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DEVELOPMENT OF ARTICULATE STORYLINE-BASED LEARNING MEDIA TO FACILITATE STUDENT SELF-REGULATED LEARNING IN SIMILARITY AND CONGRUENCE

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ABSTRACT This study emphasizes the importance of fostering self-regulated learning among students. The aim is to develop Articulate Storyline-based learning media on the topic of congruence that is both valid and practical for junior high school students. The development process follows the 4D framework: Define, Design, Develop, and Disseminate. The participants of this research were ninth-grade students at SMP Negeri 35 Pekanbaru. Data for this study were collected through literature reviews, design validation, and questionnaires using instruments such as validation questionnaires, self-regulated learning questionnaires, and student response questionnaires. The validity analysis results indicate that the learning media is highly valid, with an average score of 3.75. The practicality analysis from the large-group test shows that the media is highly practical, with an average score of 0.90. Additionally, the self-regulated learning score is 78.18%, categorized as good. Based on these results, the learning media is suitable for use, having fulfilled both validity and practicality requirements.

Keywords: articulate storyline, self regulated learning, similarity and congruence, learning media development

ABSTRAK Penelitian ini menekankan pentingnya pengembangan kemampuan belajar mandiri siswa. Tujuannya adalah untuk mengembangkan media pembelajaran berbasis Articulate Storyline pada topik kesebangunan yang valid dan praktis untuk siswa sekolah menengah pertama. Proses pengembangan mengikuti kerangka kerja 4D: Define (Pendefinisian), Design (Perancangan), Develop (Pengembangan), dan Disseminate (Penyebaran). Partisipan dalam penelitian ini adalah siswa kelas IX SMP Negeri 35 Pekanbaru. Data penelitian dikumpulkan melalui studi literatur, validasi desain, dan angket menggunakan instrumen seperti angket validasi, angket kemampuan belajar mandiri, dan angket respon siswa. Hasil analisis validitas menunjukkan bahwa media pembelajaran ini sangat valid dengan skor rata-rata 3,75. Analisis kepraktisan dari uji kelompok besar menunjukkan bahwa media ini sangat praktis dengan skor rata-rata 0,90. Selain itu, skor kemampuan belajar mandiri mencapai 78,18% yang termasuk dalam kategori baik.

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Berdasarkan hasil tersebut, media pembelajaran ini dinyatakan layak digunakan karena telah memenuhi kualifikasi validitas dan kepraktisan.

Keywords: articulate storyline, pembelajaran mandiri, kesebangunan dan kongruensi, pengembangan media pembelajaran

INTRODUCTION

Mathematics is a field of knowledge that serves as the foundation for technological advancements and the development of individual thinking skills. Given its essential role in life, mathematics is a compulsory subject taught in schools. From an early age, students need to master mathematical concepts, develop collaborative abilities, and cultivate critical, analytical, and creative thinking skills (Pratama, 2018). Poor concept mastery can affect several aspects of learning, one of which is self-regulated learning.

According to Schunk and Zimmerman (in Hendriana et al., 2017), self-regulated learning is a process influenced by one's own thoughts, feelings, strategies, and behaviors in achieving learning goals. Handoko (2013) states that students who possess self-regulated learning skills are able to analyze complex problems, work collaboratively or individually, and confidently express ideas formed during the learning process. Additionally, self-regulated learning helps students become more responsible and less dependent on others. Students with strong self-regulated learning skills develop confidence, process information more quickly, and better understand subject matter (Hendikawati et al., 2019). These students demonstrate responsibility by disciplining themselves to study, solving complex problems independently or in groups, confidently sharing ideas, and relying less on external assistance.

However, in many schools, students often exhibit low self-regulated learning skills. For example, during classroom activities, some students remain dependent on their teachers and fail to take initiative or utilize available learning resources effectively (Azizah, 2018). Syibli (2018) highlights that some students with low self-regulated learning skills lack initiative, rely on their friends' notes, and struggle to implement their learning plans.

