



Development of a Flipbook-based E-module Integrated with GeoGebra and Genially on Similarity

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Abstract

Received : June 27, 2024
Revised : July 21, 2024
Accepted : August 20, 2024

The aim of this research is to develop an e-module using flipbook media that is integrated with GeoGebra and Genially in Mathematics subjects, especially about similarity for class IX SMP Khadijah 2 Surabaya which can be used as interactive teaching material. The objective of this study is to develop an e-module using a flipbook for the Mathematics subject, specifically on the topic of similarity for Grade IX at SMP Khadijah 2 Surabaya, that is both effective and suitable for use. The research method employed is the R&D (Research & Development) model by Borg and Gall, which involves data collection to produce, develop, and validate the product, utilizing the ASSURE method introduced by Robert Heinich and colleagues in the 1980s. This study uses the ASSURE model, which consists of six steps: 1) Analyze Learner Characteristics; 2) State Performance Objectives; 3) Select Methods, Media, and Materials; 4) Utilize Materials; 5) Require Learner Participation; 6) Evaluate and Revise. The data used in this research includes both qualitative and quantitative data. The research data was obtained from the feasibility level assessed by learning media experts at 83%, design experts at 92%, learning material experts at 98%, peer trials at 100%, small group trials with 5 students at 88%, medium group trials with 9 students at 90%, and large group trials with 24 students at 86%.

Keywords:

ASSURE, e-module development, Flipbook, Geogebra, Genially, Similarity

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How to Cite: Cholilah, M., Noor Fatirul, A., & Harwanto. (2024). Development of a Flipbook-based E-module integrated with GeoGebra and Genially on Similarity. *JTP - Jurnal Teknologi Pendidikan*, 26(2), 492-506. <https://doi.org/10.21009/jtp.v26i2.47148>

INTRODUCTION

Education is important in increasing one's insight and knowledge (Masykur et al., 2017). Mathematics is a branch of knowledge that needs to be conveyed through the learning process. Mathematics is also important in the development and progress of technology (Laamena et al., 2021). Mathematics, as basic knowledge, is important for developing thinking skills in solving problems in daily life and in facing advances in science and technology (Hikmah, 2017). Thus, learning mathematics requires understanding and mastery of the material, especially in understanding symbols, tables and diagrams which are often used in mathematics.

According to Wahab & Rosnawati, (2021), learning is an interactive activity between students, teachers, and all other learning resources which are learning tools so that they are in accordance with the expected goals in order to change students' mindsets and behavior. According to Aqib (in Wahab & Rosnawati, 2021) the



learning process is a systematic effort carried out by teachers through planning, implementation and evaluation to create an effective and efficient learning process.

Efforts to improve the quality of effective learning can be done through developing teaching materials. This is in line with Saputra (in Mana et al., 2021) where to improve the quality of education, new breakthroughs are needed by improving teaching methods and the quality of educators so that they have a solid basis for transferring knowledge and preparing the quality of human resources. One of the teaching materials that can be used independently is a module. According to Hamidani (in Lubis et al., 2022), teaching modules are all forms of modules or materials that are systematically arranged which are used to assist teachers or instructors in carrying out teaching and learning activities so that an environment or atmosphere is achieved that allows students to learn. The same thing was conveyed by Andi Prastowo (in Widyastuti & Wiryokusumo, 2019) that teaching modules are systematic teaching materials using light language so that they are easy for students to understand, according to their age and level of knowledge so they can learn independently.

It can be concluded that teaching modules are systematic teaching materials as learning guidelines to achieve the desired learning objectives. Meanwhile, e-modules or electronic modules are an electronic version of a printed module that can be read on a computer and designed with the necessary software. e-module is a learning tool or facility that contains material, methods, limitations and ways of evaluating that are designed systematically and interestingly to achieve the expected competencies according to the level of complexity electronically. e-modules can be implemented as an independent learning resource that can help students improve their cognitive competence or understanding and no longer depend on the only source of information while also being able to present information in a structured, interesting and high level of interactivity so that the learning process does not more dependent on the instructor as the only source of information (Florentina Turnip & Karyono, 2021). The development of this e-module is very necessary to make it easier for teachers when teaching, besides that this e-module can be used by students to study independently at home as a substitute for printed books (Awwaliyah et al., 2021).

