



Feasibility of RME-Based Bilingual E-Module on 3D Shapes with Curved Surfaces

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ABSTRACT

A bilingual e-module that is systematically structured and linked to contextual problems can help students learn independently anywhere and anytime, especially in a pandemic that applies distance learning. RME is an approach that views mathematics as an activity/process in contextual problems so that students find their own understanding. This study examines the feasibility of an RME-based bilingual e-module on 3D shapes with curved surfaces materials from expert judgment on material, language, and media. This research model is the ADDIE model. There are 6 validators (2 material experts, 2 media experts, and 2 linguists). The research instrument was in the form of assessment based on expert judgement. The results showed that both material, media, and language used for the RME-based bilingual e-module is "feasible" to use in mathematics learning.

Keywords: e-module, bilingual, digital, RME.

ABSTRAK

E-modul bilingual yang disusun secara sistematis dan dikaitkan dengan masalah kontekstual dapat membantu siswa belajar mandiri di manapun dan kapanpun, terlebih di masa pandemi yang menerapkan pembelajaran jarak jauh. RME merupakan salah satu pendekatan yang memandang matematika sebagai aktivitas/proses dalam masalah kontekstual sehingga siswa menemukan pemahamannya sendiri. Penelitian ini mengkaji kelayakan e-modul bilingual berbasis RME pada materi bangun ruang sisi lengkung dari penilaian ahli materi, bahasa, media. Model penelitian ini adalah model ADDIE. Validator berjumlah 6 orang (2 ahli materi, 2 ahli media, dan 2 ahli bahasa). Instrumen penelitian berupa angket penilaian ahli. Berdasarkan penilaian ahli, baik materi, media, maupun bahasa, e-modul bilingual berbasis RME "layak digunakan" dalam pembelajaran matematika.

Kata Kunci: e-modul, bilingual, digital, RME.

INTRODUCTION

It is common knowledge that mathematics is one of the difficult subjects for students. Students tend to be passive and get bored quickly, this is because mathematics learning has not been packaged attractively by the teacher (Waskitoningtyas, 2016). Many factors cause student learning difficulties. Broadly speaking, learning difficulties consist of internal and external factors. Internal factors originating from within the students, namely physiological and psychological (Ahmadi & Supriyono, 2013). External factors include strategies and learning tools/media (Anggraeni et al., 2020).



Learning strategies and learning media are important areas that must be managed properly by teachers. Teachers' skills in managing the learning process determine the quality of learning. One way to improve skills is to increase the number of activities in compiling teaching materials by processing information in the environment of students' daily lives (Daryanto, 2014). Learning with teaching materials that have been developed by teachers can make it easier for teachers to explain systematically starting from concrete to abstract, from easy to difficult material, and according to the backgrounds and needs of different students (Indariani et al., 2018).

The survey shows more than 90% of students are happier for teachers who use media/instructional materials creatively (not contemporary) and more than 75% of students expressed a better understanding of what is taught when learning with the media/instructional materials (Febrianti et al., 2017). Problems that often arise in learning are related to teaching methods used by teachers who often do not connect mathematical concepts to students' daily activities (Hasanah, 2014; Arisetyawan et al., 2014). In addition, the teaching materials used by teachers are unable to meet the needs of students in the field so that it makes students experience confusion about the materials (Trimantoto, 2016; Widodo & Ikhwanudin, 2018).

From the description above, the researcher understands that it is necessary to develop a teaching material which integrates mathematics material into students' daily lives. Many strategies or approaches are capable of bringing contextual problems into learning, one of which is Realistic Mathematics Education (RME) (Dowling, 2014). RME as one of the approaches that is relevant to the 2013 Curriculum is the right approach to use as the basis for e-module development. Mathematics should be kept close to student life. RME is an approach to learning mathematics based on the view that mathematics as an activity/ process is not an end result. There are 3 RME principles that can be used as a reference by researchers in preparing learning tools. These three principles are (1) guided reinvention and didactical phenomenology; (2) progressive mathematization; and (3) self-developed models (Heuvel-Panhuizen & Drijvers, 2014). One of the teaching materials that can be used by students is a digital module or module or e-module. E-modules that are systematically compiled and connected to everyday culture can help students learn independently anywhere and anytime (Ardianti et al., 2019). E-modules are a relatively important requirement in this digital era, especially during the Covid-19 Pandemic which applies distance learning. In distance learning, many teachers and lecturers use e-module as a learning media (Pitriani & Pratama, 2020).