From observations at SMPN 20 Pekanbaru, it was found that students' self-regulated learning was still low. When given an assignment, many students relied on their peers' answers, especially those they perceived as more capable. Additionally, when the teacher asked questions, students tended to remain silent, and when one of them was asked to respond, they answered hesitantly and without confidence. Similarly, interviews with a mathematics teacher at SMPN 35 Pekanbaru revealed that students rarely initiated responses to questions due to a lack of confidence in their answers. Furthermore, when completing assignments, many students relied on their peers for answers or waited for the teacher's explanation to solve challenging problems. Syaputrizal and Jannah (2019) corroborated these findings, reporting that

class XI physics teachers observed similar issues, such as students failing to complete assignments and showing little to no initiative in learning independently.

To foster self-regulated learning, there is a need for innovative learning approaches that support this process, such as the integration of learning media. Learning media plays a crucial role in enhancing students' self-regulated learning (Al Karimah et al., 2017). Mahayukti (2018) stated that the use of mathematics learning tools effectively promotes self-regulated learning among students. Similarly, Heriyati (2017) emphasized that learning media helps students grasp concepts more easily, motivates them to learn, and creates a more engaging classroom atmosphere. In other words, incorporating media into mathematics education can aid students in building self-regulated learning, as it creates an engaging and stimulating environment that facilitates understanding of subject matter concepts.

In accordance with Permendikbud No. 58 of 2014 Appendix III, learning media holds significant importance in the learning process for several reasons: 1) mathematical objects are abstract, requiring a concrete and visualized approach; 2) solving mathematical problems demands adherence to strict concepts, rules, and principles, making media a valuable tool to guide students in systematic mathematical thinking; 3) mathematical topics often lack real-world relevance, necessitating media to bridge the gap between abstract concepts and everyday applications; and 4) mathematics requires focused learning, and appropriate learning media can prevent boredom and captivate students' attention.

As technology advances, learning media have evolved into numerous variations, with many beginning to incorporate computer-based applications. Computer technology offers a wide range of tools to support the creation of learning media, one of which is Articulate Storyline. This software enables users to create and present information in diverse formats, including images, videos, text, animations, and audio, effectively facilitating interactive communication between teachers and students. Moreover, Articulate Storyline allows for the seamless conversion of presentations into mobile or computer applications, making it accessible for various platforms (Bentri, 2020). By leveraging Articulate Storyline, students can engage directly with assignments embedded in the media, fostering the development of self-regulated learning.

Several previous studies have explored the application of Articulate Storyline in educational contexts, including research by Pratama (2018) at Patra Dharma 2 Balikpapan Junior High School and Khusnah et al. (2020) in Jeneponto Junior High School. These studies highlight that Articulate Storyline-based learning media are systematically designed, encompassing elements from learning objectives to quiz questions. The positive impacts observed include the creation of a varied and enjoyable mathematics learning atmosphere, enhancement of student achievement, and facilitation of self-regulated learning. However, no prior research specifically examines the application of Articulate Storyline in teaching similarity and congruence at the junior high school level.

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Similarity and congruence are critical components of geometry in mathematics. According to Lestari et al. (2018), students often encounter several challenges with this material: 1) difficulty in transforming story problems into visual representations; 2) inability to relate the concepts of similarity and congruence to plane geometry; and 3) frequent errors in performing ratio and proportion calculations. To address these challenges, researchers propose the integration of learning media as a potential solution to assist students in mastering the concepts of similarity and congruence.

Observations at SMPN 20 Pekanbaru revealed the availability of computer laboratories and projectors that could support the use of learning media. However, teachers reported that these facilities are rarely utilized for instructional purposes. Similarly, observations at SMPN 35 Pekanbaru showed that the school was well-equipped with computer laboratories, Wi-Fi, and projectors, yet teachers cited time constraints as a reason for their limited use of learning media. For topics like similarity and congruence, instruction primarily relies on traditional methods such as writing on the blackboard and solving problems from worksheets and textbooks. Given these circumstances, the development of Articulate Storyline-assisted learning media is deemed necessary to enhance the self-regulated learning of junior high school students in the topic of similarity and congruence. Such media should be designed to be both valid and practical, ensuring its effectiveness in fostering students self-regulated learning.

