

Development of Mathematics E-Module Using Kodular and Flipbook for Junior High School Students: Differences

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Received: 21 December 2022; Revised: 31 March 2023; Accepted: 20 April 2023

Abstract. To develop media such as e-modules, a comprehensive understanding of the applications used to create them is necessary. It is essential to comprehend the features of using e-module applications to ensure their effectiveness in the development of superior e-modules in the future. The objectives of the present study were showing that mobile learning by e-module using different applications, i.e. Kodular and Flipbook, are valid, practical, effective and finding differences between the characteristics of e-module development to get a comprehensive idea for future development for researchers who want to develop e-module using both applications. The present study is a research and development study. The selected development model was ADDIE i.e. Analyze, Design, Development, Implementation and Evaluation. The Subject e-module learning media users were junior high school students. The validity of e-module media by Kodular is 92.55%, which is very good. The validity of e-module media by Flipbook is 90.35%, which is very good. The test result on the respondents who used e-module by Kodular is 83.45% feasible to use and the result of e-module by Flipbook is 86.39% also feasible to use. The Kodular e-module had an average student learning outcome score of 78.28, while the Flipbook e-module had an average score of 70.67. The two e-modules from the application were examined, and five differences were identified in the characteristics of e-modules from Kodular and Flipbook, in order to support the continuous development of e-modules.

Keywords: characteristic, e-module, mathematics, kodular, flipbook

Introduction

Portable mobile devices such as tablets and smartphones are widely used as student learning media Lin, Lin, Yeh, and Wang (2016), stated that these devices are important as a communication medium to convey rich content and may contribute to the development of mobile learning. There is a new learning atmosphere when using m-learning, especially in the use of flexible and wireless technology (Mahamad, Ibrahim, & Mohd Taib, 2010). Currently mobile technology is the closest to students and is often used by students in everyday life which can be accessed via tablets or smartphones (Yunianta, Putri, & Kusuma, 2019). Therefore, the use of mobile learning is something that is feasible to use in learning.

Mobile learning is a realistic choice for use in today's all-technology era. Warsita (2011) said that mobile learning is a learning model that utilizes technology and information. Mobile learning is defined by Kearney, Schuck, Burden, and Aubusson (2012) as learning mediated by mobile devices. Mobile learning is abbreviated in the literature as M-learning or mlearning, it represents any type of learning that takes place when the learner is not at a predetermined fixed

location, or learning that takes place when the learner takes advantage of the learning opportunities offered using technology therefore learning can take place. flexibly (Vinu, Sherimon, & Krishnan, 2011). Drigas and Pappas (2015) stated that m-learning applications motivate students, making mathematics lessons more fun and interactive than ordinary teaching practices. Developing learning media, such as mobile learning, is crucial to prepare for future changes.

COVID-19 has caused changes that require adaptation from the world, especially in the field of education. Learning changes instantly due to the imposition of restrictions on community activities by the government, thus the implementation of learning is carried out online or limited offline. Online learning needs to facilitate the learning process to facilitate educational units in the learning process without having to meet face to face, as an effort to reduce the spread of the COVID-19 virus (Syafari & Montessori, 2020). It is undeniable that online learning raises various obstacles, one of which is decreasing student learning outcomes due to the lack of interest in delivering learning material (Dewi & Sadjarto, 2021). Submission of material that is less interesting can result in students being less active in participating in learning activities (Yazid, Safitri, & Jauhari, 2020). The results of research conducted by several researcher (Astuti & Prestiadi, 2020), stated the effectivity of online learning is influenced by the ways teachers deliver its learning material. Research conducted by Fauzy and Nurfauziah (2021) in a Middle School obtained a result that Mathematics became a subject with the least interest during the learning in the period of Covid pandemic with the percentage of almost 55% students out of 51 respondents. Research conducted by Nugraha, Sudiatmi, and Suswandari (2010) obtained that without innovation in an online learning then a control group obtained average score on Mathematics 64.14 compared to the presence of online subject by obtaining an average score of 80.83.

