can be accessed anywhere so that it can improve student achievement and motivation, and reduce student anxiety. For instance, in teaching mathematics, usually teachers use textbooks provided by the school and student worksheets; however, to create a pleasant learning atmosphere that can attract the students' interest in learning, teachers can use various methods of learning innovation. As an example, in delivering learning materials to students, technology-based e-module books can be used in the distance learning process (Nita, 2020).

Combining print media and computer technology (Ayu & Wahyuningtyas, 2019), e-module can be used by the students as independent learning resources that can hone their

cognitive learning competencies (Utami et al., 2018). In the e-module, there is learning information that is structured, interesting, and interactive. Using the e-module in the learning process, students does not depend largely on the teacher as a supervisor in providing sources of information in learning mathematics.

Learning mathematics helps communicate numbers using various symbols with factual thinking patterns (Saluky, 2016). One of the materials in learning mathematics is geometry. Geometry is a shape that has three dimensions. Geometry is formed from pieces separated by groups using dotted lines on all the buildings' surfaces (Sipayung, 2018). According to Khasana et al. (2020), geometry has three sizes to become volume: length, width, and height. Geometry can be implemented in real life based on the experiences of students (Vidermanova & Vallo, 2015). Geometry is one of the mathematics learning materials using straight lines consisting of length, width, and height. Through learning mathematics, students are expected to be able to solve everyday problems logically.

Mathematics learning includes numerical literacy easier for students to master because it is related to everyday life. Numerical literacy is knowledge of linking mathematical concepts in everyday life. Students are expected to improve their ability to communicate and explain various problems in their lives, such as when buying food at a store or other activities, by linking mathematical concepts (Fiangga et al., 2019). Literacy means the ability to understand, use, and interpret written texts and numeracy; it is the ability to access, use and interpret arithmetic operations (Lechner et al., 2021). Numerical literacy helps students, teachers, parents, and the community develop their ability to process numbers proficiently (Han, et.al, 2017) and examine the contribution of memory ability procedures in language and numeracy skills (Mimeau et al., 2016). Numerical literacy is part of basic mathematical concepts that cannot be separated in everyday life.

A previous study has shown that developing a geometry e-module using a realistic mathematical approach can make it easier for students to find concepts (Buchori & Rahmawati, 2017). Using e-book media in numerical literacy can also increase the students' reading interest by linking mathematical concepts in everyday life (Salim Nahdi & Cahyaningsih, 2018). In addition, the use of e-module can increase creativity and make learning more varied (Amir & Kusuma, 2018). Mathematics is closely related to everyday life and student learning activities (Heruman, 2014). The use of numerical literacy can develop the potential of students and teachers (Ekowati, et.al, 2019). Therefore, there is a need for electronic media innovation in mathematics learning especially that related to numerical literacy. In this study, mathematics learning will be developed in a numeric literacy-based

geometry electronic module. Based on the previous research, it is important to have further research investigating the innovation of numerical literacy-based building modules in the digital era. This study aims at determining the feasibility and practicality of the development of a solid image e-module based on numerical literacy for the fifth grade of elementary school.

METHODS

Using research and development (R&D) to develop products (Martianingtiyas, 2019). in developing an e-module based on numerical literacy, the researcher employed the ADDIE development model. This model consisted of Analysis, Design, Development, Implementation, and Evaluation. The researchers chose the ADDIE development model because the model was dynamic, effective, and more rational than the 4D model (Kurnia et al., 2019; Mulyaningsih & Saraswati, 2017). Jones (2014) stated that the ADDIE model uses five stages of development including:

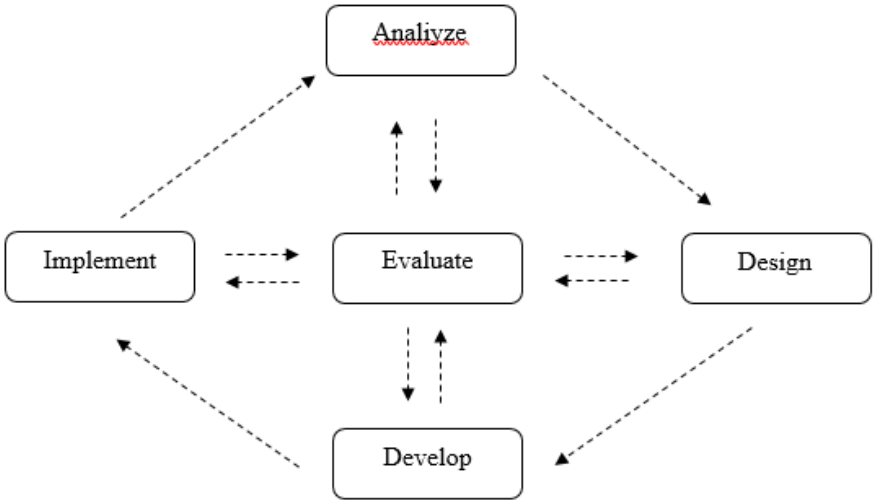


Figure 1. Stage of ADDIE Development Model

The first ADDIE stage done by the researchers was an analysis phase that consisted of four steps, namely: (1) curriculum analysis, (2) teaching material analysis, (3) material analysis, and (4) student characteristics analysis. The next stage was the design stage using the Microsoft Office Word 2016 application and the Flip pdf professional application. The next stage of development was the feasibility test and product revision before being tested. The next stage was the implementation phase with practicality tests. The last stage was the evaluation phase by improving the e-module, which aimed to enhance the quality of the products developed. Finally, the researchers produced the numerical literacy-based geometry e-module for the fifth grade of elementary school. The subjects of this research were ten students as a limited trial and one fifth-grade teacher at the state elementary school.

The developed e-module was an e-module based on numerical literacy. It contained geometry materials packaged innovatively by connecting learning materials in everyday life using mathematical concepts. It was also equipped with practice questions to enhance the students' learning abilities. This e-module provided scientific and activity-based learning using discovery and real-life learning approaches that lead to High Order Thinking Skills (HOTS) (Rohim, 2019). Data were collected using a questionnaire (Mardati, 2017). The questionnaire was given to validators with a score scale of (4) very good; (3) good; (2) quite good; (1) not good. The data obtained were then analyzed using qualitative and quantitative analysis. the validators provided suggestions and criticisms towards the qualitative analysis and then corrected the e-module. The quantitative analysis was obtained by filling out validator questionnaires related to the e-module based on numerical literacy for the fifth grade of elementary school.

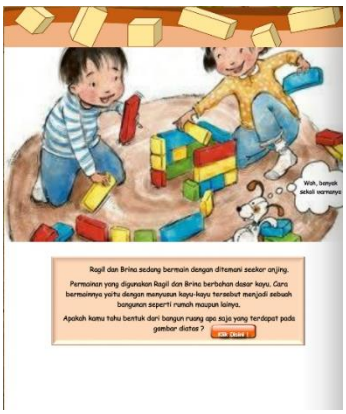
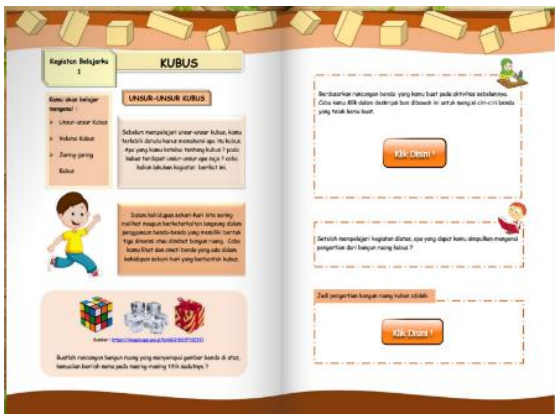
RESULTS AND DISCUSSION