METHODS

The 4D model served as the framework for this development research, encompassing four stages: define, design, develop, and disseminate (Thiagarajan et al., 1974). In the define stage, five analytical steps were undertaken: 1) preliminary and final analysis, 2) student analysis, 3) concept analysis, 4) task analysis, and 5) learning objectives analysis. These analyses aimed to identify key aspects of the learning material and the needs of students.

The design stage focused on creating the learning media based on the results of the define stage. The key steps included 1) preparation of instruments, 2) selection of media, 3) selection of formats, and 4) initial design development. The output of this stage was referred to as Prototype 1, which provided the initial version of the learning media for subsequent refinement.

The develop stage, as explained by Thiagarajan (in Endang, 2016), was essential for modifying the initial design to produce an effective and finalized version of the learning media. Although the initial design was completed in the design stage, the results were regarded as preliminary and required further improvement. This stage incorporated feedback through formative evaluation to enhance the learning media. Formative evaluation was guided by Tessmer's model (in Farihah, 2018), which outlines a sequence of stages: self-evaluation, expert reviews, one-to-one, small

group, and field testing. These stages are illustrated in Figure 1. Each step in the formative evaluation process aimed to identify and address weaknesses in the media, ensuring its practicality and validity. The final stage, disseminate, was focused on the packaging and distribution of the finalized learning media product for use by students and educators.

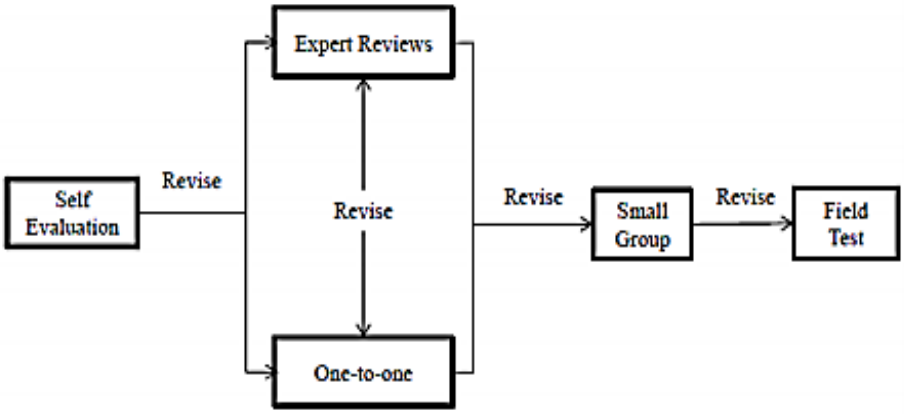

Figure 1. Tessmer's Formative Evaluation Design

In this study, qualitative data were gathered from feedback provided by validators and students regarding the developed learning media. Quantitative data, on the other hand, were numerical and derived from the validation assessments and student responses collected through the research instruments. The analysis of validation data was performed by calculating the total average of the validation scores, obtained from the comparison between the average score given by validators and the total number of validators involved. The validity levels of the media were categorized as follows: very valid ($3.25 \leq Mv < 4.00$), valid ($2.50 \leq Mv < 3.25$), less valid ($1.75 \leq Mv < 2.50$), and invalid ($1.00 \leq Mv < 1.75$). The learning media were considered valid if they achieved a minimum average score of 2.50 from the validators.

For the analysis of practicality data, the total average of student responses was calculated by comparing the average student response score to the total number of students. Practicality levels were categorized into four groups: very practical ($R \geq 0.8$), practical ($0.6 \leq R < 0.8$), less practical ($0.4 \leq R < 0.6$), and impractical ($R < 0.4$). Learning media were deemed practical if they attained a total average practicality score of at least 0.6.

The analysis of students' self-regulated learning data was conducted by calculating the percentage of self-regulated learning scores. This was achieved by dividing the total score of each aspect by the maximum possible score and multiplying the result by 100%. The self-regulated learning levels were categorized into five groups: very poor (0-20), poor (21-40), fair (41-60), good (61-80), and very good (81-100). Students were considered to have good self-regulated learning if their scores reached a

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minimum level of 61%. These criteria provided a structured framework for evaluating the validity, practicality, and self-regulated learning effectiveness of the developed media.

