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Development of Digital Mathematics Teaching Materials Based on GeoGebra and Desmos to Measure Teachers' Creativity through a Promote Action Approach

Farit Dwi Ratnasari [1], Wiwin Sri Hidayati [2], Jauhara Dian Nurul Iffah [3]

[1] Universitas PGRI Jombang, Indonesia; fdwiratnasari@gmail.com
[2] Universitas PGRI Jombang, Indonesia; hidayati25.upjb@gmail.com
[3] Universitas PGRI Jombang, Indonesia; jauharadian.upjb@gmail.com

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Abstract

This study aims to develop digital mathematics teaching materials to measure teacher creativity. The study used the ADDIE development model. Respondents were teachers and students of grade XII of SMA Diponegoro and SMA Rijan Mojokerto. The research instruments included teaching material validation sheets, creativity observation sheets, teacher and student response questionnaires, interview guidelines, pre-tests, and post-tests. The results showed that the digital mathematics teaching materials met the criteria of being valid, practical, and effective. Validity was established by two validators, who scored 74 and 78, respectively. Practicality was demonstrated by the results of the analysis of teacher response questionnaires from the two schools, with percentages of 97% and 100%, and student response questionnaires, which yielded percentages of 85% and 87%, both falling within the very practical category. Effectiveness results were obtained by comparing the differences and increases in post-test scores with those from pre-tests. The test results at SMA Rijan showed an average increase of 19.28, and at SMA Diponegoro, 19.57. Meanwhile, the results of measuring teacher creativity, based on the analysis of teacher creativity observation sheets, yielded a score of 4, indicating a very good category. The results of this study show that the teaching materials developed can be used to measure teacher creativity.

Keywords

Digital, GeoGebra, and Desmos; Mathematics Teacher Creativity; Mathematics Teaching Materials

Corresponding Author
Wiwin Sri Hidayati
Universitas PGRI Jombang, Indonesia; hidayati25.upjb@gmail.com

1. INTRODUCTION

Minister of Education, Culture, Research, and Technology Regulation No. 12 of 2024 concerning the Independent Curriculum (*Kurikulum Merdeka*) is a flexible curriculum focused on essential materials to develop student competencies. Entering the 4.0 era, teachers are considering innovative use of technology in the learning process, utilizing various learning media sources (Budiono, 2020; Euis Shintawati, 2020; Fifit Firmadani, 2010). Learning resources are any materials containing information, whether intentionally designed or utilized, that provide experiences and training to support the learning process (Nurhayati, 2023). Learning resources can include teaching materials, books, non-book resources, and expert consultants. Teaching materials are the primary and essential learning resources

required in school learning, serving to enhance teacher effectiveness and improve student learning outcomes (Nurhayati, 2023). Improving student mathematics achievement requires specific teaching materials, in the form of learning media that can help students understand the material. Learning media can serve as valuable resources to enhance student learning achievement (Manurung, 2025). Learning media can be categorized into four types: print media, audio media, visual media, and a combination of all three (Manurung, 2025). Learning media can serve as a valuable learning resource to support improved student learning achievement (Andrianingsih & Mustika, 2022; Falloon, 2020). Learning media motivates students to learn because it provides visual aids that attract their attention.

Minister of Education and Culture Regulation Number 22 of 2016 encourages active, creative, and enjoyable learning. Therefore, innovation is needed in the mathematics learning process that is more contextual and involves technology in the learning process. The reality in the field shows that mathematics is often perceived as challenging to understand, which can impact the development of mathematics learning. Students learning mathematics frequently struggle with problems that require conceptual understanding. The lack of engaging and interactive learning media makes students quickly bored and find it difficult to understand the mathematics material. Mathematical skills are essential for everyday life; mathematical concepts are frequently used in problem-solving (Farida et al., 2019; Tampubolon et al., nd.). To overcome these problems, it is necessary to develop mathematics learning, both in planning classroom activities and in providing learning tools, such as demonstration media and teaching materials (Masliah et al., 2023). Learning difficulties are a common issue that can arise during the learning process. Learning difficulties refer to students' difficulties in receiving or absorbing lessons (Amallia & Unaenah, 2018). To address challenges in the learning process, digital teaching materials such as GeoGebra and Desmos are needed to support the learning process. Digital teaching materials can accommodate students' needs by utilizing various media types, including video, images, audio, and animation (Putri et al., 2022). Digital teaching materials will provide a more enjoyable way and make it easier for students to understand complex concepts (Prihatni et al., 2023). This digital model can improve assessment accuracy and provide helpful feedback for developing student learning outcomes (Hidayati et al., 2024).