Researchers developed teaching materials in the form of an integrated flipbook-based e-module, GeoGebra and Genially, which is a type of electronic book that can be used as an interactive learning resource focusing on class IX students at SMP Khadijah 2 on Mathematics subjects, especially similarity. Based on the results of observations through interviews with Mathematics subject teachers, learning was good but not optimal. Based on this, problems were found regarding the learning media at SMP Khadijah 2, namely that there had been no development of specially created learning media such as e-modules to train students' spatial abilities and until now, the teaching materials used by teachers were textbooks and LKS.

According to Asmi (in Awwaliyah et al., 2021) flipbook-based teaching materials have advantages, namely, (1) they can have a flip effect, meaning they can be flipped back and forth so it's like reading a real book; (2) this application is easy to use; (3) not only in the form of writing but can also be accompanied by

images, sound or video; (4) products that can be produced can be published on websites in SWF or Flash form, and HTML.

Electronic modules (e-modules) are systematic and interesting learning media that can be accessed via computer or gadget and can be used as a guide for learning mathematics independently or with guidance. E-module is part of electronic based learning which utilizes technology, namely electronics. Currently, many learning aids utilize electronic media, including: ICT technology, multimedia technology, television technology and computer technology (Ramadanti et al., 2021). Where the components in the e-module can be adjusted to the components in the printed module.

With advances in electronic module technology or often called E-Modules, they are able to support educational process activities, in the E-Modules there is material and then these E-Modules can be studied by students several times (Oktaviana & Putri, 2020). Meanwhile, according to Florentina Turnip & Karyono, (2021), e-modules provide information in a structured, interesting manner and have a high level of interactivity, so that the learning process does not depend on the instructor as the only source of information.

According to Priyanthi, et al., (2017), e-modules are learning tools that include materials, methods, limitations and evaluations that are designed systematically and interestingly to achieve the expected competencies according to the level of complexity. Meanwhile, Lisa & Susilowibowo (2016) states that electronic modules or e-modules present information in the form of books that are presented electronically via media such as hard disks, diskettes, CDs, or flash disks that can be read by computers or electronic book readers. Based on the explanation regarding modules and electronic modules, it can be seen that the development principles are no different between conventional (printed) modules and e-modules. The only difference is in the physical presentation format, where the electronic module adapts the components found in printed modules in general.

So, it can be concluded that e-modules are teaching materials that are systematically arranged and equipped with supporting technology which contains images, audio and video so that learning can be carried out by students anytime and anywhere independently.

According to Susilana & Riyana (in Saparina et al., 2020) that flipbook media is a visual media in the form of sheets of paper arranged like a calendar with dimensions of 21 x 28cm tied at the top). However, along with advances in science and technology, now flipbooks can be presented in digital format which contains multimedia elements and navigation which makes users more interactive with the media.

Previous research conducted by (Setiadi et al., 2021) on the Use of Flipbook Learning Media to Improve Student Activities and Learning Outcomes shows that the use of online-based flipbook learning media can improve student learning outcomes and learning activities. Improved learning outcomes can be seen through the results of learning evaluations at the end of learning.

Geogebra is the right choice for a variety of presentations of mathematical objects because GeoGebra is dynamic geometry software that helps create points, lines, and all curved shapes. According to Mahmudi (in Winarni & Hidayat, 2018)

through geogebra abstract geometric objects can be visualized and can be manipulated quickly, accurately and efficiently.

Meanwhile, Genially media is creative and innovative learning media in the form of presentation materials, learning videos, educational games and other types of teaching materials. Genially media includes various features, namely presentations, animations or videos, infographics, electronic posters, quizzes and games which are able to provide interactive learning media for students (Dewi Astuti et al., 2022).

The similarity is part of the material of geometry. According to Fadilah & Bernard (2021), the application of this flat shape similarity can help calculate the distance or height of an object, whether on a miniature, map, or in the image of the original object. In research conducted by Islami et al., (2019) it shows the low understanding of students' concepts in similarity, where 60% of students experience difficulties in calculations and in understanding the concept of similarity.

Based on the description above, related to technological developments, the results of the analysis of students' spatial abilities and learning resources at SMP Khadijah 2 Surabaya, researchers are very interested in developing teaching materials in the form of e-modules as a form of learning innovation in an effort to improve students' mathematical abilities in solving problems, especially class IXB student at SMP Khadijah 2 Surabaya. The aim of this research is to develop a flipbook-based e-module that integrates GeoGebra and Genially in similarity to improve students' mathematical abilities, to determine the effectiveness of e-modules in learning mathematics for class IXB students at SMP Khadijah 2 Surabaya.