In developing a teaching material, for example an e-module, teachers need to pay attention to several aspects, including language. In Indonesia, English is one of the most frequently used foreign languages. Mastery of foreign languages is needed to face globalization and as a means of absorbing knowledge developing outside Indonesia (Santoso, 2014). English is widely used as it is a global language (Juriana, 2017). Therefore, the researchers developed a RME-based e-module in two languages, Indonesian and English. The reason to have bilingual e-module is that to let students begin to get used to learning mathematics in English. The e-modules are one of the researchers' contributions in improving the quality of learning, especially mathematics. There are some previous related studies focusing on similar research area, Table 1 gives information on the differences between the current study and the previous related studies.

Table 1. The Distinctions among Current Study and Previous Related Studies

Year	Digital	Bilingual	Approach	Learning Material
Harahap, 2017	No	No	RME	Geometry
Lisnani & Asmaruddin, 2018	No	Yes	RME based on local culture	2D Shapes
Mahmudah et al., 2019	No	No	RME	Systems of Linear Equation: 2 Variable
Zaqiyah et al., 2020	No	Yes	RME	3D Shapes with Curved Surfaces
Current Research	Yes	Yes	RME	3D Shapes with Curved Surfaces

The teaching materials developed in this study are in electronic or digital form, this allows researchers to integrate real videos and images to support RME with the content of food and tourist attractions in Palembang. This study aims to review the feasibility of RME-based bilingual e-module on 3D shapes with curved surfaces materials based on experts' judgment on materials, language, and media.

METHOD

This study was research and development study which uses ADDIE model consisting of Analyze, design, develop, implement and evaluate stages (Branch, 2009). The process is depicted in Figure 1. After analyzing and designing, the e-module draft was validated by experts. This stage is part of the development stage. The assessment was carried out by a team of experts consisted of two experts on material, media, and language (Indonesian and English). The team consisted of lecturers and teachers with a Master's degree, Doctoral degree, and currently pursuing Doctoral degree program in education.

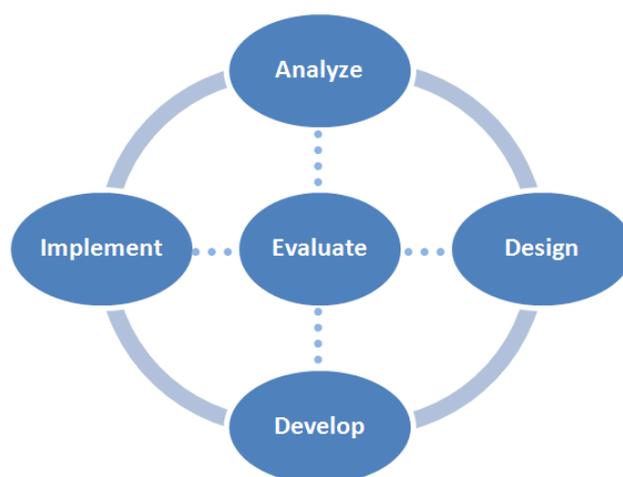


Figure 1. ADDIE Model (Branch, 2009)

Data were collected by using questionnaires on experts' judgement. Aspects and indicators assessed by experts can be seen in Table 2. The instrument was developed based on the assessment criteria set by BSNP (modified from Akbar, 2013). The instrument used has 4 answers, namely very good (4); good (3); poor (2); and very poor (1).

Table 2. Experts' Judgement Rubric

Expert	Aspect	Indicator
Material	Content	1. Suitability of materials with basic competence and indicators
		2. Material accuracy
		3. Up-to-date material
		4. Encourage curiosity
	Presentation	5. Presentation technique
		6. Presentation support
		7. Learning presentation
		8. Coherence and thought order
	RME	9. RME Characteristics
		10. RME Principles
		11. Content Illustration
Media	E-Module size	1. Size
		2. Cover layout
	Cover design	3. Font size and type
		4. Layout consistency
	Content design	5. Layout harmony
		6. Layout completeness
		7. Layout speeds up understanding
		8. E-module content typography
		9. Typography is easy to read
		10. Typography makes it easy to understand
		11. Content Illustration
Language	Straight forward	1. The accuracy of sentence structure
		2. Sentence effectiveness
		3. Rigor of the term
	Communicative	4. Readability
		5. Language structure
	Dialogical and Interactive	6. Motivational
		7. Ability to encourage critical thinking
	Suitability with students' development level	8. The suitability with students' intellectual development
		9. Conformity with the level of students' emotional development
	Cluster and thought flow cohesiveness	10. Cluster and integration between learning activities
		11. Cluster and coherence between paragraphs
		12. Terms use consistency
		13. Symbols or icons use consistency