GeoGebra functions as a drawing medium by allowing users to slide points or measure line segments and areas (Mulia, 2024). GeoGebra can connect variables with numbers, vectors, and points, find derivatives and integrate functions, and provide commands to find extreme points or roots (Mulia, 2024). Desmos is a web-based application that offers interactive mathematical tools, primarily a graphing calculator, to dynamically visualize mathematical concepts (Nisa et al., 2025). The use of GeoGebra and Desmos applications is expected to help improve student success in mathematics learning and facilitate a deeper understanding of the material. Therefore, these digital models can enhance assessment accuracy and provide valuable feedback for developing student learning outcomes (Hidayati et al., 2024). With the existence of an independent curriculum, students are expected to be active in the learning process in class. This can be achieved through Promote Action (PA), a series of teacher activities that encourage students to take action or exhibit behaviors to acquire new skills. The characteristic of this teacher-led PA is that it offers students opportunities, rather than requiring them to perform an activity. Thus, students construct new knowledge and skills through activities based on the teacher's offering (Iffah, 2021). The teacher's actions encourage students to be active and engage in their own learning (Iffah, 2016).

The existence of Promote Action (PA) in learning makes classroom conditions more engaging. One solution to overcome problems in the classroom is to implement a learning model that emphasizes student activeness and provides opportunities for them to develop their potential optimally. Problem-based learning is one model that is very effective in developing students' critical thinking skills (Hidayat Shil, 2025). Contextual learning, or learning that is relevant to the situation, problems in the surrounding environment, can motivate students to actively participate in finding solutions to authentic problems. In mathematics learning, the role of the teacher as an instructor is crucial in creating a learning process

that inspires student enthusiasm. This is because mathematics is a complex and abstract subject; therefore, in learning activities, teachers need to possess the necessary skills to convey the material to students.

Teacher creativity refers to a person's ability to create something new or develop existing ideas to provide knowledge to students in school (Humaidi Humaidi, 2020; Simangunsong et al., 2023). Teacher creativity in managing the class is essential because it will develop teacher success in overcoming student learning boredom (Tanjung & Namora, 2022). Creativity is essential in the teaching profession, particularly in the development of learning materials. Teachers can develop students' potential with valuable learning experiences (Sari, 2018; Shobrina Zulfatunnisa, 2022). This development research was conducted in response to the low level of teacher creativity in mathematics learning. Based on findings in schools, many teachers tend to use conventional, monotonous learning methods, such as lectures and practice exercises, without integrating contextual approaches or utilizing a variety of learning media. This results in students experiencing boring mathematics learning, a lack of interest in learning, and a shallow understanding of mathematical concepts. Teacher creativity plays a crucial role in developing diverse and context-specific learning strategies, methods, and media. Teachers with creativity can create a fun learning environment that meets students' needs.

Stated that soft skills are life skills and abilities, both related to oneself (intrapersonal) and in interacting with others in groups or society (interpersonal) (Hidayati et al., 2021). The development of a model for students' intrapersonal and interpersonal skills in mathematics learning can aid efforts to achieve comprehensive mathematics learning goals (Hidayati & Tristanti, 2024). According to Hidayati et al., soft skills can complement the strength of hard skills, thereby simultaneously enhancing the quality of a student's learning experience. Several aspects and indicators of soft skills, according to Hidayati et al., include verbal and nonverbal mathematical communication, critical thinking, creativity, stress management, problem-solving, collaboration, and time management. Teachers develop soft skills so they can provide examples to students. The quality and abilities of teachers are the most important aspects in student achievement and abilities. In this study, teachers' soft skill performance is measured in terms of creativity (Hidayati et al., 2022). Creativity, a key component of teachers' soft skills, is crucial for delivering learning innovations tailored to students' needs. Teacher creativity plays a crucial role in developing diverse and context-specific learning strategies, methods, and media. Creative teachers can create a fun learning environment tailored to students' needs. Through teacher creativity and the utilization of available learning methods and media, students become more engaged in learning and grasp mathematical concepts more easily. Creativity encourages teachers to think innovatively and fosters creative learning in the classroom. In line with research (Sari et al., 2023), training kindergarten teachers using GeoGebra-assisted animation learning media significantly increased their creativity. Found that fourth-grade teachers met the good criteria when it came to creativity using mathematics learning media (Rahmaniati et al., 2022). This aligns with research (Eriyanti et al., 2022)This suggests that creative teachers select problems to develop students' ability to identify learning issues and design learning steps that guide students' critical and creative thinking. According to Murdiana et al., teachers play a significant role in developing creativity, one of which is their ability to develop critical thinking skills. States that the creativity of fourth-grade teachers at Bara State Elementary School is in the high category in mathematics. Teachers demonstrate their creativity in assessing mathematics learning, for example, by assessing not only cognitive aspects but also affective and psychomotor aspects (Putri Dwiyanti1, Nurhaedah, 2023) (Fitri Nur Hasanah, Dhea Salwa Fadhylah, 2023). Proven that teacher creativity in designing LKPD plays an important role in creating a more interesting and compelling learning environment (Miftahul Hasanah, Dewi Sartika, Aryani Hasugian, 2024).

