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Abstract: The transformation geometry course is a mandatory course that studies the basic concepts of transformation geometry, including translation, reflection, rotation, dilation, and transformation composition. Transformation geometry courses cannot be separated from the activity of deductively deriving concepts, theorems and algorithms, so more skills are needed so that students can understand this course easily. Therefore, the transformation geometry course requires good and effective teaching materials which can encourage students to actively interact with each other and be able to understand the material effectively, namely in the form of textbooks. The method stages carried out in this research are needs analysis, preparation of textbooks, expert validation, revision of textbooks, trials and giving questionnaires and evaluation. The results of the student response questionnaire revealed that 80% of students stated that they strongly agreed with the use of this Transformational Geometry textbook and the results of student understanding were good, so the textbook developed was valid, practical and effective.
Keyword: geogebra, transformation geometry

INTRODUCTION

The transformation geometry course is a mandatory course taken by fifth semester students in the Mathematics Education Study Program. This course is an important course for students, especially for prospective mathematics teachers in secondary schools. Transformation geometry courses study the basic concepts of geometric transformations, including translation, reflection, rotation, dilation, and composition of transformations with competency standards in the form of understanding transformations and their operations, collineation, isometry, shear, half rotation, reflection, rotation, shear reflection, and transformation. harmony, and being able to solve problems related to everyday life (Nurmaya et al., 2021). The transformation geometry course cannot be separated from the activity of deductively deriving concepts, theorems and algorithms, so more skills are needed so that students can understand this course easily (Afhami, 2022; Indah Maulani & Sylviana Zanthy, 2020). Therefore, the transformation geometry course requires teaching materials that suit the characteristics of students so that understanding the material is easier and more interesting.

Teaching materials that are well prepared will provide good understanding for readers. Textbooks are one of the teaching materials that can support learning activities, where the design of the teaching materials determines the interactions between learning components (Wahyuni et al., 2022; Yuliastuti & Soebagyo, 2021). Textbooks become teaching materials that can create good and effective learning. Good and effective learning is active, interactive, creative, educational and fun learning that contains a series of activities that achieve learning goals. Learning can be active and interactive when supported by the use of software that suits the characteristics of the course and students. The software that can be used is GeoGebra.

GeoGebra was developed by Markus Hohenwarter in 2001. GeoGebra is a computer program (software) for teaching mathematics, especially geometry and algebra (Ulfa Siregar et al., 2023). The GeoGebra program is very useful for teachers and students. Unlike commercial software which can usually only be used in schools, Geogebra can be installed on personal computers and used anytime and anywhere by students. For teachers, GeoGebra offers an effective opportunity to create interactive online learning environments that allow students to explore a variety of mathematical concepts (Suciati et al., 2022).

Based on the description above, the researcher wishes to conduct research related to the development of a GeoGebra-assisted transformation geometry textbook for students in the Mathematics Education study program at PGRI Adi Buana University, Surabaya.

METHOD

This research is a type of development research, namely research that develops a product, namely the GeoGebra-assisted Transformational Geometry Textbook for Students in the Mathematics Education Study Program at PGRI Adi Buana University, Surabaya, odd semester 2023/2024. This research is a development type research or Research and Development (R&D). The development model used in this research is the ADDIE development model, namely Analysis, Design, Development, Implementation, Evaluation which can be described as follows (Latip, 2022; Soesilo et al., 2020).
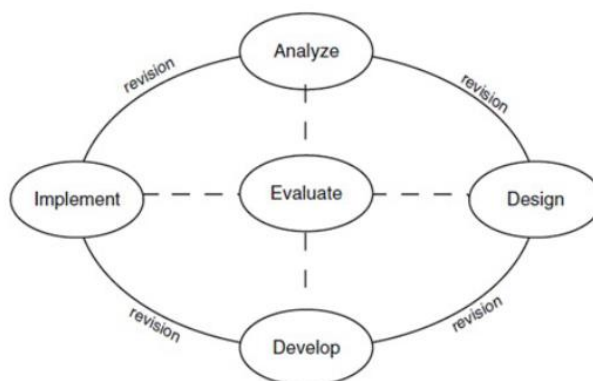
First, in the analysis stage there are three aspects that must be analyzed, namely including analysis of 1) student characteristics, 2) lectures, and 3) teaching materials. The second stage, the design stage, is designing a differential equations textbook and its application based on collaborative learning, designing textbook validation sheets and student response questionnaires. Third, the development stage, namely developing textbooks according to the chosen approach. The resulting product is called Draft 1. Fourth, the Implementation stage, namely textbook validation and prototype testing which will be explained as follows: (a) Validation. Draft I will be validated by experts, namely mathematics lecturers in the appropriate scientific field and language experts. From the results of the validation that has been carried out, Draft 1 will be revised and Draft 2 will be produced which is ready to be tested, (b) Trial. This Draft 2 trial was a limited trial conducted with 10 students in the Mathematics Education Study Program as subjects. From this trial, researchers received input, corrections and improvements to the textbook. Fifth, the evaluation stage, namely the results of expert validation and trials that have been carried out in the previous stage will be analyzed and revised so that a final textbook is obtained that is ready to be used in the classroom.

