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The Development of Powtoon-Based Mathematics Learning Media Oriented Toward Learning Outcomes on Cartesian Coordinate Material for Grade VIII Students Junior High School

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Abstract: Mathematics is an essential subject, but some students face difficulties in learning due to the lack of engaging and innovative learning resources. However, using PowToon-based learning media in videos can be an effective alternative for distance education. This study aimed to develop PowToon-based mathematics learning media that would be valid, practical, and effective for the eighth-grade Cartesian coordinate material at SMP Negeri 13 Mataram, using the 4D research method (Define, Design, Development, Dissemination). The research resulted in an MP4 video about Cartesian Coordinate material that received a validity score of 0.82, which was considered highly valid by four validators. The product is also considered practical, with an 84.6% practicality score based on the responses of 24 students who used it for the Cartesian coordinate material. The media has proven highly effective, with a student completion rate of 83.33% during the test trial. Furthermore, the learning media is disseminated through YouTube for easy student access. Thus, PowToon-based learning media can be considered valid, practical, and effective for mathematics education.

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Introduction

Mathematics is a mandatory field of study for students, serving as a tool to enhance students' thinking abilities. Mathematics is also a tool for developing students' thinking abilities to bring about an impact or change in the learning process (Ratnasari, Tadjudin, Syazali, Mujib, & Andrian, 2018). Likewise, the learning outcomes serve as a reference for students' success in the learning process.

Learning outcomes are the abilities possessed by students after they have undergone the learning process (Sudjana, 2005). Students learning outcomes can be classified into three domains: (1) the cognitive domain (knowledge or involving linguistic and logical-mathematical intelligence), (2) the affective domain (attitudes and values or involving interpersonal and intrapersonal intelligence, in other words, emotional intelligence), and (3)

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the psychomotor domain (skills or involving kinesthetic intelligence, visual-spatial intelligence, and musical intelligence) (Nuryadi & Khuzaini, 2016). Mathematics learning outcomes serve as a benchmark for students' success in learning after experiencing the learning process. This research will focus on the cognitive domain.

In reality, some students still achieve low learning outcomes. Based on data obtained from the mathematics teachers at SMP Negeri 13 Mataram, according to the Final Student Assessment (PAS) for grade VIII-C, it is known that 3 students have scores above the predetermined Minimum Competency Standard (KKM), which is 75. Meanwhile, the remaining 29 students still have scores below the KKM. This indicates the low learning outcomes among students in mathematics education.

According to the distribution of a questionnaire analyzing the needs of randomly selected 22 eighth-grade students, 72.73% of the students stated that learning media are very important in assisting them in the learning process. Additionally, 50% of the students are highly motivated, while the remaining 50% are moderately motivated when using instructional videos (animations) during their learning activities. This demonstrates the significance of learning media for students, as it also motivates them throughout the learning process.

Based on interviews with the mathematics teachers at SMP Negeri 13 Mataram, in the learning process, they more frequently rely on traditional media such as textbooks, worksheets (LKS), simple teaching aids, and PowerPoint presentations. This is primarily due to the lack of facilities for creating technology-based instructional media. Specifically, in teaching Cartesian coordinates, there is a need for additional media beyond textbooks to make the learning process more engaging and capture students' interest. The instructional media provided by the school contains limited material, resulting in inefficiencies in time during the learning process. What is needed is engaging instructional media that assists teachers in delivering the material effectively, ultimately helping them save time during the teaching process.

Instructional media are tools that deliver educational content and stimulate students' thoughts, feelings, interests, and attention (Mashuri, 2019). One of the roles of instructional media is to serve as an intermediaries in the learning process. Furthermore, instructional media make teachers more creative and innovative in delivering content to learners. They also help students avoid becoming bored during the teaching and learning process (Ayu, Triwoelandari & Fahri, 2019). Media serves as a means that functions as an intermediary, useful for enhancing the effectiveness and efficiency of achieving learning objectives.

The abundance of technology-based media like PowerPoint, Google Classroom, and others still may not be adequate in terms of features. What is needed is media that incorporates both audio and moving visuals to engage students during the learning process. One technology-based instructional media that can be utilized is Powtoon. According to Awalia (2019), Powtoon is an application that offers advanced all-in-one screen features, allowing the creation of various animations tailored to the needs of learning. Nor (2021) suggests that Powtoon is an online service for creating presentations with captivating

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animation features, including hand-drawn animations, cartoons, lively transition effects, and user-friendly timeline settings. The Powtoon program can handle video and flash animations and operates more smoothly than other media.