The presence of problem in learning in the school has made studies to search for ways in order to be able to solve the problem in the field related to the success of learning and learning interest of the students. An increase of learning success and students' interest in learning is needed through the efforts of teachers in order to attract their interest and motivation in studying (Miftah, 2013). One of the efforts is by using a learning media (Sulistiyawati, Budi, & Siswono, 2019). In line with that, successful teacher in their teaching are teachers who delivery their materials by utilizing a learning media (Mastur, Afifulloh, & Dina, 2020). A learning media that will be developed as a proposed solution need to be clearly defined and supported with related studies. Learning media here is interpreted as one of the tools used by teachers to facilitate the delivery of learning material (Dwijayani, 2019; Irawati & Setyadi, 2021). The use of learning media is very important because with learning media teachers can easily manipulate abstract material, so students can more easily understand subject matter (Fajriani & Hidayat, 2021). In addition, the

use of media in the learning process can also be used as a stimulus to facilitate and improve student harmony in receiving material (Misbahudin, Rochman, Nasrudin, & Solihati, 2018). The use of instructional media is also necessary for teachers because it can assist teachers in presenting learning material to be interesting, so as to increase student interest and motivation in learning (Nurrita, 2018).

The media selected here is E-Module. This is supported by (Anandari, Kurniawati, Piyana, Melinda, Meidiawati, & Fajar, 2019) which states that one of the media that can attract student interest and motivation is the E-module. E-modules are electronic versions of modules that have been printed and can be read via a computer (Sugianto, Abdullah, Elvyanti, & Muladi, 2013). E-Modules are used as a learning tool or a tool that contains materials, methods, limitations, and ways of evaluating that are designed in a systematic and interesting way to achieve the expected competencies (Priyanthi, Agustini, & Santyadiputra, 2017). In addition, by using e-modules students can also solve problems in their own way through the learning experiences they get (Hamzah & Mentari, 2017).

The aim of this research is to develop an E-Module and look for the differences in its characteristics when it is developed with two different applications, namely Kodular and Flipbook applications. The reason for using these two applications is to facilitate flexible learning through e-modules. The Kodular application is designed using coding blocks, which differs significantly from the Flipbook application. Moreover, both these applications are available for free and can be used by teachers without the need for any purchases or additional expenses. This e-module will be developed by assessing its validity, user response, and impact on student learning outcomes. The hope of the results of this study is to provide a comprehensive description of the characteristics in developing mathematics e-modules with Kodular and Flipbook applications. By examining the various characteristics of the developed e-modules, researchers and teachers can identify opportunities for further improvement in e-module development. These characteristics include specific details that are expected to be useful in the development of better e-modules in the future.

Method

Research and development are the type of research chosen in this study. This research produced two learning media products in the form of mathematics e-modules which were developed with two different applications. The two applications used in this study are Kodular and Flipbook applications. The E-Module with the Kodular application takes material on polyhedron, while the E-module with the Flipbook application takes geometric transformation material. All selected material is intended for junior high school (SMP) student subjects.

The products produced in this study were validated by validators from academics, in this case lecturers and junior high school teachers. Then for the research subjects who were respondents to the limited trial of learning media in the form of e-modules were students of SMP Negeri 9 Salatiga. The E-Module with the Kodular application was tested in class VIII and the one with the Flipbook application was tested in class IX.

The Mathematics E-Module with Kodular and Flipbook for Middle School Students was developed using the Analyze Design Develop Implementation Evaluation (ADDIE) model. As for the steps taken, namely: 1) the analyze stage is carried out to analysis the problems and information needed with the details of the following activities: (a) analysis of the need for the development of new learning media; (b) feasibility analysis and requirements for developing new learning media; (c) analysis of learning mathematics on the material; (d) analysis in student learning includes curriculum analysis and field analysis; 2) the design stage, namely the media design stage that will be developed according to the results of the analysis carried out by previous researchers; 3) the development stage here is the stage of realizing the learning media according to the design that has been made and validating the e-module; 4) the implementation stage here is a limited trial only related to knowing the response of e-module users to junior high school students; and 5) the evaluation stage is carried out to evaluate the developed media.

After the e-module media was developed, the researcher then identified and analyzed based on experience from the initial stage to the final stage of media development. The researcher conducted Focus Group Discussions in the process of making media and also collected data through individual questionnaires from parties involved in developing e-modules using Kodular applications and flipbooks.

