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Developing Canva-based E-Module of flat surfaces in geometry for eighth

Rinto Bouti *, Sarson W. Dj. Pomalato and Ismail Djakaria

Universitas Negeri Gorontalo, Indonesia.

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Abstract

This development research is aimed at developing an e-module of flat surfaces in geometry for eighth graders and describing it based on validity, practicality, and effectiveness aspects. We used the 4D model, i.e., define, design, develop, and disseminate, as the development model and assessment sheets for the e-module as research instruments, later filled out by material and media experts to measure their validity. Other research instruments included assessment sheets for teachers as practitioners to measure practicality, student response questionnaires, and learning outcome test to measure the e-module's effectiveness. The product was tested on 30 eighth graders, and results demonstrated that the material expert gave a mean score of 4.2 with a good criterion, and the media expert gave a score of 4.8 with an excellent criterion. Accordingly, the e-module developed was considered valid. Practitioners gave a mean score of 4.8 to the e-module, therefore classified as excellent and practical. Student responses were very positive to the e-module at 91.71%, and the classical completeness percentage based on the student learning test results was 96.67%, thereby declaring that the e-module was effective.

Keywords: Development; e-Module; Geometry; Graders

1. Introduction

Teachers have to organize and develop materials into learning materials to allow effective material presentation in the learning process and enable students to study the materials efficiently. Teacher competency in developing learning materials is associated with pedagogic and professional competencies, as stated in the Attachment to Permendiknas Number 16/2007 concerning Standards for Academic Qualifications and Teacher Competency. As professional educators, teachers are expected to develop learning materials aligned with available mechanisms by also taking students' characteristics and social environment into account (Depdiknas, 2008:25).

According to Sungkono (2003:2), learning materials must be compiled completely and systematically by learning principles teachers and students apply in the learning process. As they are systematic, they need to be organized, making students learn efficiently. Learning materials are also unique and specific, indicating that they are purposively used to achieve certain targets through a particular learning process and bear purposively designed content to achieve specific competencies and targets, respectively. One of the alternative learning materials to activate students in learning is an electronic module or e-module.

Most students believe mathematics is difficult and thus maintain less interest in it, bringing on learning outcomes which do not fulfill Minimum Completeness Criteria. It is caused by several factors, e.g., unattractive material presentation unable to draw students' learning interest and motivation. This issue demands teachers to adapt and make innovations in presenting mathematics learning materials effectively, such as by using technological development.

* Corresponding author: Rinto Bouti

Our observation at SMPN 1 Buntulia pointed out that many students disliked mathematics, especially geometric materials, at the flat surface topic and participated in the monotonous classroom learning process. They were given dull learning sources which could not draw their attention. One of the learning topics in geometry delivered at a junior high school level is flat surfaces, and our evaluation presented that 78.13% of students' learning outcomes at SMPN 1 Buntulia for flat surfaces in geometry were under Minimum Completeness Criteria.

Student incompetency attributed to geometric materials is confirmed by the survey carried out by the Programme for International Student Assessment (PISA) in 2022/2001, showing student weaknesses in geometry, particularly spaces and shapes. For instance, students face difficulties conceiving a hollow cube, determining space diagonal, plane diagonal, and nets, and others.

Especially in mathematics learning, teachers can provide an e-module because it can facilitate students to understand materials structurally and allow them to access it from anywhere and at any time. The e-module is expected to enable students to learn independently and understand mathematics learning materials, act as a reference, help teachers present learning materials, and make the learning process accessible anywhere and anytime.

This research focuses on developing an e-module of flat surfaces in geometry and is aimed at describing the process of developing a Canva-based e-module of flat surfaces in geometry and engendering a valid, practical, and effective mathematic e-module.

2. Material and Method

This research and development or R&D research was conducted on May 29th-July 29th, 2023, at SMPN Buntulia using a specific research design, the Four-D design model (Define, Design, Develop, and Disseminate). The subjects were 30 eighth graders of SMPN 1 Buntulia in the 2022/2023 academic year.

Research procedures were: defining and determining the developed product; analyzing the need for literature review, potency, problem, and applicable curriculum related to the e-module of flat surfaces in geometry; making the selected product design emanating from the define stage by determining competency achievement indicators and making the framework of the e-module prepared; developing the e-module into a product, repeating product validation to make the product commensurate with the predefined specifications, making an e-module of flat surfaces in geometry, validating the e-module, performing a limited test on the e-module, analyzing the e-module's practicality and effectiveness, and fixing the e-module weaknesses to meet the criteria; and disseminating the tested product for others' interest by writing a journal article or directly giving it to mathematic teachers at junior high schools/Islamic junior high schools.

