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E-module in Learning Mathematics: An effort to Stimulate Learning Independence

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Abstract

The use of technology in education results in user-friendly, distinctive, valuable, and informative learning apps. MIT App Inventor was used in this development research to create a valid and interesting junior high school mathematics learning module. The ADDIE model was used to conduct this development research. To assess the product's feasibility, validation was performed by media and material experts. Product trials were conducted by analyzing students' answers to establish the product's attractiveness. This study's test subjects were 45 UIN Raden Intan Lampung students majoring in Mathematics Education in semester 1. The feasibility test results from media and material validators were 3.32 and 3.52 in the valid category. The attractiveness test received a score of 3.54 on the small-scale trial with the highly attractive and 3.6 on the large-scale trial with the same criteria. It is possible to conclude that the developed module is feasible.

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INTRODUCTION

Educational interactions to achieve learning objectives characterize the learning process (Pane & Dasopang, 2017). Learning objectives will be easily met if students can learn on their initiative and independently. Students must be able to learn independently. Learning autonomy is another factor that influences learning outcomes. Essentially, a learner with good learning independence can take the initiative, have self-confidence, be responsible, and do something without relying on others (Nurfadilah & Hakim, 2019).

Learning independence promotes students' ability to participate in active learning activities (Ningsih & Nurrahmah, 2016). Learning independence motivates students to strive to improve their academic performance (Wira, 2021). However, each learner's level of independence is unique (Sobri, 2020). As a result, efforts must be made to increase students' independence. There are six indicators of learning independence: (1) independence from others. (2) having self-assurance. (3) maintain a disciplined demeanor. (4) have a sense of accountability. (5) act in a disciplined fashion on their initiative. (6) demonstrating self-control (Hidayati & Listyani, 2010).

According to interviews with lecturers, the learning process used group discussion methods and lectures. During the learning process, they used their printed books and PowerPoint media. Nobody has ever created a learning module. Furthermore, students recognize that the material in the printed book needs to be narrower. Hence, students rely only on lecturers as conveyors of lecture material and need to be more active in seeking other learning resources. The traditional learning process also results in a need for more enthusiasm for student learning. Some students need help to

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answer questions about the material taught owing to a lack of student awareness to learn independently.

Individualized learning through teaching materials, specifically modules, is one effort to meet the needs of students independently (Prastowo, 2015; Suastika, 2019). Modules are self-instructional, self-contained, stand-alone, adaptable, and user-friendly (Najuah et al., 2020). Modules with these characteristics encourage students' learning agility by completing one or more basic competencies (Subhananto, 2015). The preparation of modules in simple language can assist students based on their level of knowledge and age, allowing them to learn independently with the assistance or guidance of educators (Suprihatiningsih & Annurwanda, 2019).

Modules come in a variety of formats, including print and electronic. However, to keep up with technological advancements, the educational world must be adaptable (Fitri et al., 2021). Some studies show the development of electronic learning products (Rahmawati et al., 2022; Ummah et al., 2021). As a result, it is appropriate to create electronic modules. Many e-module developments have occurred, including the creation of guided discovery-based e-modules (Handayani et al., 2021), ethnoconstructivism e-modules (Asrial et al., 2019), CTL-based e-modules (Wahyuningtyas et al., 2018), ethnomathematics-based e-modules (Sutarto et al., 2022), interactive e-modules (Asmianto et al., 2022), RME-based e-modules (Suparman & Achmad, 2020), and inquiry-based e-modules (Suastika & Wahyuningtyas, 2020). Even e-module teaching materials for independent learning have been created(Purwasih et al., 2022; Setiyani et al., 2022). However, e-modules with learning independence at the university level have yet to be developed. As a result, this research aims to create e-modules that are easy to understand and interesting to read. The module is intended to assist students in learning independently and to facilitate the learning process.