METHODS

This research uses the R&D (Research & Development) development model by Borg and Gall, while the model used in the research is the ASSURE model which was coined by Robert Heinich, et al in the 1980s which consists of six steps, namely 1) Analysis of student character; 2) Determining competencies; 3) Choose methods, media and teaching materials; 4) Utilization of teaching materials and learning media; 5) Involving students in the learning process; 6) Evaluation and revision. The ASSURE model is a reference for educators in learning that is systematically planned and streamlined through the integration of technology and media to produce more effective and meaningful learning for students (Alfafa, 2017). The data used in this research are qualitative and quantitative data. Quantitative data was obtained from validation from media, design and learning material experts, as well as peer response questionnaires and target trials, namely Khadijah 2 Middle School students, Surabaya, namely small group trials (5 class IXA students), medium group trials (9 students class IXA), and large group trials (24 class IXB students). Qualitative data was obtained from criticism and suggestions from the results of e-module validation and response questionnaires. Validation of the similarity e-module is carried out by filling out a questionnaire which is previously adjusted to the media, design and learning material criteria. The level of eligibility criteria used can be seen in table 1 below

To find out the average validator assessment results, the following formula is used.

$$P = \frac{S}{N} \times 100\%$$

S is the total score obtained, N is the maximum score obtained and P is the percentage obtained. The results of the expert assessment will be converted using the following table.

Table 1. Eligibility criteria for e-modules

Score	Criteria
$81\% \leq skor \leq 100\%$	Very Good
$61\% \leq skor \leq 80\%$	Good
$41\% \leq skor \leq 60\%$	Poor
$21\% \leq skor \leq 40\%$	Not Good
$skor \leq 21\%$	Very Bad

RESULTS & DISCUSSION

RESULT

This research aims to determine the validation and effectiveness of mathematics e-modules on flipbook-based similarity integrated with GeoGebra and Genially. This e-module is based on learning outcomes in the independent curriculum created for class IX students at junior high school level so they can solve and resolve problems related to similarity.

The data collection technique uses instruments/questionnaires in the form of validation instruments to learning media experts, design experts and learning material experts, equipped with peer trials and target trials to students in small groups of 5 students, medium group trials of 9 students, and a large group trial, namely 24 students in class IXB of SMP Khadijah 2 Surabaya. This validation and trial was carried out to see the effectiveness and feasibility of the flipbook-based e-module developed by the researcher. According to Sugiyono (in Islamiati et al., 2019) a questionnaire is a data collection technique that is carried out by giving a set of questions or written statements to respondents to answer.

The development of Geogebra and Genially's integrated flipbook-based e-module on similarity utilizes the Research & Development (R & D) development flow as a research cycle, while the development of the e-module uses the ASSURE model which consists of six steps, namely 1) Analyze Learner Characteristics; 2) State Performance Objectives; 3) Select Methods, Media, and Materials; 4) Utilize Materials; 5) Require Learner Participation; 6) Evaluate and Revise.

According to Fatirul, et al., (2022) in their book entitled Instructional Development Design Teaching Materials, the characteristics of the ASSURE development model are more oriented towards learning activities that do not explicitly mention learning strategies. Learning strategies are developed through the selection and use of methods, media, teaching materials, and student participation in class. The ASSURE model is very helpful in designing programs using various types of media.

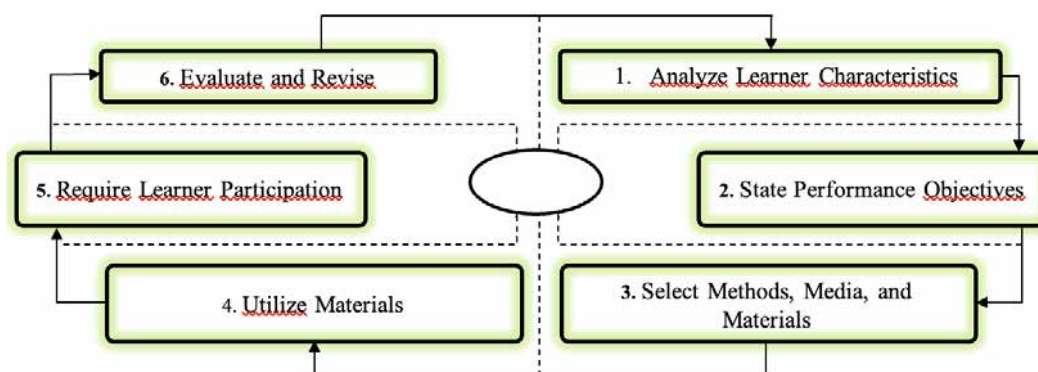


Figure 1. Stages of Development of the ASSURE Model Similarity Material E-Module

The stages of developing GeoGebra and Genially integrated flipbook-based e-module products on similarity at SMP Khadijah 2 Surabaya with the ASSURE model consist of six steps, namely