FINDING AND DISCUSSION

The learning media developed follows the steps in the 4D model, with the following explanations:

Define

The initial activity carried out in the define stage is the initial analysis to identify the fundamental problems encountered during the mathematics learning process. This was done through interviews, observations, and pre-research questionnaires. Based on interviews, it was found that teachers already have laptops or computers and can operate them. However, in teaching and learning activities, teachers predominantly use textbooks and student worksheets rather than incorporating learning media. This is attributed to time constraints and limited teacher creativity. While the use of textbooks and student worksheets is not inherently wrong, it often results in students being less independent and active in their learning process. Teachers also reported that students face difficulties in learning the material on similarity and congruence. Supporting this, pre-research questionnaires revealed that most students find it challenging to determine the appropriate formulas for solving problems related to similarity and congruence. Some students also indicated difficulty solving problems due to weak abstract thinking skills. This aligns with Fitriyani et al. (2000), who stated that similarity and congruence are challenging topics for students, as they tend to struggle when the material becomes more complex. Thus, there is a need for learning media that facilitates self-regulated learning in junior high school students by transforming abstract concepts into more concrete representations.

The second activity in the define stage is student analysis, aimed at understanding students' characteristics in the mathematics learning process. Information gathered from pre-research questionnaires showed the following: (1) all students have smartphones, and some students own laptops and can operate them proficiently; (2) students believe that learning media can promote independence in their learning process; (3) students expressed the need for learning media that provides clear explanations of material, examples, discussions, and visual illustrations. These findings align with Mahayukti (2018), who stated that mathematics learning media tools effectively enhance students' self-regulated learning.

Additionally, the concept analysis identified four main concepts to be taught: (1) equality of plane figures, (2) congruence of plane figures, (3) equality of triangles, and (4) congruence of triangles. These concepts were based on the 2018 revised edition of the 2013 curriculum mathematics book for the topic of equality and congruence. The task analysis then involved formulating learning objectives for the

competencies related to equality and congruence. The define stage concluded with an analysis of learning objectives derived from the concept and task analyses. Based on these results, the researchers designed learning media to be delivered in four meetings.

Design

During the design stage, several activities were carried out systematically. The first activity involved the preparation of instruments, which included validation sheets and student response questionnaires. These instruments were created to evaluate the quality and effectiveness of the learning media. The second activity focused on media selection, where the researchers chose to use the Articulate Storyline application. This software was selected due to its ability to produce outputs in various formats, such as HTML5, making it adaptable to different platforms. Additionally, the use of this media aligns with the characteristics of junior high school students, who are generally familiar with technology and are at the formal operational stage of cognitive development. The next activity, format selection, involved designing key elements of the learning media. These included the home page, which displays the title of the material, the class, the researcher's name, and a start button. The main menu featured four options: instructions, basic competencies, indicators of competency achievement, and material. The instructions section explained the function of each button in the media, while the basic competencies and indicators of competency achievement sections helped students understand the learning goals they were expected to achieve. The material section was divided into four sub-materials to present the content systematically, and the exit button was designed with a confirmation page to ensure users' intent to exit. The final activity in this stage was the creation of the initial design, which involved developing the learning media based on the planned structure and format. The appearance of the learning media's home page is depicted in Figure 2.

Figure 2. Display of the Learning Media Home Page

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The developed learning media is designed to facilitate students' self-regulated learning. The main menu of the learning media features key buttons, including instructions, basic competencies, learning objectives, and materials. Figure 3 illustrates the layout of the main menu page within the learning media.

Figure 3. Display of the Main Menu Page of Learning Media

The content section of the learning media provides materials designed to align with indicators of students' self-regulated learning. Figure 4 illustrates an example of the content display within the learning media.