The average scores were calculated (\bar{x}). The results of the calculation were interpreted based on the Table 3 (Wibowo & Pratiwi, 2018).

Table 3. Feasibility Criteria of Experts' Judgement

Quality Score	Feasibility Criteria	Information
$3,26 < \bar{x} \leq 4,00$	Feasible	Without revision
$2,51 < \bar{x} \leq 3,26$	Feasible Enough	With partial revision as suggested
$1,76 < \bar{x} \leq 2,51$	Less Feasible	Partial revision and review
$1,00 < \bar{x} \leq 1,76$	Not Feasible	Complete revision

RESULT

The RME-based bilingual e-module generally consists of a beginning, a content and an end. The left side of the e-module is in Indonesian and the right side is in English. The initial part consists of the cover, page cover, the preface, the contents, the concept map, the manual for the e-module, info math (information about mathematician), and an introduction. The body section consists of three

learning activities consisting of the materials dealing with cylinder, cone and spheres. In the final section consists of formative test, bibliography, glossary and profile.

First, the material was compiled in Microsoft Publisher. After that, the format of the teaching materials was transferred, from pub to pdf. Then, using the Flip PDF Corporate Edition software, the teaching materials were redesigned. Through this software, e-modules are designed to be as attractive as possible by integrating text, images, animation, video, music, and interactive quizzes so that the information conveyed is richer compared to printed teaching materials. In addition, e-modules contain contextual problems that are often encountered in everyday life. Students are expected to more easily understand the material of 3D shapes with curved surfaces.

Whether we realize it or not, the use of gadgets in learning has become a new habit. Therefore, the use of gadgets in learning (mathematics in particular) is a necessity. The bilingual e-module as one of the learning media innovations must be developed properly. This development needs experts' judgment.

Feasibility According to Material Experts' Judgement

Figure 2 shows a comparison of the results of experts' judgement on materials. In stage I, the experts concluded that the e-module was in the "feasible enough" category with an average score of 2.85. This means that researchers still have to make partial revisions according to the suggestions given by the experts. After revising, the experts reassessed the e-module. The results of the second stage assessment shows that the e-module is in the "feasible" category with an average score of 3.5.

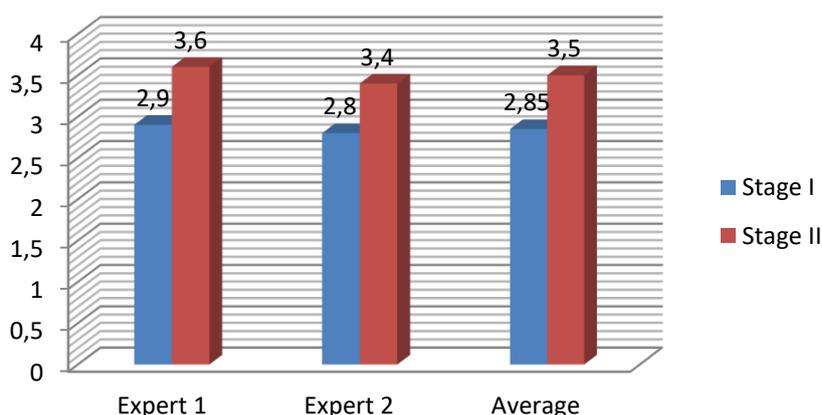


Figure 2. Material Experts' Judgement Results

The suggestions given by material experts are summarized in Table 4.

Table 4. Material Experts' Comments at Stage 1

Experts	Comments
Material 1	Learning objectives 1 has not been facilitated through the module. To develop critical thinking, provide scaffolding in a form of questions is suggested.
Material 2	Providing questions can stimulate students to develop their own models. Are questions at the end of each learning activity summative tests? Maybe it's best to use the same terms. Give answer key to summative or formative test questions and give a feedback. Add Glossary to provide information on mathematics terms. Provide up-to-date references

Experts	Comments
	Providing summary seems important.