Research instruments were (1) assessment sheets filled out by material and media experts and practitioners, (2) student response questionnaires, and (3) student learning outcome tests. All instruments had been expert-validated. Data collection techniques were observation, interview, questionnaire distribution, and test.

Data analysis techniques used were qualitative and quantitative, the first of which was applied by analyzing preliminary observation results, whose data were used as consideration materials in the e-module development, and the second was undertaken through validity analysis, practicality analysis, and effectiveness analysis.

3. Results and discussion

This development research used the 4D development model, covering four phases: Define, Design, Develop, and Disseminate, explained as follows:

3.1. Define Phase

3.1.1. Curriculum Analysis

The curriculum used at SMPN 1 Buntulia, the 2013 Curriculum, contained a set of plans and management regarding learning objectives, content, materials, and methods and served as guidelines for implementing learning activities to attain learning objectives at schools. It was developed grounded on the principle that students had a central position to develop their competency and become those who believe in God, nurture morals, are healthy, knowledgeable, competent, creative, and independent and democratic and responsible citizenry. To advocate realizing the objectives,

student competency development should comport with student potency, development, need, and interest and environmental demands.

3.1.2. Student Analysis

Student analysis was performed to identify the learning sources students needed using Android-based mobile phones since, in general, students had the gadgets and internet networking around their domicile. No digital learning sources students could access through mobile phones were available, emphasizing the criticality of developing one, i.e., this mathematic e-module.

3.1.3. Material Analysis

Material analysis was undertaken to set the focus on a topic developed in the e-module, and we had identified the applicable curriculum before carrying out the analysis and found that SMPN 1 Buntulia used the Revised 2013 Curriculum, in which several basic competencies were eliminated and replaced with new ones. Table 1 shows core and basic competencies associated with flat surfaces in geometry materials.

Table 1 Core and Basic Competencies Concerning Flat Surfaces in Geometry

Core Competency	**Basic Competency**
Appreciating and complying with the religious teaching believed. Appreciating and implementing honesty, discipline, responsibility, caring (tolerance and mutual help), politeness, and confidence when interacting effectively with the social and natural environments within the reach of their socialization and existence. Understanding knowledge (factual, conceptual, and procedural) based on their curiosity toward science, technology, art, and culture regarding visible phenomena and occurrence. Trying, processing, and presenting in a concrete domain (using, elaborating, arranging, modifying, and making) and in an abstract domain (writing, reading, quantifying, drawing, and making a narration) conforming to what is learned at schools and other sources with the same perspectives/theories.	3.9. Differentiating and determining the surface area and volume of a flat surface (cube, block, prism, and pyramid). 4.9. Solving a mathematical problem concerning the surface area and volume of a flat surface (cube, block, prism, and pyramid) and its combination.

Referencing Table 1, we chose some achievement indicators developed in the e-module as follows:

- Identifying the nature of cube and block.
- Identifying the nature of prism and pyramid.
- Identifying the surface area of cube and block.
- Identifying the surface area of prism and pyramid.
- Determining the volume of cube and block.
- Determining the volume of prism and pyramid.
- Solving the problem concerning cube, block, prism, and pyramid.

3.1.4. Task Analysis

Task analysis was carried out to identify the suitability of the tasks in the e-module to learning objectives. The e-module of flat surfaces in geometry contained four learning activities, each equipped with exercises to identify student competency achievement in learning.

3.1.5. Learning Objective Formulation

Learning objective formulation was aimed at determining the learning objective which should be attained after learning the e-module and congruent with learning materials. After learning using the mathematic e-module, students were expected to:

- Understand the nature of cube and block.
- Understand the nature of prism and pyramid.
- Determine the surface area of cube and block.

- Determine the surface area of prism and pyramid.
- Determine the volume of cube and block.
- Determine the volume of prism and pyramid.
- Solve problems concerning cube, block, prism, and pyramid.

3.2. Design Phase

3.2.1. Media Selection

The selected learning media was relevant to learning objectives, allowing well-delivered learning materials. The media used in the learning implementation was an e-module of flat surfaces in geometry for eighth graders at SMPN 1 Buntulia.

3.2.2. Format Selection

A particular format was selected to determine the developed learning source. In this research, the learning source we generated was digital, which was a mathematic e-module. This format complied with the standard module format yet was adjusted to its digital version.

3.2.3. Preliminary Design

The preliminary e-module design was made to induce the prototype of the product, i.e., an e-module of flat surfaces in geometry, using Canva. The phase's result was draft 1/preliminary draft.

3.3. Develop Phase

Draft 1/preliminary draft was developed in the following stages in this phase.