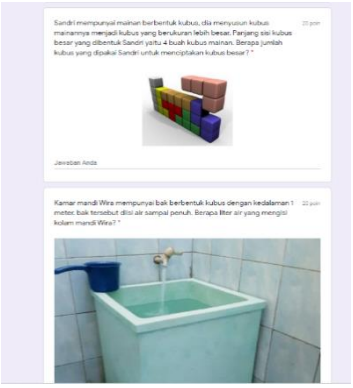
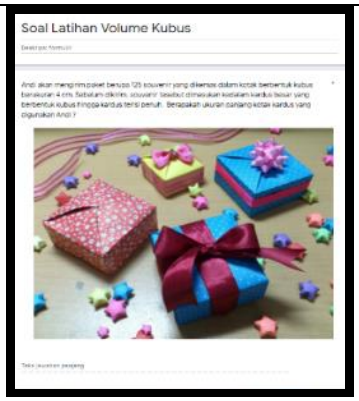
The e-module based on numerical literacy for the fifth grade of elementary school was developed according to the five stages in the ADDIE model (Kurnia et al., 2019) namely the analysis stage that includes analysis in the curriculum, analysis of the characteristics of students, and analysis of teaching materials applied in the teaching and learning process (Cahyadi, 2019). In implementing distance learning, students and teachers only employed textbooks and student worksheets provided by the school. Based on the analysis results, innovative teaching materials in e-module were needed to increase student interest in the learning process both directly (offline) and indirectly (online).

In the design stage, the researchers developed an electronic mathematics module of geometry materials that could be used by the fifth-grade students. At the stage, the materials on geometry were compiled using the steps of the numerical literacy basis. Components such as videos and images related to objects in everyday life were added by creating stories to improve students' reading activities using the Microsoft Office Word application, designed through a professional flip pdf application. At the stage of development, improvements of the products were made to achieve the learning objectives. In designing the e-module, themes consisting of background and knowledge information were included. The numerical literacy-based geometry e-module consisted of a front cover, concept map, introduction, numerical literacy components, core competencies, basic competencies and indicators, literacy, scientific-based learning process, activities, discovery, my teacher said, real-life, video

learning, quizzes, HOTS practice questions, evaluation questions, glossary, developer profile, back cover. The following is a complete description of these sections.

Table 1. Design of a Numerical Literacy-based Geometry e-module

No.	Figure	No.	Note
1.		2.	
	Numerical literacy-based Geometry e-module front cover		The introduction to the e-module consists of a description and instructions for using the e-module.
3.		4.	
	Scientific In the early learning activities, they observe the pictures in everyday life, namely the form of geometry, which aims to increase the students' interest in learning.		Activity In the e-module, some activities aim to improve student-oriented learning abilities.

5.  Discovery There are activities to find concepts based on the data provided in the cube and block geometry materials. Students are expected to solve problems in the learning activities.	6.  Real Life the e-module allows students to have skills in solving problems in real contexts in everyday life.
7.  High Order Thinking Skill (HOTS) In addition to the material in the e-module, five practice questions use higher thinking skills that aim to measure the students' ability to understand the materials.	8.  Rubric in practice questions

Presented with an attractive image, the front cover showcased the contents of the e-module development stage based on numerical literacy. An introduction to the contents of the e-module contained a brief description of the e-module and instructions for its use. In the initial stage of learning, the students observed the pictures around them in the form of solid images. They were given activities to hone their abilities. Students tried to make discoveries through the materials provided. Students were given problems to solve. Besides, the solid images of the e-module were presented with HOTS practice questions. Furthermore, there were rubrics in student assessment that contained the understanding of the materials, socializing, problem-solving skills and practice questions, glossary, developer profile, and

back cover. The numerical literacy-based building e-module connected numbers in mathematics with everyday life (Abidin, Mulyati, & Yunansah, 2017). Previous studies have developed a numerical literacy e-book (Lopez-Pedersen et al., 2020; Salim Nahdi & Cahyaningsih, 2018) and a companion module for the numerical literacy movement. Thus, the module using a numerical literacy approach in everyday life can increase the students' reading interest and improve their perceptive thinking skills (Asrial et al., 2020).

At the Implementation stage, the researcher conducted a trial with ten students as the subject of a limited trial of e-modules. The class teacher randomly selected the users as subjects (Putri et al., 2016). Trials were conducted to determine the practicality of the products that had been developed. At the evaluation stage, a practicality test was carried out to determine product improvements from potential users by determining the results of the analysis of the geometry e-module on the results of the practicality assessment of teachers and students (Syahrial et al., 2019). The researcher gave a questionnaire to 10 students as research subjects and fifth-grade homeroom teachers in this study. The results of the assessment of the practicality of teachers and students can be seen in table 2.