METHOD

This research method is called R&D (Research and Development)(Sugiyono, 2013). Research and Development is a research method that creates new products or goods and enhances the value of existing products or goods. Tests, learning models, data-based management systems, learning media, and learning systems are examples of long-term or gradual products (Lena et al., 2019). The ADDIE research model was used in the research.

The ADDIE model development research procedure has five stages: analysis, design, development, implementation, and evaluation (Branch, 2010). However, this stage is restricted only until the development stage. The instruments used in this study were a validation questionnaire sheet to determine the module's feasibility and a student response questionnaire sheet to determine the module's attractiveness. The following formula was used to calculate the questionnaire assessment score (Sudijono, 2007) :

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Where

$$x_i = \frac{\text{Total score}}{\text{total maximum score}} \times 4$$

Description:
$\bar{x}$ = average score; x_i = validators' score-I; n = number of validators.
Each questionnaire consists of four answers according to the statement given. The assessment score of each answer choice can be seen in table 1(Arikunto, 2010).

Table 1. The Scoring Scale of the Validation

Category	Score
Poor	1
Moderate	2
High	3
Excellent	4

The assessment score for the learner response questionnaire can be seen in table 2 (Hidayatullah, 2018).

Table 2. Learner Response Rating Scale

Category	Score
Highly attractive	4
Attractive	3
Less attractive	2
Unattractive	1

The average calculation based on the assessment can be converted to questions to determine the validity and feasibility of the module. The modified score can be seen in table 3 (Akbar, 2015).

Table 3. Validation Sheet Rating Scale

Criteria	Validity Level
$3{,}26 < x \leq 4{,}00$	Valid
$2{,}51 < x \leq 3{,}26$	Moderately Valid
$1{,}76 < x \leq 2{,}51$	Less Valid
$1{,}00 < x \leq 1{,}76$	Invalid

Assessment of score calculation on learner responses can be seen in table 4.

Table 4. Student Response Rating scale

Criteria	Validity Level
$3{,}26 < x \leq 4{,}00$	Highly attractive
$2{,}51 < x \leq 3{,}26$	Attractive
$1{,}76 < x \leq 2{,}51$	Less attractive
$1{,}00 < x \leq 1{,}76$	Unattractive

RESULTS AND DISCUSSION

This research resulted in the creation of an e-module with the assistance of MIT APP Inventor. This research seeks to create learning modules that will assist students in developing learning independence. This study employs the ADDIE model, which is limited to the development stage.

Analysis Stage

A needs analysis was conducted to identify the problems discovered in the Mathematics Education Department of UIN Raden Intan Lampung. Based on interviews with lecturers of Junior High School Mathematics Learning courses and the results of student questionnaires, it was discovered that student learning independence needed to be improved. So, if the course material is turned into a module, it will be more efficient because students can study it independently before the lecture begins.

An examination of the learning curriculum at Raden Intan Lampung State Islamic University. Furthermore, it examines learning independence and the materials used in the Development of Junior High School Mathematics Learning Modules with the assistance of MIT App Inventor to Stimulate Learning Independence.

The preliminary research findings on students indicate that learning independence in junior high school mathematics learning courses is critical. Before the lecturer begins, students must first learn independently. The problem is the requirement for a Junior High School Mathematics Learning Module using MIT App Inventor. Furthermore, at the analysis stage, an evaluation was performed, and it was determined that the researcher would create a Junior High School Mathematics Learning Module with the assistance of MIT App Inventor. Because Junior High School Mathematics Learning is a first-semester course in the Mathematics Education Department of UIN Raden Intan Lampung, this module is intended to encourage students learning independence.