The novelty in this research, compared to previous studies, lies in the development of mathematics teaching materials packaged in digital form and utilizing the GeoGebra and Desmos applications to assess the creativity of mathematics teachers through a Promote Action approach. Therefore, with the rapid development of existing technology, teachers must be innovative in the mathematics learning

process and possess creativity as one of the essential soft skills to manage the class effectively and achieve learning objectives. Students must be able to understand the material thoroughly and actively participate in the learning process during class. The Promote Action approach is designed to offer students an opportunity, rather than requiring them to perform an activity, so that they can construct knowledge and skills. Therefore, it is important to develop digital mathematics teaching materials based on GeoGebra and Desmos to measure mathematics teachers' creativity on the topic of circles. This study aims to develop digital mathematics teaching materials based on GeoGebra and Desmos to measure teachers' creativity through a Promote Action approach.

2. METHODS

This type of research employs the development research method known as Research and Development (R&D). Research and development is a research approach used to produce new products or improve existing ones (Widiawati et al., 2022). The development model used in this research is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) (Waruwu, 2024). The ADDIE model is one of the most effective tools for producing products (Kharisma & Asman, 2018; Mahmudi, 2022). According to (Sundari & Siregar, 2023) The ADDIE development model is one of the most effective tools for producing a product because it is a complex framework. This research was conducted at Diponegoro High School and Rijan High School, involving research subjects that included teachers and grade 12 students.

The research instruments include: (1) Validation sheets to validate digital mathematics teaching materials based on GeoGebra and Desmos to measure teacher creativity through Promote Action. The validation sheet contains 20 aspects that are assessed, including the presentation of the cover page display, the suitability of the teaching material, the use of language, and the bibliography. The digital mathematics teaching material validation sheet is used to assess the validity of digital mathematics teaching materials. (2) Observation sheet and interview guide for the teacher's learning process to observe creativity and the use of teaching materials during learning. The observation sheet contains aspects of teachers' soft skills and creativity, as well as interview guidelines; it includes five items used by researchers in classroom learning observations. (3) Teacher and student response questionnaires to determine teacher responses to digital mathematics teaching materials based on GeoGebra and Desmos to measure teacher creativity through a Promote Action approach. Both teachers and students must complete seventeen statements. The teacher and student response questionnaire is used to determine the responses of teachers and students to the digital mathematics teaching materials that have been developed, as well as to assess the practicality of these materials. (4) Student learning outcome test sheet after implementing digital mathematics teaching materials based on GeoGebra and Desmos to measure teachers' creativity through a Promote Action approach. This test consists of two types: a pre-test administered before the use of digital mathematics teaching materials, and a post-test administered after the materials have been used. Each test question (pre-test and post-test) contains essay questions based on the GeoGebra and Desmos applications. The learning outcome test aims to assess the difference in learning outcomes, specifically whether the use of digital mathematics teaching materials has an effect. The validators in this study were a Mathematics Education lecturer who teaches the learning media course and a high school mathematics teacher.

The research process undertaken by the researcher is illustrated in Figure 1.