Analysis of The Validity and Practicality of the Mathematics E-Module

Validation tests by experts were carried out to obtain e-modules that are valid and suitable for use. This validity test was carried out using a feasibility instrument from an expert assessment. The results of the data obtained based on the validator's assessment were analyzed using the formula approach from (Arikunto, 2012), which was then further categorized according to the eligibility criteria according to Table 1.

$$\text{Score} = \frac{\text{Total score obtained}}{\text{Maximum total score}} \times 100\%$$

Table 1. Assessment criteria for electronic module validity

Interval	Criteria
$0 \leq \text{Skor} \leq 20\%$	Not Feasible
$20 < \text{Skor} \leq 40\%$	Less Feasible
$40 < \text{Skor} \leq 60\%$	Quite Feasible
$60 < \text{Skor} \leq 80\%$	Feasible
$80 < \text{Skor} < 100\%$	Very Feasible

After obtaining a valid e-module, it was then tested on a limited basis with 27 students from class VII and 30 students from class IX at SMP Negeri 9 Salatiga. The data pertaining to respondents' evaluations of the practical use of e-modules were collected through a questionnaire that utilized a Likert scale and assessed four criteria: presentation of material aspect, language aspect, appearance aspect, and benefit aspect. This Likert scale was compiled and analyzed with criteria referring to (Sugiyono 2020) as shown in Table 2. The table was used as a criterion for assessing the practicality of the developed learning media and was provided to the students as feedback on the use of the e-module. The use of the Likert scale was also employed in the research of Fonda and Sumargiyani (2018).

Table 2. Likert scale of E-module use by respondents

Code	Criteria
SS	Strongly agree
S	Agree
RG	Doubtful
TS	Don't agree
STS	Strongly Disagree

There are calculations and criteria used in showing the results of the assessment of the respondents. Calculation of the results of respondents from students related to the developed e-module refers to Sugiyono (2020). The criteria for assessing respondents as in Table 3 refer to (Arikunto & Cepi, 2009).

$$\text{Percentage of Eligibility by Respondents} = \frac{\text{Acquisition score}}{\text{Maximum total score}} \times 100\%$$

Table 3. Assessment criteria for electronic module practicality

Interval	Criteria
$0 \leq \text{Skor} \leq 20\%$	Not Feasible
$20 < \text{Skor} \leq 40\%$	Less Feasible
$40 < \text{Skor} \leq 60\%$	Quite Feasible
$60 < \text{Skor} \leq 80\%$	Feasible
$80 < \text{Skor} < 100\%$	Very Feasible

Effectiveness of Mathematics E-Module Using Kodular and Flipbook

The effectiveness of the e-module is tested through analysis based on pretest and posttest results of students regarding the use of Mathematics e-module created with Kodular and Flipbook in learning. Pretest and posttest scores are compared to obtain the mean difference using a t-test analysis. The Mathematics E-Module is considered effective if there is a significant difference between the average pretest and posttest scores.

Results and Discussion

Development of E-Module Mathematics using Kodular Applications

The e-module that was developed with the Kodular application takes the material for Polyhedron and this e-module is named E-BRISDA. E-BRISDA is designed so that it can be used

by students in learning anywhere and anytime. The concept is that students must study the material and work on questions related to the material. This E-BRISDA media was developed so that it can be used individually or in groups in understanding the material and practicing questions about polyhedron.

The logo design and appearance of the media are created using the Canva application. The logo and media display are designed to be as attractive as possible by combining several fonts that are clearly legible, attractive images and colors. The display of the development of E-BRISDA can be seen in Figure 1.



Figure 1. Display of E-BRISDA using the kodular application

The features provided in E-BRISDA can be filled with visual, audio and audio-visual images. The use of e-modules in this application is made with the facilities of the buttons provided and allows users to exit and enter according to their learning wishes. In this E-BRISDA there is a menu of instructions for use, learning materials and videos as well as practice questions. This E-BRISDA is assessed by an expert or validator to obtain a feasibility assessment. The results of the assessment of the validators can be seen in Table 4.

Table 4. Results of E-module validation with kodular applications

No.	Expert	Assessment Score (%)	Note
1.	Validator 1	91,43	Very Valid
2.	Validator 2	93,67	Very Valid
Total (%)		92,55	Very Valid

The organization and sequence of content in E-BRISDA can be seen in Figure 2. There are 5 levels of layers created in the E-Module starting from the front page to the properties, elements,

nets, surface area and volume layers. Its use is not set in a particular order. Users can use it according to their learning interests. If you want to know more details about existing content, you need to open it according to the buttons sorted from top to bottom, especially in the material section where there are core competencies, basic competencies, E-Module material and learning videos. The one-way arrow indicates that the button/layer used can only go to the next layer without being able to return. On the other hand, the two-way arrow means you can enter and you can also return to the original layer.