Based on the issues previously presented, there is a need for the development of instructional media to assist teachers and students in facilitating the learning process. Therefore, the researcher is interested in conducting a study titled "Development of PowToon-Based Mathematics Learning Media Oriented Toward Learning Outcomes in Cartesian Coordinate Material for Grade VIII."

Research Method

The type of research used is the Research and Development (R&D) method. In research and development, several models can be employed by researchers. In this study, the 4-D research model is used, as proposed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel in their book "Instructional Development for Training Teachers of Exceptional Children" (1974). The 4-D research model consists of four stages: Define (definition), Design (design), Development, and Dissemination.

Figure 1. The 4D Stages

This research is conducted at SMP Negeri 13 Mataram. The subjects used in this study are eighth-grade students from class VIII-D at SMP Negeri 13 Mataram. The instructional media developed in this research must meet several criteria to ensure that it is valid, practical, and effective for use. First, the media must meet the validity criteria, as assessed by experts. To measure the validity of the mathematics learning media based on PowToon, Aiken's V index formula is used. The developed learning media is considered valid if it scores ≥ 0.61. Second, the practicality of the learning media is assessed based on students' responses to the media. Learning media is considered practical if it receives a percentage of $\geq 61\%$ with a practical category. Third, Powtoon learning media is deemed effective in this study if 80% of the students who take the test achieve scores above the passing grade, which is 75.

Result and Discussion

This development research resulted in a final product in the form of PowToon-based instructional media on Cartesian Coordinates for eighth-grade students, presented in MP4 video format. This instructional media is designed to assist eighth-grade students in learning Cartesian coordinate materials with ease. The development process of this instructional media utilized the 4D model (define, design, develop, disseminate).

Research Findings

In the development of instructional media, the 4D model (define, design, develop, disseminate) is used, consisting of four stages explained as follows:

1. Define (Definition Stage): In this stage, the researcher analyzes the challenges in the mathematics learning process in eighth grade at SMP Negeri 13 Mataram through

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observation and interviews. Questionnaires are also distributed to analyze students' needs, interests, and motivations in mathematics learning. Subsequently, a concept analysis is conducted to determine the content to be presented in the instructional media. The curriculum standards (KI and KD) related to the content to be developed are analyzed, and competency achievement indicators are defined based on these curriculum standards. Finally, learning objectives are determined based on the analysis of KI and KD.

2. Design (Design Stage): In this stage, the researcher selects the media, which is Powtoon. As described by Nor (2021), Powtoon is an online service for creating presentations with captivating animation features, including hand-drawn animations, cartoons, lively transition effects, and an easy-to-use timeline. Additionally, the researcher selects the format and creates a flowchart to facilitate the development process of instructional media.
3. Develop (Development Stage): In this stage, the instructional media is created according to the previously developed flowchart. Afterward, the media is validated by two media experts and the content is validated by two content experts. The results of the validation by media experts can be found in Table 3, and the results of the validation by content experts can be found in Table 4. After receiving feedback and recommendations from these expert validators, the researcher revises the media according to their input. Lastly, a limited trial is conducted. The results of these revisions can be seen in Figures 2 and 3.

Table 3: Results of Media Expert Validation

Aspects Assessed	**Validity Score**	**Criteria**
Display Design	0,83	Very Valid
Ease of Use Aspect	0,83	Veryy Valid
User Instruction	0,78	Valid
Average Validity Score	**0,82**	**Very Valid**

Based on the validation results provided by media experts and content experts, the average score obtained is 0.82, which falls under the "very valid" category. This indicates that the instructional media has been thoroughly validated and is considered highly valid for use in the teaching and learning process.

Table 4: Result of Content Expert Validation

Aspects Assessed	**Validity Score**	**Criteria**
Content	0,78	Valid
Learning Process	0,83	Very Valid
Assessment Aspect	0,83	Very Valid
Language	0,83	Very Valid
Average Validity Score	**0,82**	**Highly Valid**