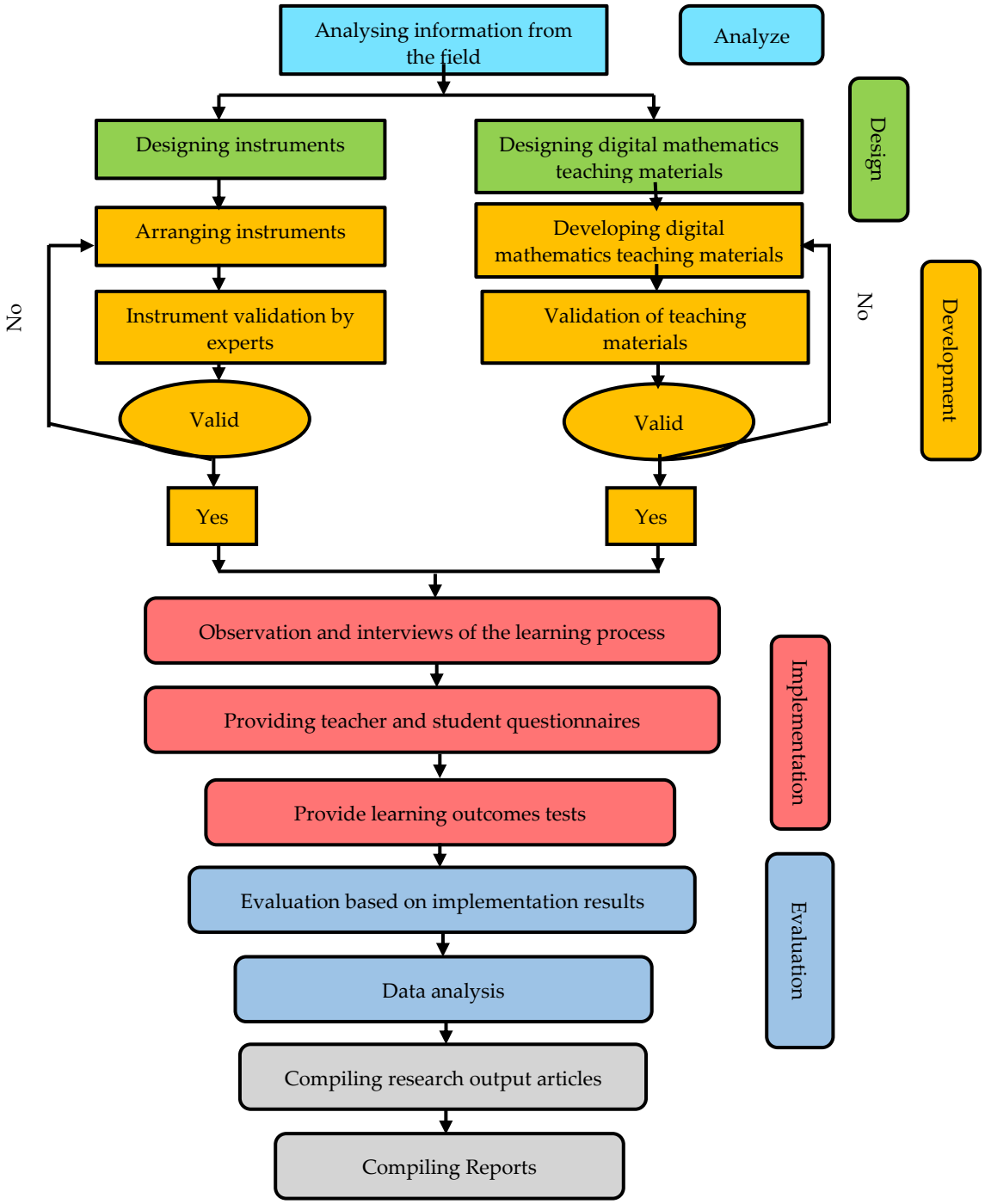

Figure 1. ADDIE Research Development Process

This study has established criteria for digital mathematics teaching materials based on GeoGebra and Desmos to measure teacher creativity through a Promote Action approach. These criteria include valid, practical, and effective aspects used to assess whether digital mathematics teaching materials can be categorized as successful and suitable for use in the learning process. The validity aspects of digital mathematics teaching materials are obtained from validation results by expert validators. A product is declared valid if it meets the validity criteria.

Table 1. Valid Criteria Classification

Criteria	Score
65 – 80	Valid
50 – 64	Quite Valid
35 – 49	Less Valid
20 – 34	Invalid

The practicality aspect was obtained from the results of teacher and student questionnaires. A product is considered practical if it meets the criteria of practicality. Practicality criteria are presented in Table 2.