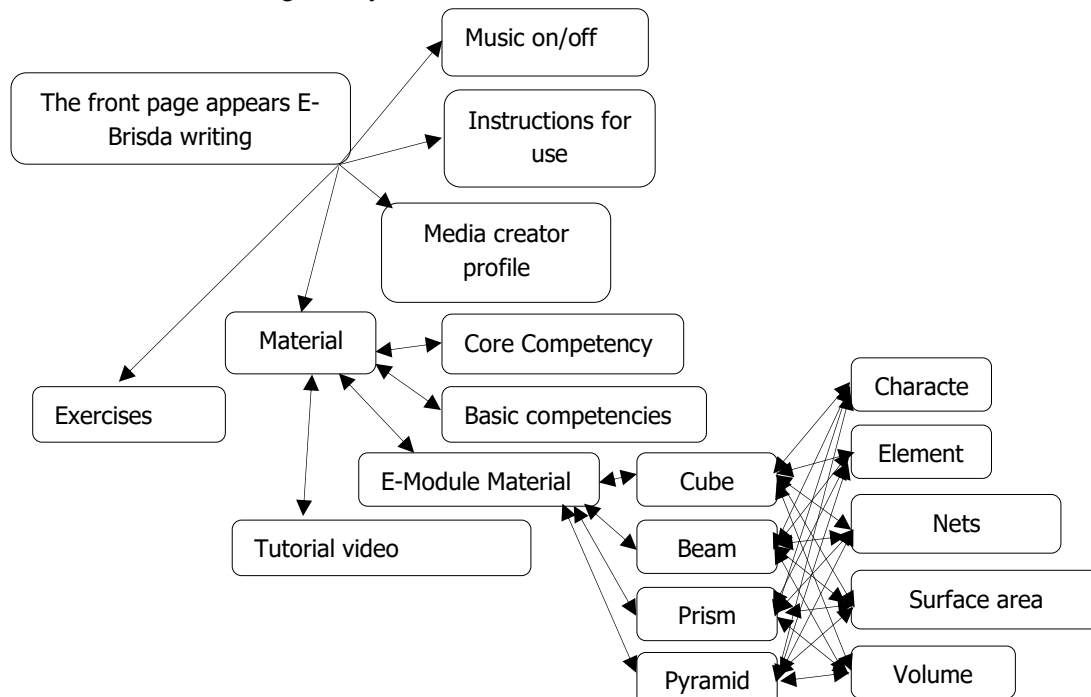


Figure 2. Flow of organizing and content sequence in E-BRISDA

Development of the Mathematics E-Module using the Flipbook Application

The e-module developed with the Flipbook application takes geometric transformation material called E-TRANSFORM. The concept built is that students can have e-modules that are like in general but can be carried anywhere using a smartphone or tablet. The material is arranged using a systematic flow like student textbooks. As for the order made in E-TRANSFORM, there are instructions for use, basic competency information, concept maps are provided, prerequisite materials and the material contained in them is arranged in a complete and coherent manner. In the final section, a challenge is given in the form of a STEM Project for students to apply their theory in the form of hands-on experience activities that are completed in teams.

The content design from E-TRANSFORM was created using the Microsoft Word application and the appearance of the media was created using the Canva application. The display is designed according to the needs of middle school students with clearly visible fonts, then attractive pictures and colors are provided. The E-Module application was created using a Flipbook and an overview of the contents of the E-TRANSFORM can be seen in Figure 3.