3.3.1. Expert Assessment

The expert assessment referred to validating the generated e-module (draft 1) and was conducted by validators. The assessment encompassed material, media, and practicality validation. The validation results acted as references to revise the e-module. In revising the e-module, we took experts' suggestions and instructions in mind as references for improving it. The results were then used to identify the developed e-module's validity and practicality.

The material expert's assessment of the e-module of flat surfaces in geometry is stated in Table 2.

Table 2 Results of the Material Expert's Assessment

No.	Aspect	Mean Score	Criterion
1	Content reliability	4.2	Excellent
2	Language reliability	4.2	Excellent
3	Presentation	4.3	Excellent
4	Independent learning	4	Good
Overall mean		4.2	Excellent

Components in Table 2 were thus categorized as "Excellent" ($4 < \overline{V} \leq 5$). Predicated on validity criteria, the e-module had a high degree of validity and was reliable to use.

Table 3 Results of the Media Expert's Assessment

No.	Aspect	Mean Score	Criterion
1	E-module cover design	4.9	Excellent
2	E-module content design	4.6	Excellent
Overall mean		4.8	Excellent

Components in Table 3, based on the media expert's assessment, were categorized as "Excellent" ($4 < \overline{V} \leq 5$). Grounded on validity criteria, the e-module had a high degree of validity and was reliable to use.

Table 4 Results of the Practitioner's Assessment

No.	Aspect	Mean Score	Criterion
1	Material aspect	4.6	Excellent
2	E-module content design	5	Excellent
Overall mean		4.8	Excellent

Components in Table 4, predicated on the practitioner's assessment, were categorized as "Excellent" ($4 < \overline{V} \leq 5$). Based on validity criteria, the e-module had a high degree of validity and was reliable to use.

However, the experts and the practitioner gave several suggestions and demanded improvements in some aspects of draft 1. Table 5 suggests the material and media experts' and practitioner's revisions.

Table 5 Experts' and Practitioner's Revisions for the E-Module as Validation Results

Validator	Revision	Follow-Up
Material	Problem 3 in *Ayo Berlatih* 1: The geometry's ribs are unrealistic.	Applied by instruction.
	Problem 2 in *Ayo Berlatih* 2: The cupboard's size is not contextual.	Applied by instruction.
	The roof tiles' price in the problem example on page 33 is unrealistic.	Applied by instruction.
	The geometry's ribs in the problem example on page 35 are not proportional.	Applied by instruction.
Media	The e-module cover should be more attractive using flat surface images.	Applied by instruction.
	The authors' profiles should be stated at the end of the e-module.	Applied by instruction.
Practitioner	Problems in *Ayo Berlatih* should be equipped with key answers attached at the end of the e-module.	Applied by instruction.

Effectiveness was measured using student response questionnaires and learning outcomes, as described in Table 6.

Table 6 Results of the Analysis of Student Response Questionnaires

No.	Aspect	Percentage (%)	Criteria
1	Interest	91.67	Very Positive
2	Usability	89.17	Very Positive
3	Pleasure	93.33	Very Positive
4	Activeness	88.33	Very Positive
5	Efficiency	91.11	Very Positive
6	Optimism	96.67	Very Positive
Overall mean		91.71	Very Positive

Table 6 demonstrates that student responses to using the e-module during the learning process were excellent at an overall mean of 91.71%. The results of students' mathematic learning outcome test after using the e-module are exhibited in Table 7.

Table 7 Results of Students' Learning Outcome Test After Using the E-Module

Competency	Number of Students	Mean Score
Excellent (91-100)	3	91.20
Good (81-90)	20	85.60
Acceptable (70-80)	6	72.25
Poor (< 70)	1	55.00

Ariyani & Siradjuddin (2014) conveyed that classical learning completeness was fulfilled if at least 80% of students in a class achieved learning completeness. Grounded on Table 7, the e-module of flat surfaces in geometry met the effectiveness aspect as it was effective based on student responses and learning outcome tests.

3.4. Disseminate Phase

The disseminate phase was carried out using social media apps, e.g., WhatsApp and Facebook, and targeted the mathematic MGMP community at a junior high school level in Pohuwato and the National Mathematic Association in Gorontalo Province.

4. Conclusion

This e-module of flat surfaces in geometry was developed using the 4D model, covering four phases, i.e., Define, Design, Develop, and Disseminate. Results indicated that the developed e-module of flat surfaces in geometry fulfilled the valid, practical, and effective qualifications; hence, it was reliable to use. In this research, the developed e-module only focused on geometry, especially flat surfaces, and accordingly, we expect that future researchers will develop e-modules of other materials.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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