Table 2. Classification of Practical Criteria

Score	Presentation	Criteria
56 – 68	80% - 100%	Very Practical
43 – 55	60% - 79%	Practical
30 – 42	40% - 59%	Less Practical
17 – 29	0% - 39%	Impractical

The effectiveness aspect is determined by the learning outcome test, specifically the pre-test and post-test. Pre-test and post-test results were analyzed using the t-test (paired) to determine whether the post-test score was significantly different from the pre-test score. This study asserts that digital mathematics teaching materials, based on GeoGebra and Desmos, can facilitate teacher creativity through an interactive, Promote Action approach. There are differences and improvements in student learning outcomes before and after the introduction of digital mathematics teaching materials. Digital mathematics teaching materials are considered effective if there are noticeable differences and improvements in student learning outcomes from the pre-test to the post-test.

The learning observation sheet used to measure teacher creativity is analyzed descriptively, drawing on references from Table 3.

Table 3. Classification of Teacher Creativity Observation Sheets

Score	Criteria
4	Very Good (VG)
3	Good (G)
2	Less (L)
1	Very Low (VL)

3. FINDINGS AND DISCUSSIONS

The results of this study indicate that digital mathematics teaching materials, based on GeoGebra and Desmos, can facilitate teacher creativity through a Promote Action approach. The developed materials meet the criteria of being valid, practical, and effective. The development of these digital mathematics teaching materials uses the *ADDIE* model (Analysis, Design, Development, Implementation, and Evaluation).

The analysis stage involves analyzing all the necessary information, which serves as the basis for digital mathematics teaching materials. This analysis promotes teacher creativity through an approach

that encourages action. Researchers conducted observations and interviews with high school mathematics teachers to ask what material was challenging to understand and what teaching materials were commonly used in learning. The results showed that the teaching materials used by teachers were still predominantly paper-based, students often struggled to understand the material, and the learning media employed were less innovative. Furthermore, researchers analyzed various teaching materials that were suitable for high school students, taking into account students' cognitive abilities, increasingly rapid technological developments, and the use of digital applications such as GeoGebra and Desmos, so researchers decided to use digital mathematics teaching materials using a flipbook that is appropriate to the students' conditions. The information obtained includes any problems that occur in schools related to mathematics teaching materials. It determines whether to develop digital mathematics teaching materials based on the Promote Action to measure the creativity of mathematics teachers.

Design stage, which involves designing the structure, searching for and collecting components, and creating an instrument to assess the feasibility of digital mathematics teaching materials. At this stage, the researcher designed a product, specifically digital mathematics teaching materials, based on the Promote Action framework. The research instruments include digital mathematics teaching material validation sheets, creativity aspect observation sheets for teachers' soft skills, and interview guidelines. Additionally, preparation of learning outcome test questions (pre-test and post-test) is conducted, utilizing GeoGebra and Desmos applications. First, the researcher designed digital mathematics teaching materials, which consisted of teaching materials, example questions, and practice questions. The purpose of providing practice questions is to strengthen students' understanding of the material on circles and, second, to design digital mathematics teaching materials using a flipbook application.

Development stage, namely developing digital mathematics teaching materials based on Promote Action, then validated by media and material experts. The steps taken by the researcher were: (1) the researcher developed digital mathematics teaching materials based on Promote Action, validation sheet, observation sheet, interview guide and student learning outcome test (2) researcher validated digital mathematics teaching materials using validation sheet, observation sheet validation, interview guide and learning outcome test to validator (3) revised teaching materials and other research instruments based on validation results. The initial step taken by the researcher in creating and developing digital mathematics teaching materials, specifically in utilizing circle materials for digital mathematics teaching. Next, the researcher created digital mathematics teaching materials comprising several components, including a cover, foreword, table of contents, learning objectives, concept maps, circle material, and example questions, utilizing GeoGebra and Desmos applications. The next part of the digital mathematics teaching materials is the material, namely, circles. Before proceeding to the material chapter, a concept map is provided to explain the flow of the material that will be studied. The digital mathematics teaching materials begin with an explanation of the circle material. The next part contains example questions about circles that contain GeoGebra and Desmos applications for solving them. The digital mathematics teaching materials are shown in Figure 2.