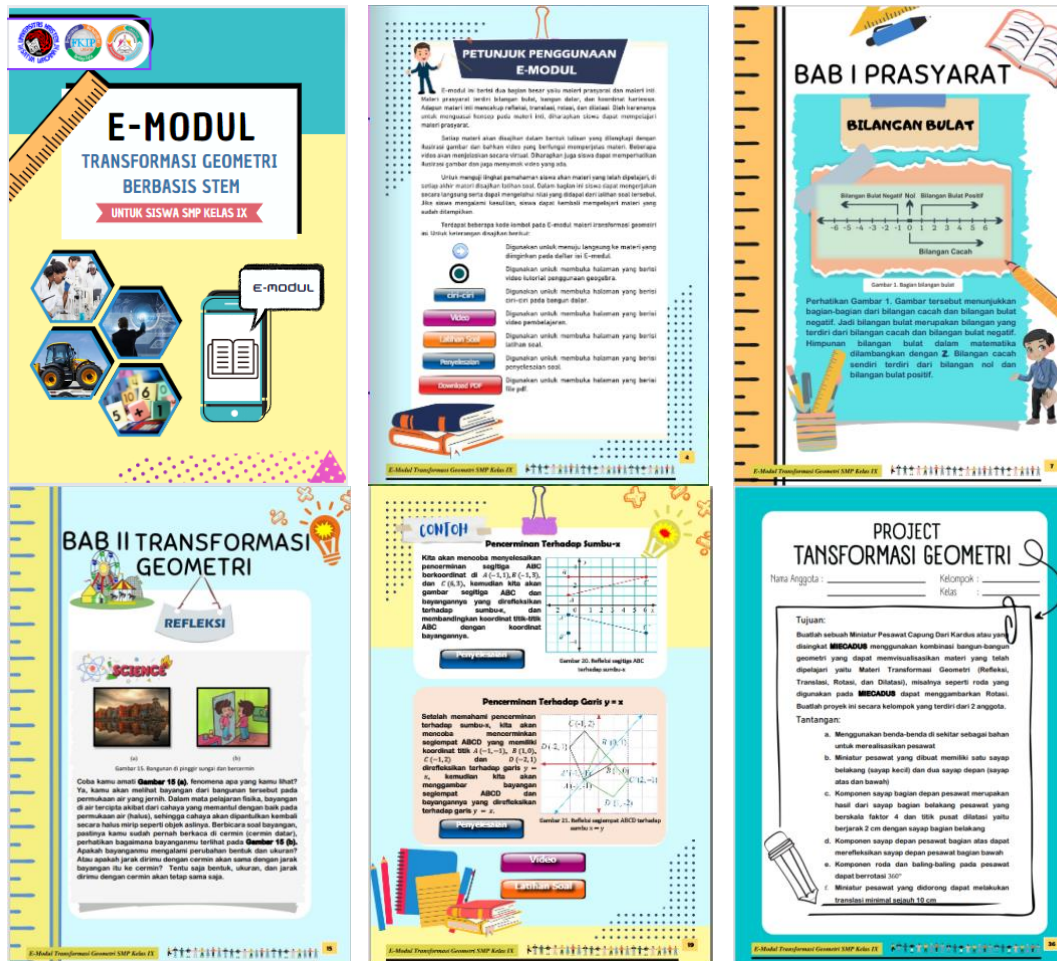


Figure 3. Display of E-TRANSFORM using flipbook application

The features provided in E-TRANSFORM can also be filled with visual images as well as audio-visuals. Especially for audio only, it is not provided with more interesting considerations in the e-module with this Flipbook application using audio-visuals. The use of E-TRANSFORM is in the form of a LINK which is clicked and will appear as in the form of an electronic book. It also provides material that is arranged in a coherent and systematic manner with the exercises given and completion which can be viewed by clicking the Completion button. If you want to add information related to the material, you can click Video and to practice further, you can click Practice Questions. Everything in the application is assessed by the Experts in this case as a validator. The E-TRANSFORM assessment by the validators can be seen in Table 5.

Table 5. Results of the E-module validation with the flipbook application

No.	Expert	Assessment Score (%)	Note
1.	Validator 1	93,80	Very Valid
2.	Validator 2	86,9	Very Valid
Total (%)		90,35	Very Valid

The organization and sequence of content in E-TRANSFORM can be seen in Figure 4. Unlike E-BRISDA which consists of layers, E-TRANSFORM consists of pages like a book. The use of this E-Module is set in a certain order. Users are advised to use it according to the learning

sequence that has been arranged so that it is easier to understand the material and be ready for the learning given. The content provided has a feedback facility, namely the practice questions and completion section. Then it has interactive content that functions as an explanatory, namely video tutorials, features and learning videos. There are downloadable group study activities in the STEM Project Challenges section in the Download PDF section. Also, in Figure 4 there are two different arrows. A one-way arrow indicates that the page used can only go to the next section of the page without being able to return. On the other hand, a two-way arrow means you can enter and you can also return to the original page.