1. Analyze Learner Characteristics

This stage aims to determine student characteristics that can be identified from students' learning styles and spatial abilities. The results of the exploration of student characters carried out by researchers are presented in the form of scientific articles. According to Cholilah, (2023) the spatial abilities of Class IXB students at SMP Khadijah 2 Surabaya are relatively homogeneous, where students' spatial abilities are still relatively low because only 3 out of 24 students, namely around 12.5%, who got a score ≥ 65.97 are classified as having high spatial abilities. , while 58.3% (14 of 24 students) got a score of $40.29 < 65.97$, classified as having moderate spatial ability, and 29.2% (7 of 24 students) who got a score of ≤ 40.29 were classified as having moderate spatial ability. low spatial. So it can be concluded that the spatial abilities of Khadijah 2 Middle School students in Surabaya are classified as moderate with an average of 53.13.

After identifying students' spatial abilities, researchers also utilized the results of students' psychological tests regarding learning styles. So with the information on learning styles and spatial abilities obtained, where spatial abilities are very necessary in understanding the concept of similarity, the researchers are trying to improve students' mathematical abilities by increasing their spatial abilities through learning media by paying attention to students' characteristics, so the researchers developed learning media in the form of e-modules. which is flipbook based which is easy for students to access anywhere and anytime so that users are more interactive with the media, then GeoGebra is also integrated which is able to visualize and manipulate abstract geometric objects. Researchers also integrated the e-module product with the Genially educational application, which is a creative and innovative learning media in the form of educational games so that students feel interested in learning Mathematics and suppress boredom during learning.

2. State Performance Objectives

After finding potential and problems, the next step is to plan product development by formulating the competencies to be achieved. Determine the formulation of learning objectives derived from the syllabus/ATP from the curriculum guide using ABCD (Audience, Behavior, Condition, Degree).

The learning outcomes used to develop this class IX mathematics e-module are that students can explain the properties of similarity and similarity in triangles and quadrilaterals, and use them to solve problems. Meanwhile, the learning objectives to be achieved are:

- a) Students can visually classify two flat shapes that are similar and not similar
- b) Identify the conditions for similarity in flat shapes
- c) Identify the conditions for similarity in triangles
- d) Resolving problems related to similarity

3. Select Methods, Media, and Materials

The method used in learning is the scientific learning method. According to Karisma (in Suparsawan, 2021) the scientific approach is a learning approach that requires students to think systematically and critically in an effort to solve problems.

The next step is to choose methods, media and teaching materials (Select method, media and materials), namely by drafting an e-module with the choice of method, namely scientific learning which can require students to think critically and systematically in an effort to solve problems. Through media in the form of an integrated flipbook-based e-module with GeoGebra and Genially and this similarity material e-module can be used as teaching material for interactive learning.

Based on previous research by Pratiwi, (2016) it also shows that the GeoGebra application has a positive influence on increasing the ability to understand mathematical concepts in the learning process.

And based on research by Fatma & Ichsan, (2022) regarding the application of Genially-based learning media to improve science learning outcomes at Muhammadiyah Elementary School, it shows that the learning outcomes of class IVB students at Condongcatur Muhammadiyah Elementary School increased with Genially-based learning.

Furthermore, researchers feel challenged to innovate in developing teaching materials in the form of flipbook-based e-modules that integrate GeoGebra and Genially into similarity.

Researchers also prepared validation instruments for media experts, design experts, material experts, and colleagues as well as student test instruments. The questionnaire instrument created is the result of rating scale data using five alternative answers in the form of a score of 1 to 5. The validity and reliability test of the student instrument is carried out to determine the validity of each indicator in the questionnaire/questionnaire and

Rosita et al., 2021 stated that a validity test is a test of the accuracy of measuring something that should be measured. According to Dewi & Sudaryanto, 2020 (in Rosita et al., 2021) that the reliability test of a research

instrument is a test to find out whether the questionnaire used in collecting research data can be said to be reliable or not. Meanwhile, according to Edy Purwanto (in Pramuaji & Loekmono, 2018) reliability is defined as the degree to which test scores are consistent, reliable and repeatable.