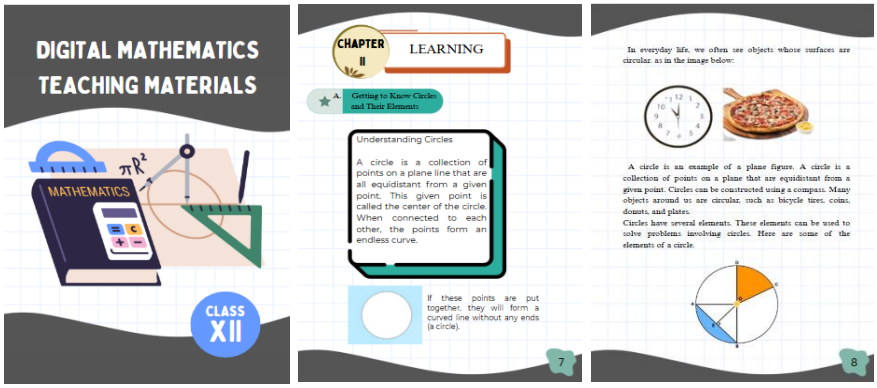

Figure 2. Digital Mathematics Teaching Materials

The following section contains example problems about circles that use GeoGebra and Desmos to solve them. The circle material, created using GeoGebra and Desmos, is shown in Figure 3

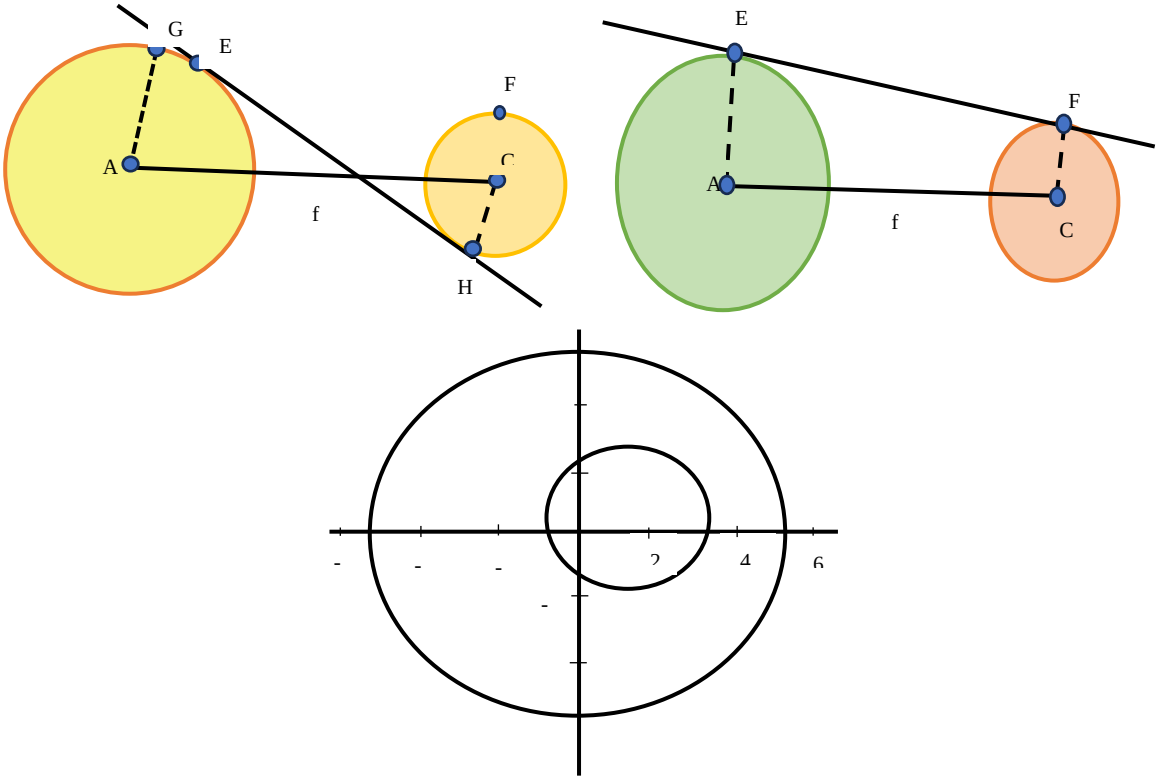

Figure 3. Learning Media with GeoGebra and Desmos.

The second step in the development phase is validation. The validation activity was conducted by researchers, who validated research instruments in the form of digital mathematics teaching materials, validation sheets, and observation sheets of teachers' soft skill creativity aspects, teacher and student response questionnaires, pre-test and post-test questions, and interview guidelines. Aspects assessed include the presentation of the cover page display, foreword, sub-chapter material, use of language, and bibliography. The validation of digital mathematics teaching materials was conducted by two validators: a lecturer from the learning media course and a high school mathematics teacher. The results of the validation of digital mathematics teaching materials by the expert validators are presented in Table 4.