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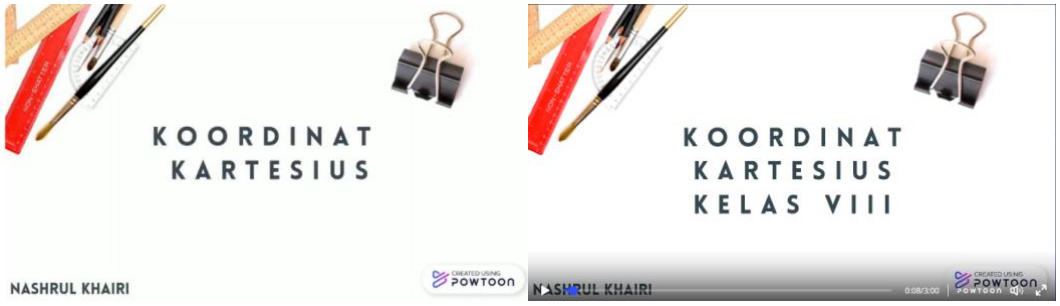

a b

Figure 2. a) Before and b) After Classroom Revisions

a b

Figure 3. a) Before and b) After Axis Label Revisions

After the validation stage, the practicality of the instructional media is assessed. According to Khofifah & Kamalia (2022), instructional media, in this case, Powtoon, is considered practical based on student responses. The practicality of the mathematics instructional media based on PowToon is determined through the results of the student response instrument administered during a limited trial to 24 eighth-grade students at SMP Negeri 13 Mataram. The practicality rating for the mathematics instructional media based on PowToon, based on student responses, is 84.6%, categorized as "very practical." This indicates that the media is highly practical for use in the classroom. The results of the practicality analysis can be seen in Table 5.

Following the assessment of the practicality of instructional media, a limited trial is conducted to evaluate the effectiveness of the mathematics instructional media based on Powtoon. The effectiveness of this media is assessed by evaluating students' learning outcomes through exercises and assessments after using the media in their learning process. This assessment involves 24 students who participated in the learning process. The effectiveness of the media is determined by analyzing the results of student performance after using the media, and the analysis results are presented in Table 6. Effectiveness is typically achieved in a class if ≥ 80% of the students score above the Minimum Competency Standard (KKM), which in this case is 75. Based on the calculations presented in Table 6, it is determined that 83.33% of the students achieved competence. Therefore, the mathematics instructional media based on Powtoon can be considered effective as the percentage of students who achieved competence exceeds the threshold at 83.33%.

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Table 5: Results of Media Practicality

Number of Students	Number of Indicators	Total Score	Maximum Total Score
24	15	1269	1500
Percentage of Practicality			**84,6%**
Practicality Criteria			**Very Practically**

Table 6: Results of Media Effectiveness Analysis

Number of Students	Mastery		KKM
	Complete	Not Complete	
24	20	4	75
Percentage of Mastery			**83,33%**
Effectiveness Criteria			**Effective**

4. Disseminate (Dissemination Stage): The instructional media that has been designed and developed will be presented to a wider audience of students and teachers through the popular platform, YouTube. The purpose of disseminating it through YouTube is to ensure that the instructional media is accessible to teachers and students from various locations. Sharing it online will enable teachers and students from diverse backgrounds to access and utilize it as an effective learning tool. YouTube, as a video-sharing platform, provides broad accessibility, allowing students and teachers to study mathematics learning materials based on Powtoon anytime and anywhere, according to their learning needs.

Discussion

The Powtoon-based instructional media for the Cartesian coordinate material in eighth grade at SMP Negeri 13 Mataram is one form of highly effective instructional media. It is available in MP4 format, making it very accessible and easy to use in the learning process. The use of Powtoon as a mathematics learning platform creates an interactive and engaging learning experience for students. According to Salsabila, Lu'luilmaknun, Novitasari, Tyaningsih, and Ardani (2020), this represents a new way of learning, integrating technology into education.

In the development of this instructional media, the researcher focused on creating a highly flexible and widely accessible learning tool. The resulting instructional media can be easily accessed through the YouTube platform, allowing users to access it anytime and anywhere according to their needs, as demonstrated in research conducted by Nuriyanti (2022), where the instructional media can be accessed online by students via YouTube. Various virtual media can be used to create online learning materials (Turmuzi & Hikmah, 2021). The ability to access learning materials online offers a significant advantage in terms of accessibility, enabling students or learners to study according to their schedules and preferences.

The Powtoon media will be validated by experts before being tested with students (Fardany & Dewi, 2020). After the validation stage, the PowToon animation media is improved based on the comments and suggestions from experts (Awalia et al., 2019). According to the validation results provided by media experts, the obtained score is 0.82, categorized as "very valid." The breakdown per aspect provided by the media expert is as follows: (1) The aspect of design appearance received a score of 0.83, categorized as "very valid." (2) The aspect of operational ease received a score of 0.83, categorized as "very

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valid," and (3) The aspect of usage instructions received a score of 0.78, categorized as "valid."