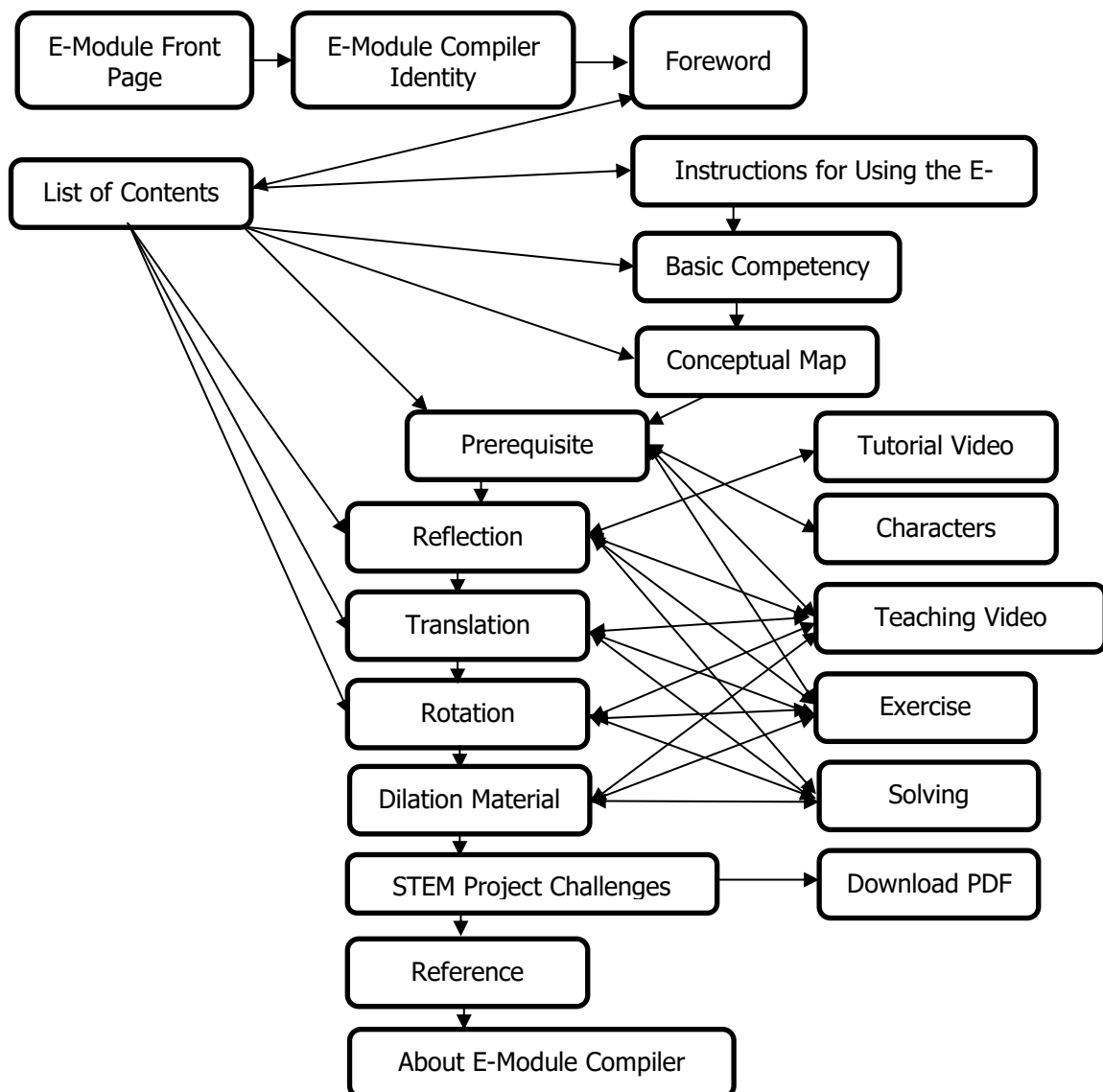


Figure 4. Organizational flow and content sequence in E-TRANSFORM

Student Response Using E-Module

After the two e-modules were valid, both were tested on students at SMP Negeri 9 Salatiga. E-BRISDA was tried out in class VIII and E-TRANSFORM was to be tried out in class IX. The test here is used to get a response to the e-module media that has been created. This response from

the teacher or student is needed to get feedback on the e-module that was created. The response results for using E-BRISDA and E-TRANSFORM are presented in Table 6.