Table 4. Validation Results of Digital Mathematics Teaching Materials by Validators

Validator	Score

Lecturer	74
Teacher	78

Based on Table 4. The first validator, a lecturer in the Learning Media course, assigned a score of 74 for the validation of the digital mathematics teaching materials. In contrast, the second validator, a mathematics teacher, assigned a score of 78 for the validation of the digital mathematics teaching materials. The validation results from both expert validators were within the valid criteria. This indicates that the digital mathematics teaching materials met the valid criteria and could be used. After the digital mathematics teaching materials were declared valid, they were implemented in grade XII at SMA Diponegoro and SMA Rijan. The learning activities are shown in Figure 4.

Figure 4. Classroom Teaching Activities (Diponegoro High School and Rijan High School)

The implementation phase was conducted at two schools: Diponegoro High School and Rijan High School. The subjects were a mathematics teacher and 12th-grade students. The mathematics teacher delivered the circle material to the students. The researcher acted as an observer and recorded everything on an observation sheet. After the learning process was completed, students were given a student response questionnaire to determine the practicality of the digital mathematics teaching materials.

The evaluation phase of this study aims to refine and improve the digital mathematics teaching materials and instruments as expected. Before the implementation phase, the researcher conducted several evaluations. First, the evaluation was conducted during the planning phase to refine the digital mathematics teaching materials, namely, completing the cover of the mathematics teaching materials related to the circle material and adding references to the bibliography. Second, after the researcher conducted evaluations during the planning and development phase, the researcher implemented GeoGebra and Desmos-based digital mathematics teaching materials to measure teacher creativity through a proactive approach in the learning process.

The practicality of digital mathematics teaching materials was analyzed based on the results of the teacher response questionnaire and the student response questionnaire. Based on the results of the Rijan High School teacher questionnaire analysis, a total score of 65 was obtained in the very practical category, indicating that 97% of the Rijan High School teachers considered the questionnaire practical. The results of the Diponegoro High School teacher questionnaire analysis obtained a total score of 68 in the very practical category. The percentage of the Diponegoro High School teacher questionnaire was 100%, meaning in the practical category. The results of the Rijan High School student response questionnaire yielded a percentage of 85%, with a very practical category, and the results of the Diponegoro High School student response questionnaire yielded a percentage of 87%, also with a very practical category. Based on the results of the teacher and student questionnaires, digital mathematics teaching materials were developed using GeoGebra and Desmos to measure teacher creativity through

a learning approach, Promote Action, and meet practical criteria for use.

Digital mathematics teaching materials were analyzed based on the results of the pre-test and post-test given to students. The test results at Rijan High School obtained an average pre-test score of 62.57, while the average post-test score was 81.85. Thus, the increase in the average pre-test and post-test scores of students was 19.28. While the test results at Diponegoro High School showed an average pre-test score of 64.28, the average post-test score was 83.85. Thus, the increase in the average pre-test and post-test scores of students was 19.57. Based on the t-test (paired) sig. (2-tailed) = 0.000, 0.05; then H0 is rejected and H1 is accepted, indicating a significant difference and an increase in student learning outcomes with digital mathematics teaching materials.

This study also measures teachers' soft skills in implementing digital mathematics teaching materials. In this study, the creativity aspect of teachers' soft skills was measured. The observation results of teachers' soft skills in the classroom are as follows: aspects of teacher creativity, (1) Developing varied learning methods, teachers in learning use problem-based learning methods, with problem-based learning, students are directly involved in problem solving and critical thinking, thus creating enjoyable learning for students. (2) Using innovative learning media, teachers increase the effectiveness of the learning process by using interactive learning resources, such as learning videos with circle material. (3) The use of GeoGebra and Desmos applications enables students to understand mathematical concepts, and students explore finding concepts using GeoGebra and Desmos. (4) Creating enjoyable and non-monotonous learning, in class, teachers can arouse students' curiosity, motivate students to be actively involved, and improve students' understanding of the circle material being taught. The results of the analysis of the mathematics teacher creativity observation sheet yielded a score of 100%, indicating a very good category. The study's results show that teacher creativity is positively correlated with student engagement in learning.