4. Utilize Materials

The use of media and teaching materials in learning is very important by adapting to student needs so that students have a pleasant and beneficial learning experience. Students can use teaching materials in the form of e-modules independently, or in small groups, the e-modules that have been developed are reviewed by material experts and media experts to determine their feasibility in terms of product validity. Meanwhile, according to Smaldino (Pasmawangi et al., 2023), at this stage, preview materials are carried out or review of the modules that have been developed before they are implemented.

The use of teaching materials and learning media (Utilize Materials) from products that have been developed in the form of flipbook-based e-modules integrated with GeoGebra and Genially in similarity can be used as a reference by teachers and students in learning which can be easily accessed anywhere and anytime. By involving students in student-centered learning (Requires Learner Participation) by utilizing the similarity e-module, it will stimulate student activity during learning and increase student independence in studying similarity.

5. Require Learner Participation

During learning there must be activities that allow students to practice knowledge, skills, and receive feedback from the teacher. Through learning using scientific methods by utilizing teaching materials in the form of flipbook-based e-modules integrated with GeoGebra and Genially, this will stimulate students to become more active so that the learning process will be effective, efficient and attractive. With this e-module, learning activities become more interactive, so students will become more active during the learning process (student-centered learning), it will make it easier for students to understand the material provided by the teacher, and increase students' learning motivation.

6. Evaluate and Revise

This stage aims to assess the effectiveness and efficiency of learning carried out using this similarity e-module. By holding an expert test using a questionnaire conducted by three experts. Media Experts, Design Experts, and Material Experts, and friends as well as small group, medium group, and large group trials can provide a comprehensive assessment or input so that the feasibility of the e-module being developed can be determined.

Small and medium group trials were carried out on class IXA students based on the results of the 2024 interest talent assessment, especially spatial abilities, taken from the website <https://pusmendik.kemdikbud.go.id/abm>. Meanwhile, large group trials were carried out on class IXB students with spatial ability characteristics based on previous research.

The e-modules that have been developed are then validated by experts including media experts, design experts and learning material experts. The validation results are shown in the following table

Table 2. Results of Questionnaire Responses and Learning Media Expert Assessments

No	Aspect	Aspect Percentage	Category
1	Media Aspect	85%	Very Good
2	Linguistic Aspect	80%	Good
3	Aspect of Module Presentation	86%	Very Good
4	Media effect Aspect	80%	Good
	Mean	83%	Very Good

Based on the results of the questionnaire, learning media experts provided input, comments and suggestions that the e-module requirements had been met so that e-modules with flipbook media were suitable for use so that the next validation of the e-module was to validate it with learning design experts.

Table 3. Results of Questionnaire Responses and Learning Design Expert Assessments

No	Aspect	Aspect Percentage	Category
1	Aspect of learning design	93%	Very Good
2	Aspect use of technology	90%	Very Good
3	Aspect e-modul design	93%	Very Good
	Mean	92%	Very Good

Based on the results of the questionnaire, learning design experts provided input, comments and suggestions as follows:

- a. Sentences in e-modules should be more concise so that they focus on the material in question.
- b. The use of font types should be more varied.

To follow up on comments, suggestions and input from design experts related to e-modules is to revise the e-module being developed. The revised results from the design expert validation produce draft II which will then be validated by learning material experts as in the following table.

Table 4. Results of Questionnaire Responses and Expert Assessment of Learning Materials

No	Aspect	Aspect Percentage	Category
1	Aspect of material content	100%	Very Good
2	Aspect of appropriateness of media	100%	Very Good
3	Aspect presentation	95%	Very Good
	Mean	98%	Very Good

Based on the results of the questionnaire/questionnaire, there are comments, suggestions and input from material experts related to this e-module as follows:

- a. E-modules are suitable for use for learning by revising according to input from learning material experts
- b. Need to add buttons or links to make it more interactive

To follow up on comments, suggestions and input from material experts related to the e-module, revise the Draft II e-module to produce Draft III.