Design

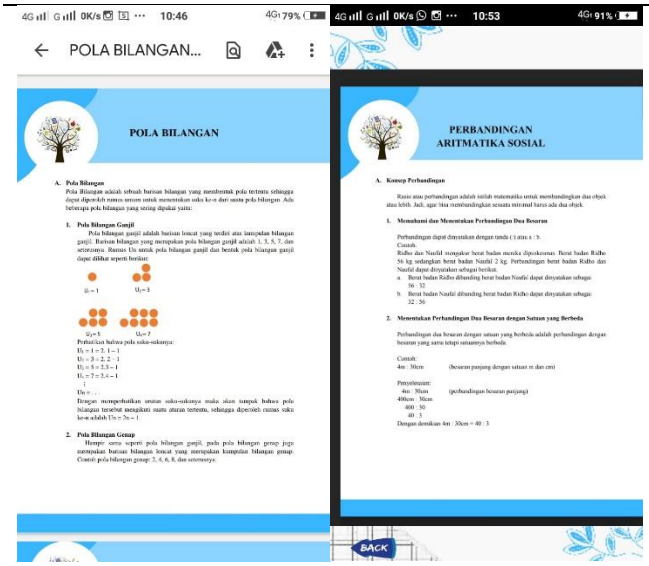
The design stage was carried out with the assistance of software. Using the Canva app, create the appearance of the opening and background. This arrangement includes a welcome page, information, a topic, indicators, material, and basic competencies. Material references are taken from lecturer-used package books and reliable sources, such as the basic mathematics books (Netriwati, 2018), the junior high school student book mathematics grade seventh (Anggraena, 2017), and mathematics books for the seventh-grade of junior high school (Simangunson et al., 2006). The design results were then formatted as an Android application using the MIT App Inventory website.

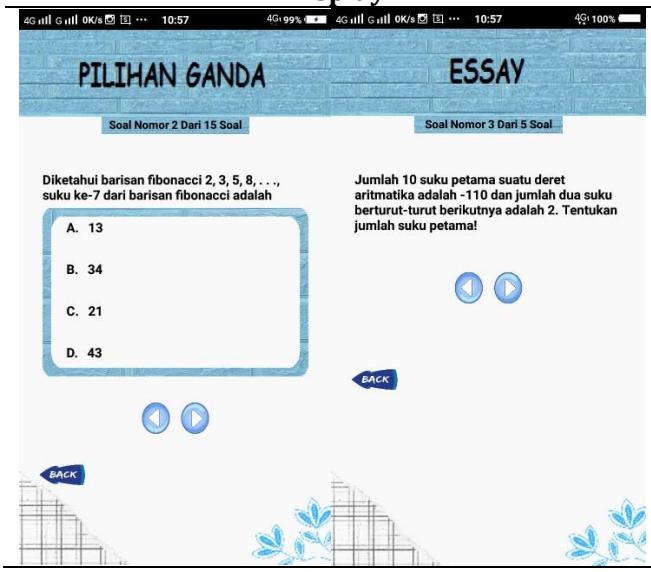
Aside from focusing on product design, questionnaire instrument design was also executed to measure the product's feasibility and attractiveness. Media and material experts were given validation questionnaires. The students were given response questionnaires so that the researchers could assess the module's attractiveness.

Development Stage

The MIT App Inventor-assisted Junior High Mathematics Learning Module was done at this stage following the design at the design stage. Table 5 displays the MIT App Inventor-assisted module that has been developed.

Table 5. E-module Assisted by MIT App Inventor

Display	Description
	The initial display of the E-module with the topic menu. To open the module by clicking the 'Play Now" button. This module has five topics, including number patterns, sets, relations, functions, and opportunities; algebraic forms; SPLSV and SPLDV; and social arithmetic comparison.
	Display of material in the e-module. Presentation of material is presented in a language that is easy to understand.

Display	Description
	In the end, there is an evaluation in the form of multiple-choice questions and essays.

The Mathematics Learning Module was validated by three media expert validators and three material expert validators after it was created using MIT App Inventor. The validation results include module and material assessments, comments, suggestions, and input to revise the developed modules to make them even better and more usable. Figure 1 depicts the results of the media validation assessment.