Discussion

Based on findings in schools, many teachers tend to use monotonous conventional learning methods, such as lectures and practice exercises, without integrating contextual approaches or using varied learning media. This results in boring mathematics lessons for students, a lack of student interest in learning, and a shallow understanding of mathematical concepts. This development research resulted in a product in the form of digital mathematics teaching materials, based on GeoGebra and Desmos, to measure creativity through a Promote Action proven, valid, practical, and effective approach. Statistical results showing that digital mathematics teaching materials achieved a first validator score of 74 and a second validator score of 78 are considered valid. The practicality of digital mathematics teaching materials, as indicated by the results of the Rijan High School teacher questionnaire analysis, yielded a total score of 65 and a percentage of 97% among Rijan High School teachers, suggesting that both are in the practical category. The results of the Diponegoro High School teacher questionnaire analysis yielded a total score of 68 and a percentage of 100% for Diponegoro High School teacher questionnaires, indicating both are in the very practical category. The results of the Rijan High School student response questionnaire obtained a percentage of 85% and Diponegoro High School obtained a percentage of 87%, meaning both are in the very practical category. Digital mathematics teaching materials were analyzed based on the results of the pre-test and post-test given to students. The test results at Rijan High School obtained an average pre-test score of 62.57, while the average post-test score was 81.85. Thus, there was an increase in the average pre-test and post-test scores of students by 19.28. Meanwhile, the test results at Diponegoro High School obtained an average pre-test score of 64.28, while the average post-test score was 83.85. Thus, there was an increase in the average pre-test and post-test scores of students by 19.57. Based on the t-test (paired) sig. value (2-tailed) = 0.000 < 0,05. This digital mathematics teaching material is presented in the form of a link connected to the internet. The digital mathematics teaching material is declared valid after fulfilling the completeness of the digital mathematics teaching material components, the suitability of the cover to the circle material, the presentation of the circle material, and the choice of words and language used in the digital mathematics teaching material. This aligns with

the learning objectives that will be achieved in the classroom. This development research produced a product in the form of digital mathematics teaching materials that are considered valid, practical, and effective. Additionally, the validation sheet for the digital mathematics teaching material was deemed valid by an expert validator. In line with the results of research by Luritawaty et al. (on the e-module GeoGebra-based PBL, which is suitable for use and can enhance the mathematical spatial abilities of junior high school students in the context of spatial structures.

The results of the teacher questionnaire analysis and the student questionnaire analysis fall into the very practical category. According to the Rijan High School teacher questionnaire, the total score is 65. The percentage of the Rijan High School teacher questionnaire is 97%, meaning that both are in the practical category. The results of the Diponegoro High School teacher questionnaire analysis show a total score of 68. The percentage of the Diponegoro High School teacher questionnaire is 100%, meaning that both are in the very practical category. The results of the Rijan High School student response questionnaire show a percentage of 85% and Diponegoro High School shows a percentage of 87%, meaning that both are in the very practical category.

Students responded very well to the digital mathematics teaching materials used by their teachers during learning. Students stated that the digital mathematics teaching materials had an attractive appearance, and the text and images, presented in the form of links, were easy to understand and clear. Students understood the digital mathematics teaching materials on the topic of circles better because, in addition to learning about circles, they also explored GeoGebra and Desmos applications as tools for working on problems related to the circle material. The results of the teacher questionnaire indicated that digital mathematics teaching materials with a practical category were very suitable for application in learning. Teachers found it easier to convey the material, and students were more active and interested in the concepts contained in the digital mathematics teaching materials. In line with the research results by Masliah et al., teaching materials in the form of LKPD, assisted by GeoGebra, were developed, which are practical and suitable for use as a mathematics learning medium. Based on the results of previous research, producing mathematics teaching materials using GeoGebra that are both valid and practical (Wahyuni et al., 2022).

Based on the results of the pre-test and post-test, it is evident that digital mathematics teaching materials on circle materials are effective in improving student learning outcomes and can be used to measure teacher creativity in learning. In line with previous research (Ariani el al., 2024), which stated that the development of learning media assisted by GeoGebra software on integer material is effective, and considering the results of developing learning media assisted by GeoGebra software on effective integer material. This aligns with the findings of (Luritawaty et al., 2025), who stated that developing a GeoGebra-based Problem-Based Learning module can improve students' mathematical spatial abilities and enhance student learning outcomes. Thus, the development of digital mathematics teaching materials can serve as an alternative learning resource to enhance students' learning abilities.

4. CONCLUSION

Based on the results and discussions presented, it can be concluded that the development of digital mathematics teaching materials using GeoGebra and Desmos through a Promote Action approach has been proven effective in supporting interactive learning processes and measuring teacher creativity. Teachers can foster creativity by utilizing GeoGebra and Desmos as learning tools, enabling students to participate in their own learning actively. Teacher creativity can create learning that is relevant to students' needs.

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