Feasibility According to Media Experts' Judgement

Figure 3 shows a comparison of the results of experts' judgement on media. In stage I, the experts considered the e-module was in the "feasible enough" category with an average score of 3.05. This means that researchers still have to make partial revisions according to the advice given by the experts. After making revisions, the experts reassessed the e-module. The second stage of experts' judgement results in that the e-module is in the "feasible" category with an average score of 3.36.

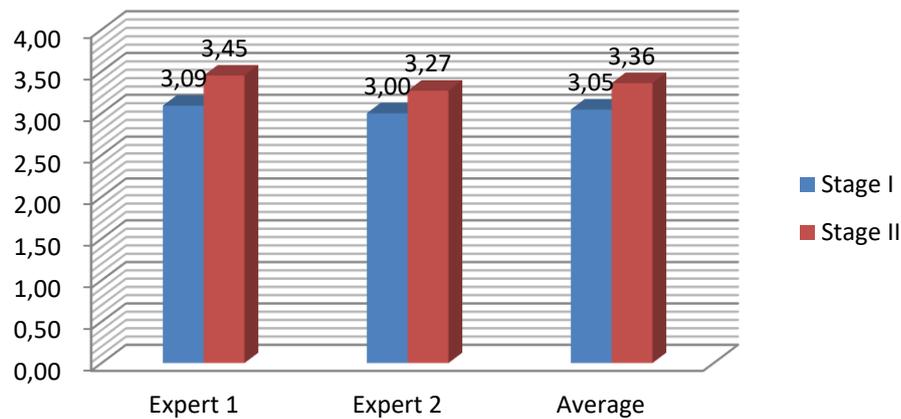


Figure 3. Media Experts' Judgement Results

The suggestions given by media experts are summarized in Table 5.

Expert	Comments
Media 1	Good design, but changes on some sentences have to be made to make it more operational Provide more information on activities to make it clearer
Media 2	Extend the duration of the videos Provides an opening and a closing to the videos

Feasibility According to Language Experts' Judgement

Figure 4 shows a comparison of the results based on experts' judgement on language. In stage I, the experts concluded that the e-module was in the "feasible enough" category with an average score of 3.09. This means that researchers still have to make partial revisions according to the suggestions given by the experts. After making revisions, the experts reassessed the e-module. The second stage shows the results that the e-module is in the "feasible" category with an average score of 3.42.

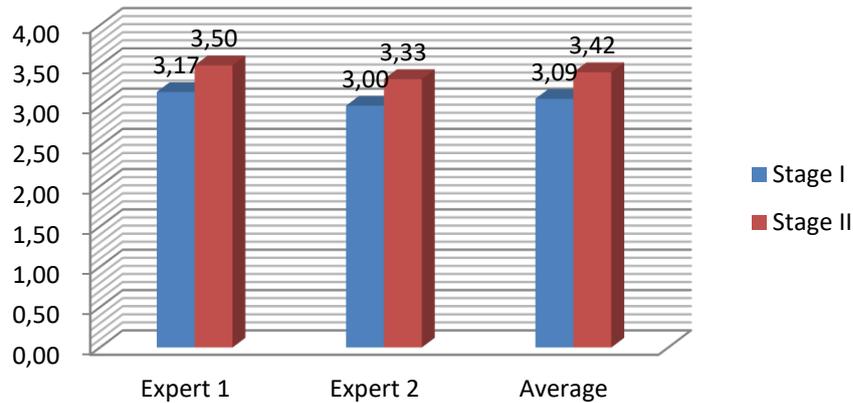


Figure 4. Language Experts' Judgement Results

The suggestions given by language experts are summarized in Table 6.