Table 5. Results of Questionnaire Responses and Peer Assessments

No	Aspect	Aspect Percentage	Category
1	Material aspect	100%	Very Good
2	Linguistic aspect	100%	Very Good
3	Presentation Aspect	100%	Very Good
4	Media effect Aspect	100%	Very Good
5	Aspek Tampilan	100%	Very Good
	Mean	100%	Very Good

Based on the results of the questionnaire/questionnaire, there are comments, suggestions and input from colleagues related to this e-module as follows:

- The e-module is very good, it makes it easier for students to understand similarity so the e-module is very suitable for use
- Assessments made in e-modules should be made more interactive, so that students can work on and find out the value of their learning outcomes which reflect their understanding of the material of similarity.

To follow up on comments, suggestions and input from material experts related to the e-module, revise Draft III of the e-module on the existing assessment to produce Draft IV.

After the e-module was revised based on input from experts, including media experts, design experts, material experts and colleagues, it was then used in learning and tested on students. The trial targets were randomly selected from the results of the 2024 interest talent assessment in the medium and good categories. The small group trials were in class IXA with 5 students, the medium group was in class IXA with 9 students, while the large group trials were carried out on class IXB students with 24 students. The following is an assessment of the results of target trials on the e-module products being developed.

Table 6. Results of the Target Trial Response Questionnaire

No	Aspect	Aspect Percentage		
		Small Group Trials	Medium Group Trials	Large Group Trials
1	Aspect of material content	87%	87%	84%
2	Aspect of ease of access	89%	92%	89%
3	Aspect of presentation	88%	92%	85%
	Total	88%	90%	86%
	Category	Very Good	Very Good	Very Good

From the results of target trials, both small group trials, medium group trials and large group trials as in table 6, the e-module product developed is very suitable for use as teaching material for class IX students at SMP Khadijah 2 Surabaya. The final product of this e-module will be socialized to class IX students of SMP Khadijah 2 Surabaya and also members of the Surabaya City Mathematics MGMP. Below is an example of the display of the e-module that has been developed.



Figure 2. E-modul cover page



Figure 3. Developing an interactive table of contents page in the e-module



Figure 4. Development of material in-depth pages on e-modules in comic form



Figure 5. Utilization of Geogebra in e-module development

Based on research findings regarding the development of digital flipbook-based e-modules, this has important implications compared to traditional textbook-based learning (Iffah, 2022). In previous research by Angelia et al., 2024, it was concluded that there was a positive and significant influence from the use of digital

flipbook media on students' motivation and learning outcomes in elementary school mathematics fractions.

By using GeoGebra, it is easier for students to determine the corresponding sides and angles because they are more visualized. This agrees with Syahbana (in Rachmawati et al., n.d., 2023) who said that GeoGebra can make it easier to visualize abstract geometric objects. Meanwhile, the application is genially used for educational games to make the e-module more interactive. This is also in line with research conducted by Vidyasari et al., 2024 that the Genially educational game is an influential and effective learning media for increasing students' interest in learning compared to classical learning media.

From this research and views, the development of an integrated flipbook-based e-module with GeoGebra and Genially on similarity, this e-module can enable students to understand similarity better and make learning more enjoyable. Meanwhile, from the results of expert assessments, including media, design and learning materials experts, colleagues, and target trials, namely students, it can be concluded that the flipbook-based e-module integrated with GeoGebra and Genially in this congruence material is said to be very valid and suitable for use as material. teaching at SMP Khadijah 2 Surabaya, especially on similarity material in class IX.

CONCLUSION

Research on the development of geogebraically and genially integrated flipbook-based e-modules on similarity at SMP Khadijah 2 Surabaya in accordance with the stages of the ASSURE development model which consists of six steps, namely analyzing student characteristics; determine competency; choose methods, media and teaching materials; utilize teaching materials and learning media; involving students in the learning process; and carry out evaluations and revisions. The product produced is in the form of teaching materials in the form of flipbook-based e-modules which can be accessed via the following link https://bit.ly/e-Modul_Interactive_Kesebangunan. Based on the assessment of validators, namely design experts, media experts, and learning material experts as well as peer trials and student trials on the teaching materials developed, they are considered suitable for use in terms of media, design, materials, interactivity and ease of use. It is hoped that the existence of this e-module can increase student involvement in full learning (student-centered learning) where the e-module can help students improve their mastery of similarity.

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to the Management of the Khadijah Foundation, who have allowed me to study further, as well as to the Management and Teachers and Education Personnel of Khadijah 2 Middle School Surabaya and students of class IX and special ones who have allowed me to carry out research at SMP Khadijah 2 Surabaya.

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