RESULT AND DISCUSSION

The activity steps that have been implemented can be explained as follows.

1. In the analysis stage, an analysis of the curriculum used by the mathematics education study program is carried out, analysis of student characteristics to determine student abilities, and analysis of teaching materials by collecting appropriate references and relevant material, then rearranging them systematically, according to the expected objectives.

2. Design stage. The results of this stage are still limited to selecting the format and initial design of the textbook to be developed.

3. Development stage. In this phase, a textbook began to be developed with the title "Geogebra-based transformation geometry textbook".

4. Validation stage, where the first validation has been carried out, several revisions have been obtained related to the content and mathematical language used.

5. Implementation. The textbook that has been developed will then be tested on a limited basis on 10 students which will be carried out on February 2 2024. This trial is intended to obtain data regarding readability tests, student responses, and suitability of the material to student

characteristics. In this limited trial, several questions were also given that were in accordance with the content of the textbook material, so that student response data was obtained after using the "Transformational Geometry" textbook that was developed. As for the results of the student response questionnaire, it was found that 80% of students stated that they strongly agreed with the use of this Transformational Geometry textbook and The effectiveness of teaching materials can be seen from the results of analysis of learning outcomes tests which show that the percentage of student learning completion is 85% and the percentage of incompleteness is 15%. So based on limited implementation, students agree that textbooks are widely used.

6. Evaluation stage. After the product has been tested on a limited basis, the weaknesses or shortcomings of the book the teaching will be known. If the results of student responses and the results of tests on student understanding of this product are good and interesting, then it can be concluded that the textbook has been completed, and the final draft of the Textbook "Transformation Geometry" can be obtained. However, if there are still deficiencies, the results of this trial will be used as material for improving and perfecting the textbooks being developed. After completing all stages, the textbook is ready to be used in class.

Result of the development of GeoGebra-based teaching materials can be seen in the following image
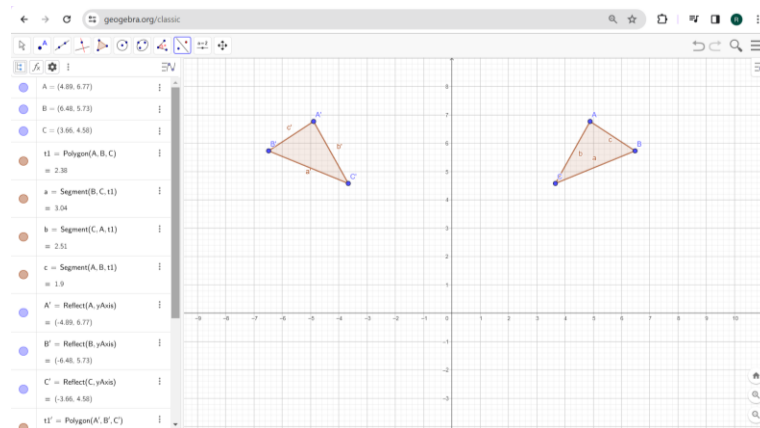