Table 6. Experts' Comments on Language at Stage 1	
Experts	Comments
Indonesian	Adjust with Indonesian spelling system Find the right diction Be careful on punctuation use and placement Use more effective sentences
English	Grammar error Pay attention to terms related to math in English Inconsistency of letters use English use was good enough

DISCUSSION

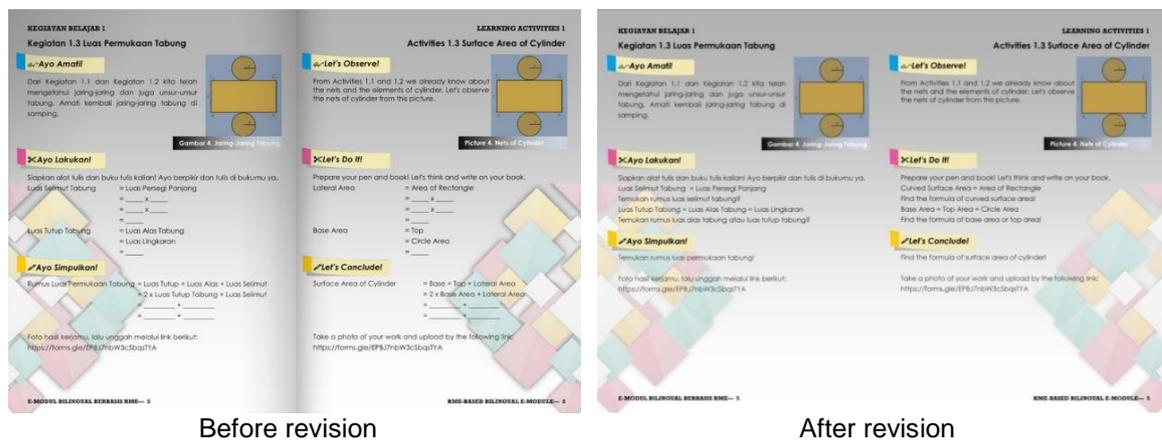


Figure 5. Revision Example

The purpose of this study was to see the feasibility of RME-based bilingual e-module. The results show that this e-module is feasible to use. The researcher made several revisions following the suggestions of experts, here is one of the revisions that have been made (Figure 5). The material in this e-module is about 3D shapes with curved surfaces. Students have had difficulty remembering and using formula of the surface area and volume (Arifin et al., 2017). Therefore, through the activities in this e-module, students can find their own surface area and volume formulas. The series

of activities in this e-module are based on RME where the steps can increase student activity and learning outcomes (Supardji, 2020). Students are only given questions that stimulate students to find their own formulas.

At first, researchers still used dots or empty spaces to stimulate students to find the formula for the surface area of the tube (as in Figure 5). According to experts' judgement on material at stage 1, students should be given enough scaffolding in the form of questions. This will create a more meaningful learning experience, especially if it is related to the real life of the students (Zulkardi, 2002). So that they are able to make students connect all the information that has been obtained previously to solve problems (Novak, 2011).

The e-module is a digital teaching material that can contain information text, audio, photos/images, and videos (Tasri, 2011; Hwan, 2017). Digital teaching materials make it easier for teachers to teach and make it easier for students to access the material (Suarsana & Mahyukti, 2013), making it possible to do distance learning (Martha et al., 2018). Especially in the current conditions of the Covid-19 Pandemic which require students to study independently at home. Figure 6 is a display of several pages of the bilingual e-module on cylinder material. There are video that can watched by students. Content of the video is an activity to stimulate student to find their concept about cylinder.



Figure 6. An Example of Cylinder Material in E-Module

The Industrial Revolution 4.0 shows the increasingly sophisticated technology, but this would be one of the threats and the challenges to both national and local culture (Maskar & Anderha, 2019). The identity of students will be formed through interaction between language and culture. The two of them cannot be separated (Santoso, 2014). This is in line with the e-module in this study, the researcher integrates the culture of Palembang City. The integrated culture is culinary and tourist attractions in Palembang, for example *Pempek* and *Punti Kayu* Tourism Forest.

Then, the use of two languages (Indonesian and English) in this e-module is an effort to train students' English skills. In Indonesia, English is one of the most frequently used foreign languages. Mastery of foreign languages is needed to face globalization and as a means of absorbing knowledge (Santoso, 2014). English is currently an important global language and is a global demand (Juriana, 2017).

CONCLUSION

Based on experts' judgment on material, media, and language, the bilingual RME-based e-module on the curved-side geometry material is "feasible" for use in mathematics learning. The development of digital teaching materials should be further expanded. Because this research was only limited to the 3D shapes with curved surfaces material. Then, further research can try to see the potential effects of e-module that have been developed.

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