Table 6. Results of the E-module user response assessment

No.	E-Module Name	User Response Rating Score (%)	Note
1.	E-BRISDA	83,45	Feasible
2.	E-TRANSFORM	86,39	Feasible

Implementation E-Modules in the Classroom

The results of trials in learning mathematics using E-BRISDA and E-TRANSFORM were obtained through limited testing at SMP Negeri 9 Salatiga. Both of these learning media contribute to the learning of mathematics. Students express interest in learning under the conditions of the Covid-19 pandemic. Data related to the contribution of the E-Module in learning indicates differences in the average initial and final grades, which were analyzed using a t-test as presented in Table 7.

Table 7. Results of limited testing of learning using E-modules

No.	E-Module Name	Pretest	Posttest	T-test value	Sign.	Conclusion
1.	E-BRISDA	29,31	78,28	-18,213	0,000	There are differences in the average
2.	E-TRANSFORM	29,67	70,67	11,267	0,000	

E-BRISDA is an E-Module developed with the Kodular application. Kodular can be arranged in the form of e-modules that combine text, images, sound and video. This is in line with Hasanudin, Fitrianiingsih, Utomo, and Baihaqi (2022) and Safitri and Aziz (2022) state that Kodular is an application that can be used to compile initial reading material in the form of text, images, sound, video and animation. E-BRISDA with Kodular is also designed to be used wherever students are and can be used both in class and outside of class in line with the research results of Syarlijsiswan, Sukarmin, and Wahyuningsih (2021) and Nugraheny and Wahyuningsih (2022). This contributes to the development of future e-modules that are flexible and tailored to the needs of students, allowing them to learn wherever they are.

E-TRANSFORM is an E-Module developed with the Flipbook application. E-TRANSFORM in this study is a supplement in learning both inside and outside the classroom. This means that it can be an alternative learning resource that is in line with (Sriyanti, Almafie, Marlina, & Jauhari, 2020). Similar to using Kodular, E-Modules with Flipbook can also be designed by including content, images, videos, language, presentations, and graphics. This is in line with the research of Fahmi, Priwantoro, Cahdriyana, Hendroanto, Rohmah, and Nisa (2019). Based on these results, it contributes to the development of more varied e-modules and provides children with more ways to learn, which is expected to support students' learning styles.

The development of E-Modules using Flipbook and Kodular applications share several common characteristics, which are demonstrated in two examples: E-BRISDA (using Kodular)

and E-TRANSFORM (using Flipbook). Firstly, both Kodular and Flipbook apps are free, allowing users to create E-Modules without incurring additional costs. Secondly, the use of additional applications is required for the development of E-Modules on both platforms, regardless of whether Kodular or Flipbook is used. Thirdly, the development of E-Modules on both platforms can include buttons to navigate to other layers or sheets, as well as hyperlinks that provide access to external resources such as YouTube videos. Fourthly, E-Modules created on either platform can be converted into APK format, making them compatible with Android devices. Fifthly, the resulting E-Modules can be used both online and offline, providing users with access to the content at any time and in any location. Lastly, the flexibility of using the E-Modules is another shared characteristic, as the results of the development can be used on any device with the appropriate software installed.

The two E-modules developed have similarities and also have different characteristics in their development. Based on the characteristic similarities, these two E-modules can be used by students either accompanied by a teacher or not and can also be used independently by students which is in line with the development of the E-Module by Fonda and Sumargiyani (2018). Furthermore, even though the two modules have differences according to Table 8. The developed E-Module can make students actively involved in learning in line with Damayanti and Qohar (2019). Understanding the characteristics of the developed e-module contributes to the development of e-modules that are more suitable for the needs of students.

Table 8. Differences in characteristics of e-module development with flipbook and kodular applications

No.	Media Characteristics	E-BRISDA (Using Kodular)	E-TRANFORM (Using Flipbook)
1.	Creation stages	At the manufacturing stage, you must use internet access	At the manufacturing stage, you don't have to use internet access
		It is made using drag and drop programming blocks to arrange the appearance and buttons on the layer which are designed with the help of other applications	It is made using the help of other applications to design the appearance and then it is made in PDF format and on that page you can add the necessary buttons or links
		Content development uses filling in the layers provided by drag and drop programming blocks from content that is designed with additional applications and can then be connected to other layers.	Content development by creating pages using other applications and setting them in PDF form can then be linked with a button or can be opened directly to the next page like opening a book.
2.	Organizational and Sequencing	Organizing the material in the E-Module starts from the front page that reads E-Brisda, then enters the selection of material, namely instructions, profiles, materials and exercises.	Organizing the material is made coherently with a flow that is adjusted to the load of the material being studied