Table 2. Practical Results of E-module for Teachers and Students

No.	Assessment Aspect	Scoring Criteria		Interpretation
		Teachers	Students	
1	Language and legibility	95%	100%	Superlative
2	Presentation	93%	88%	Superlative
3	Content/material	95%	100%	Superlative
	Average	94%	96%	Superlative

Based on the data in table 2, of the total teacher practicality questionnaire assessment, the practicality of the e-module gets an average percentage value of 94%. Based on the interpretation, it is categorized as excellent to be applied to students. Similarly, the total assessment of the practicality of students' questionnaires gets an average value of 96% with excellent interpretations. These results are in line with the opinion of Syukra (2019) regarding the use of e-module in terms of the practical test of teachers. The practicality category is considered very high. It can be concluded that the numerical literacy-based geometry e-module that has been developed is easy to use for students because it is practical to be implemented (Salim Nahdi & Cahyaningsih, 2018). In addition, using the e-module can attract the students in using it because of their positive response in the learning process (Suarjana et al., 2017).

The feasibility analysis of the spatial literacy-based e-module was carried out to determine the feasibility of the e-module. Based on the results of expert validation in the validation sheet instrument, the data were obtained in the form of the percentage value of the feasibility level. The assessment of expert validation results and categories can be seen in table 3:

Table 3. E-module Assessment of Media Expert

No.	Assessment Aspect	Scoring Criteria	Interpretation
1	Cover	100%	Proper
2	Serving equipment	94%	Proper
3	Layout	100%	Proper
4	Color	100%	Proper
5	Picture	100%	Proper
6	Writing Form	100%	Proper
	Average	99%	Proper

Based on the results in table 3, the feasibility level of the e-module is determined from six aspects including presentation completeness, layout, color, image, and written form. The geometry e-module based on numerical literacy gets an average value of 99 %. Thus, it is categorized as feasible. The analysis of the material in the geometry e-module is based on the validation results of the material expert in the validation sheet instrument. The results of expert validation and its categories can be seen in table 4 below.

Table 4. E-module Assessment of Material Expert

No.	Assessment Aspect	Scoring Criteria	Interpretation
1	Relevance of learning materials	88%	Proper
2	Material eligibility	88%	Proper
3	The suitability of the material with numerical literacy	80%	Proper
4	Material quality	75%	Proper
	Average	83%	Proper

Based on the results in table 4, the feasibility level of the material in the e-module is determined from four aspects including the learning material relevance, material feasibility, material suitability with numerical literacy, and the quality of the material. The geometry e-module based on numerical literacy obtains an average value of 83%. Thus, it is in a feasible category. Following Irwansyah et al., (2017), the validation results from the presentation and display of the material's content are valid or feasible. The language analysis in the geometry e-module is based on the validation results of linguists in the validation sheet instrument. The results of expert validation and their categories can be seen in table 5.

Table 5. E-Modul Assessment of Linguist

No.	Assessment Aspect	Scoring Criteria	Interpretation
1	Cover view	83%	Proper
2	Foreword and content of the e-module	90%	Proper
	Average	87%	Proper

Based on the results in table 5, the feasibility level of discussing e-modules is determined from two aspects including the cover display, the foreword and the content of e-module. It can be seen that the geometry e-module based on numerical literacy obtains an average value of 87%. It is categorized as worthy. A study by Roskos et al., (2017) states that the e-module is categorized as feasible if it allows students to develop a learning motivation, independency, and numerical literacy skills.

Based on the evaluation results, the geometry e-module based on numerical literacy for the fifth grade of elementary school has met the practicality criteria. In addition to be practical to apply, the e-module has met the eligibility criteria. Therefore, the e-learning geometry module is suitable for application in the fifth grade of elementary school. The numerical literacy-based e-module is packaged into an electronic book containing learning materials by linking them into everyday life according to mathematical concepts. Its application uses smartphones to access data in the learning process to attract the students' learning attention. The use of the numerical literacy-based e-module is expected to develop the students' passion in mathematics learning.

CONCLUSION

Based on the results of this study, the numerical literacy-based geometry e-module for the fifth grade of elementary school was considered practical for teachers and students, with a very good category. But the feasibility results from the materials, media, and language experts were still under the criteria. The researchers hope that the e-module can be developed in other elementary schools in Indonesia as independent materials for student companions. In addition, further research could delve into how the e-module can increase the students' motivation in learning. Further research can also shed light on the innovations in packaging the materials and the application of concepts. Such innovations will provide meaningful contribution in the field of education, especially in mathematics.

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