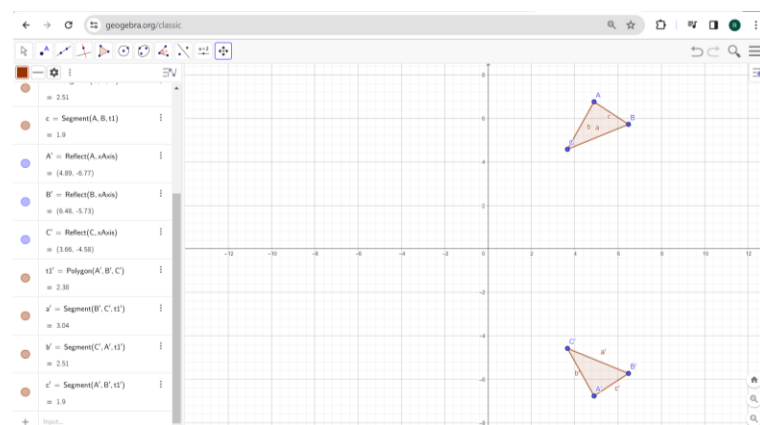Figure 1. Y-axis reflection
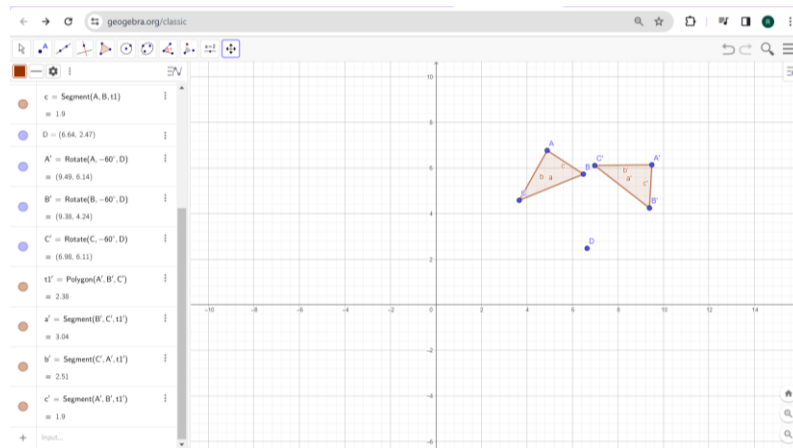

Figure 2. X-axis reflection
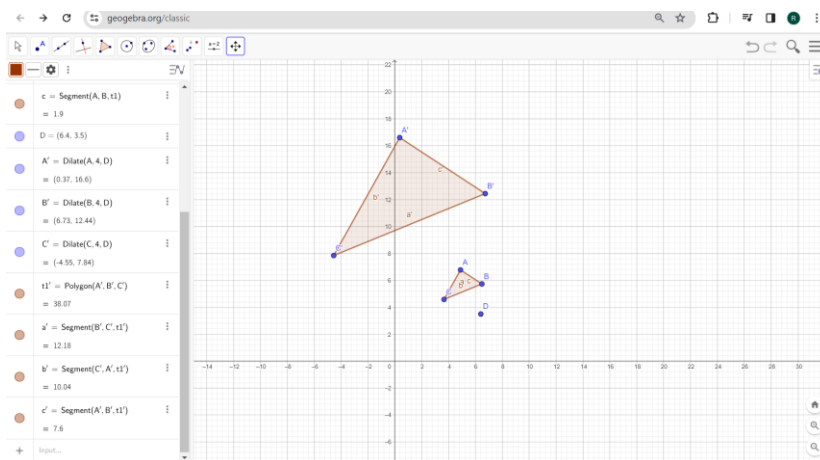
Figure 3. Rotation 60 degrees clockwise

Figure 4. Dilation with Scale Factor 4

GeoGebra software is one of the mathematical software that can be used in developing textbooks, one of which is material on geometric transformations.The development of GeoGebra software-based teaching materials applied to mathematics education students at Universitas PGRI Adi Buana Surabaya can increase understanding students' concepts and motivation in learning transformation geometry. These findings are in line with research what Suciati dkk (2022) did, namely that there is an internal influence GeoGebra assisted learning towards students' conceptual understanding. Besides that, according to (Suciati et al., 2022; Suhaifi et al., 2021; Ulfa Siregar et al., 2023; Wahyuni et al., 2022)use of software GeoGebra increases students' interest and performance in learning mathematics.

CONCLUSION

Development of a GeoGebra-based transformation geometry textbook with the ADDIE development model whose stages are analysis, design, development, implementation and evaluation. Based on the results of testing GeoGebra-based transformation geometry textbooks, student response questionnaires and concept understanding tests were obtained in the valid category. Valid textbooks are then applied in the learning process to see the practicality and effectiveness of the teaching materials. The teaching materials developed were stated to be practical by looking at the results of the questionnaire analysis, student responses were at a percentage of 80%. The effectiveness of teaching materials can be seen from the results of analysis of learning outcomes tests which show that the percentage of student learning completion is 85% and the percentage of incompleteness is 15%. Therefore, the textbooks developed are effective.

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