3.	Instruction	The use of E-Modules can be used in an arbitrary manner	The use of this E-Module is recommended to be sequenced according to the learning flow provided to get maximum learning results
4.	Feedback	This E-Module provides feedback only on values that come out and are carried out through the built system	The E-Module here has more forms of feedback as provided in Practice questions in the form of grades, completion buttons where students can see the answer is right or wrong
	Learner Participation	Student participation in carrying out learning activities is limited only in the E-Modules that are made	Student participation in carrying out learning activities is not limited to the E-Modules that are made but can be done by writing on paper then matching answers and students can also carry out collaborative activities with study groups to work on STEM projects
5.	Higher order thinking Skills (HOTS) and concept formation	The concept of the material presented here is simple and limited in the layers provided and the questions provided have not trained students' higher-order thinking skills	The concept of the material presented using the HOTS approach is related to contextual matters and the questions provided have led to HOTS being included in the STEM project to make dragonfly planes

The characteristics in Figure 2, Figure 4 and Table 8 are also adapted from Fahy (2004). The difference is adjusted to the uniqueness of the application used. The characteristics of the development of E-BRISDA and E-TRANSFORM can answer research by (Muhson, 2010) that in making this E-module there is a systematic planning for developing and using learning media.

The development of this E-Module is expected to help the problem of lack of media as part of the problems in the development of learning media. The problems faced by teachers in developing media are that there is still a minimum of learning media in schools and the teacher's weak ability to use or develop learning media (Alwi, 2017). The more media developed such as E-BRISDA and E-TRANSFORM, this can be an option for teachers to assist learning so that the quality of learning in class can be improved or at least solve learning problems in class.

Evidence that both e-modules can improve the quality of learning can be seen in Table 6 and Table 7. Tables 6 and 7 reveal that both developed e-modules were effective and practical for student use. E-BRISDA and E-TRANSFORM were deemed feasible for implementation with a practicality value exceeding 81, according to the criteria outlined in Table 1. Furthermore, these e-modules were found to significantly contribute to student learning outcomes. Based on the paired T-test, it was found that both E-Modules developed have a contribution in learning as indicated by the T-test significance value of $0.000 < 0.05$, meaning there is a difference between the initial and final test values in the class learning. This means that the E-BRISDA and E-TRANSFORM learning media are effective to be used in student learning at the junior high school level. The results of this research are in line with Asrial, Kurniawan, Chan, Septianingsih, and Perdana (2019) that e-modules are effective in increasing students' abilities and interests. This is

also consistent with Agustin (2020) and Rani and Maarif (2021) that E-Modules contribute to student learning outcomes. Ikram, Essink-Bot, and Suurmond (2015) mentioned that the created e-learning module is effective in improving medical students' knowledge, and this is consistent with this study.

This research has limitations on the development of E-Modules with Kodular and Flipbook applications only. The materials utilized are limited to those of polyhedron and geometric transformation. E-Module development is also limited to the results of limited thinking by researchers. This development is also limited to valid learning media and gets teacher and student responses. Furthermore, further implementation research is needed in the field so that the implications for learning outcomes can be seen as part of supporting media development to be said to be effective.

Conclusion

The study discusses the development of two e-modules, E-BRISDA using Kodular application and E-TRANSFORM using Flipbook application. Both e-modules were designed to provide flexible learning materials that can be used in and outside the classroom. The e-modules combined various forms of media, such as text, images, sound, video, and animation, to cater to the needs of students' learning styles. The e-modules were found to have a significant contribution to student learning outcomes as indicated by the paired t-test results. The study highlights the importance of understanding the characteristics of the applications used in e-module development to create more suitable and effective learning media. The development of e-modules like E-BRISDA and E-TRANSFORM can provide alternative options for teachers to improve the quality of learning in class and address the problem of limited learning media in schools. However, the study is limited to the development of e-modules with Kodular and Flipbook applications and needs further implementation research in the field to determine its effectiveness as a supporting media development tool.

The two E-Modules created have their own uniqueness based on the application used. The application when used to create e-modules will eventually have observable characteristics. The six characteristics of E-Module development found here are an illustration of the development of E-modules compiled with Kodular and Flipbook applications. Through these findings, it is hoped that the E-Module Mathematics can be developed even better in the future using Kodular Applications and Flipbooks or perhaps with other development applications.

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