Meanwhile, the validation results for the content, provided by content experts, yielded a score of 0.82, categorized as "very valid." The breakdown per aspect provided by the content experts is as follows: (1) The content aspect received a score of 0.78, categorized as "valid." (2) The learning process aspect received a score of 0.83, categorized as "very valid." (3) The assessment aspect received a score of 0.83, categorized as "valid." (4) The language aspect received a score of 0.83, categorized as "very valid". The average score from the validation assessments of both media and content by experts is 0.82, categorized as "very valid." From the detailed validation assessments of media and content, it can be concluded that the Powtoon-based instructional media developed is valid and can be used for teaching mathematics, specifically in the Cartesian coordinate material.

According to Nasution (2018), a learning tool is considered practical when experts state that the instructional media design can be easily used in the learning process. Practicality is determined by examining student responses to the instructional media used (Nuriyanti et al., 2022). Practicality is assessed to understand how easy the instructional media is to use. After evaluating the validity of the developed instructional media, the practicality is assessed based on student response questionnaires. The analysis indicates that this Powtoon-based mathematics instructional media received a score of 84.6%, categorized as "very practical." This demonstrates that the developed instructional media is indeed practical and easy to use during the teaching and learning process for both teachers and students.

According to Anggraeni & Yuniarsih (2017), effectiveness can be defined as the degree of success in achieving a target or goal through the activities carried out. Learning outcomes refer to the abilities that students possess after going through the learning process (Sudjana, 2005). With the achievement of learning objectives and the predefined competency achievement indicators, the developed instructional media can be considered effective if the percentage of students who have successfully achieved the learning outcomes is at least 80% with a Minimum Competency Standard (KKM) set at 75. After calculating the percentage of student competence, the researcher found that the score achieved was 83.33%. This result indicates that the developed instructional media has reached an adequate level of effectiveness in supporting the learning process. In other words, a significant portion of students has successfully achieved the prescribed competence, and the instructional media has made a positive contribution to their learning outcomes. With these findings, it can be concluded that the instructional media developed is an effective tool in assisting students in achieving their learning objectives.

Learning videos are considered highly effective media, especially in the context of education (Khofifah & Kamalia, 2022). The presence of animated videos used as a tool in the school's learning process can optimize learning motivation for learners (Alannasir, 2016). Powtoon media can also be employed to enhance learning outcomes and student motivation (Putri, 2021). In the development of instructional media, the use of technology holds significant potential for improving various important aspects of the learning process. This includes ease of access, sharing, interactivity, and learner engagement. Learning videos are acknowledged as one of the most effective media in education. The utilization of animated videos in education can boost learner motivation, and the use of Powtoon media can also assist in improving learning outcomes and student motivation. Consequently, technology and

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instructional media have a crucial role in enhancing learners' comprehension and motivation in the school environment.

Conclusion

The Powtoon-based mathematics instructional media that has been developed received high evaluations from various parties. Media experts provided a score of 0.82, categorized as "very valid," while content experts also gave a validation score of 0.82, indicating "very valid" criteria. Overall, this Powtoon-based mathematics instructional media achieved an average validation score of 0.82, signifying "very valid" criteria. In terms of practicality, based on 24 student responses and 1 teacher, the Powtoon-based instructional media received a score of 84.6%, categorized as "very practical." In evaluating its effectiveness, the instructional media has proven to be successfully utilized, as evidenced by the level of student completion rates in tests. A total of 83.33% of students who took the test achieved passing scores, indicating that this media has been proven effective in supporting their learning.

Therefore, it can be concluded that the Powtoon-based mathematics instructional media that has been developed is a valid, practical, and effective tool for use in teaching Cartesian coordinate materials, as it meets the criteria for validity, practicality, and effectiveness.

Recommendation

Recommendations for future researchers in the development of Powtoon-based mathematics instructional media include conducting further research on the impact of Powtoon media in mathematics education, including comparisons with other teaching methods. Involving more subjects and user groups in research to gain a deeper understanding of the effectiveness of this media. Continuously monitoring developments in educational technology and evaluating whether this media remains relevant in the future. By following these suggestions, the use of Powtoon-based mathematics instructional media can become more effective and provide greater benefits to the student learning process.

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