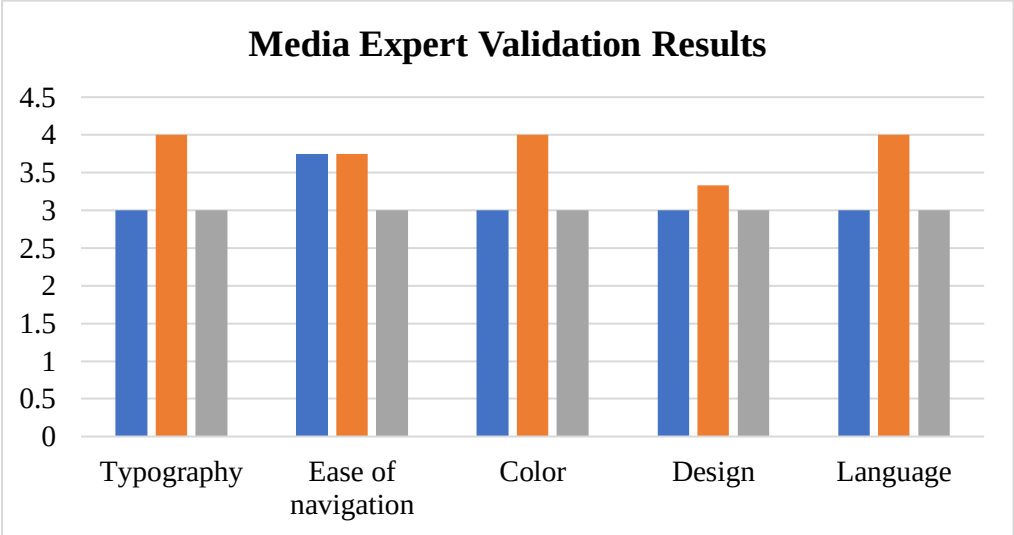


Figure 1. Media Expert Validation

With valid criteria, the average score of aspects is 3.32. It is possible to conclude that the Junior High School Mathematics Learning Module, aided by MIT App Inventor, is valid and usable. Figure 2 depicts the material validation assessment results.

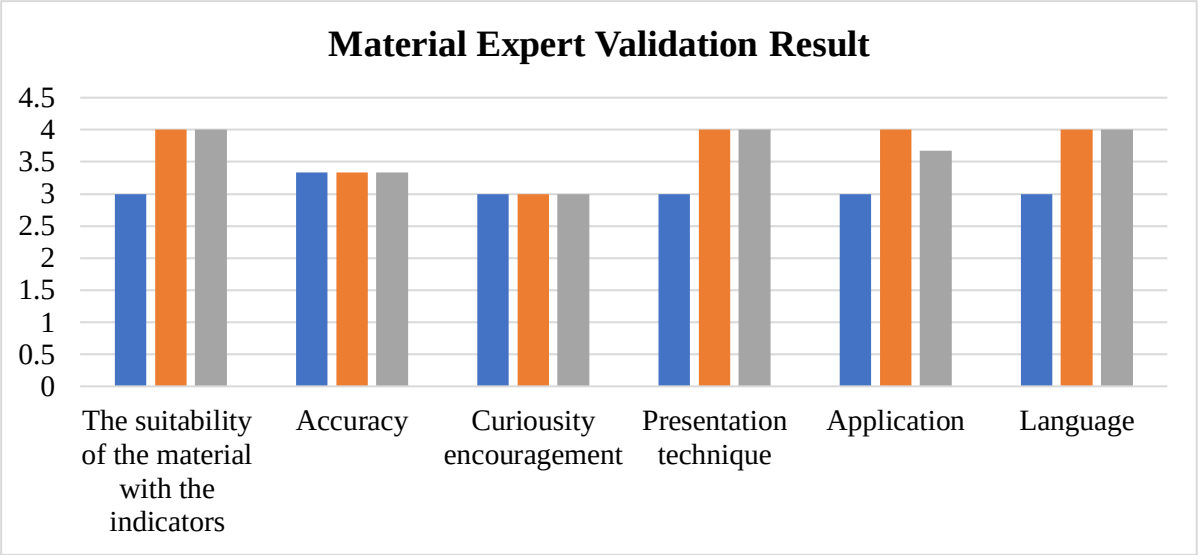


Figure 2. Material Expert Validation

With valid criteria, the average score of the material expert assessment aspects is 3.52. The evaluation is based on the six aspects of the material validity assessment. The attractiveness trial was conducted, with UIN Raden Intan Lampung Education students receiving a response assessment questionnaire. The product attractiveness trial included a small-scale test with 13 UIN Raden Intan Lampung mathematics education majors and a large-scale attractiveness test with 22 UIN Raden Intan Lampung mathematics education majors. Students were given a questionnaire to determine the attractiveness of the Mathematics Learning Module, developed with MIT App Inventor's help. The small-scale trial results are shown in Figure 3:

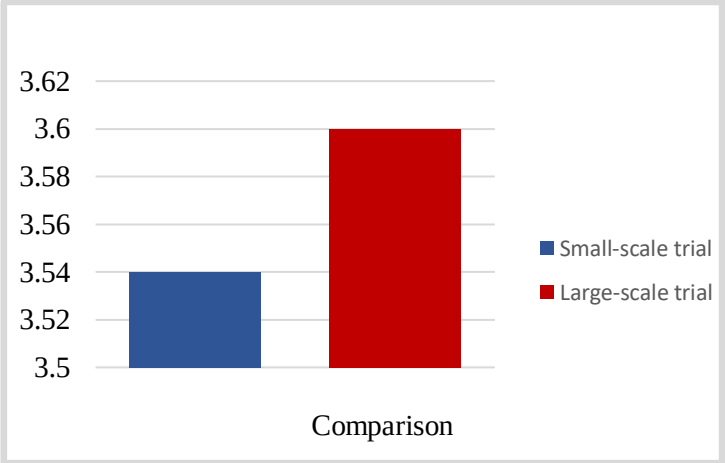


Figure 3. Attractiveness Trials Results

Figure 3 depicts the test comparison graph for the small-scale and large-scale trials. The small-scale trial was taken by 13 students who scored 3.54 on the "highly attractive" criteria. The large-scale trial was taken by 22 students, who received an average score of 3.6 on the "highly attractive" criteria. This finding demonstrated that the respondents were enthusiastic about the developed module. This e-module has the benefit of being available offline. Therefore, users can access the e-module without connecting to the internet. As a result, the developed module can be used at any time and from any location. However, because this module is only intended for smartphone users with the Android operating system, users with other operating systems, such as the IOS operating system, cannot use it.

This e-module is appropriate for encouraging student learning independence. This e-module is intended to summarize various concepts of basic materials that students must understand when

learning mathematics in junior high school by presenting junior high school mathematics learning materials. Students have prepared themselves by learning independently through this e-module before the learning begins. This is consistent with several studies that show that using e-modules can encourage students to learn independently (Mulyasari, 2021; Ramadhani & Fitria, 2021; Sari, 2021). Students can solve their problems and are better prepared for classroom learning because they have previously studied independently.

This development research helps to create products like e-modules that encourage student learning independence. This research, however, has limitations because it has yet to reach the effectiveness test for determining student independence. The next study will test the effectiveness of e-modules on student learning independence.

CONCLUSION

This research and development results in a product, the MIT App Inventor-assisted module, which was created using the ADDIE model (analysis, design, development, implementation, and evaluation). This module covers the material in the junior high school mathematics learning course. The results of the media validation questionnaire, material, and student responses regarding the module's feasibility and attractiveness received an average of 3.52 from material experts and 3.32 from media experts. The results of the small-scale trial's response questionnaires received an average of 3.54. The large-scale trial obtained an average score of 3.6 with very interesting criteria. This research, however, is limited to the development stage. More research is needed to determine the effectiveness of e-modules in promoting learning independence. The developed module is also realistically limited to junior high school mathematics learning materials, so creating learning modules with different materials is recommended.

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