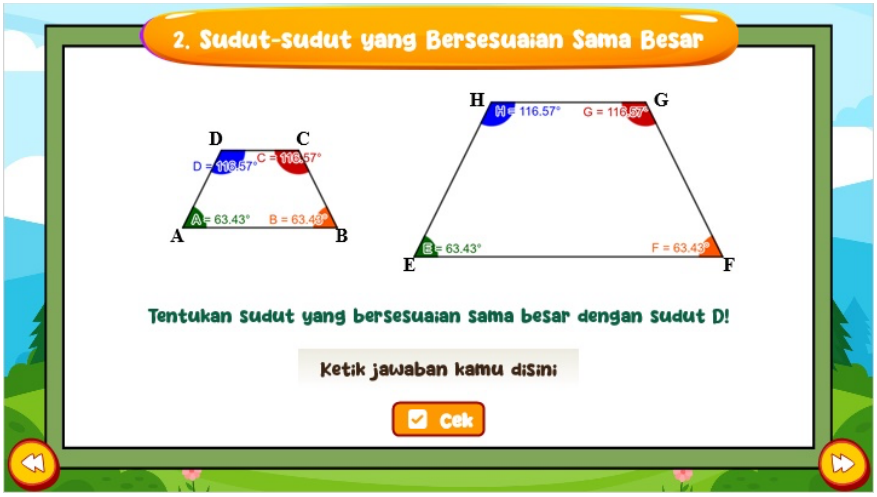

Figure 4. Example of the Content Display of Learning Media

Develop

After completing the initial design of the learning media, the next step involves modifications through formative evaluation to produce a final learning media that is both valid and practical. This process can be described in the following steps:

The self-evaluation stage involves reviewing the learning media internally before expert validation. Feedback from peers is also sought regarding content, language, design, and other aspects, which is then used as a foundation for revising the initial

product. The expert review stage is conducted by a team of two mathematics lecturers and one competent practitioner to assess the product's precision, accuracy, and overall quality. The feedback obtained from the experts plays a crucial role in refining the learning media to ensure it meets the required standards. The results of the validity analysis provided by all validators are illustrated in Figure 5.

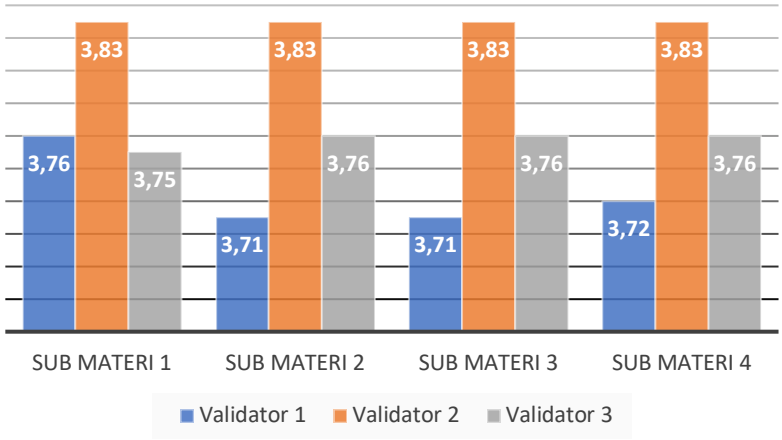

Figure 5. Results of Learning Media Validation

Based on the results of the validation sheet, the average validity score is 3.75, indicating that the learning media is classified as "very valid." This aligns with Sudijono (in Jalinus & Alim, 2018), who states that learning media is considered very valid when it achieves a score of more than 3.25. After conducting validation, the learning media is deemed suitable for trial with improvements.

One-to-one, conducted simultaneously with expert evaluation. The students' responses to the learning media indicate that the initial page of the learning media is engaging, the language used and the presentation of the material are clear and easy to understand, the images and example questions are very helpful for grasping the material, the choice of colors and image quality is good, and the instructions in the learning media are easy to comprehend. However, there are typing errors in the sub-materials and practice questions. From the student's comments, the product was improved in one-to-one sessions.

Revisions to the learning media were made based on feedback from validators and students to enhance its quality and effectiveness. The first revision involved placing the indicators of competency achievement at the beginning of each material instead of presenting them in the main menu. This adjustment helps students immediately understand the learning objectives for each section. The second revision focused on the material presentation, allowing students to explore and discover concepts independently, thereby encouraging active learning and deeper engagement. The third revision addressed the instructional media for learning by providing clearer feedback when students give incorrect answers, ensuring better understanding and avoiding misconceptions. Lastly, a typo in the exercise questions was identified

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during the one-on-one session with a student and was subsequently corrected to maintain the accuracy of the learning media. These revisions collectively improved the usability and effectiveness of the developed learning media.

A small group was conducted to assess the practicality level of the learning media. At this stage, the learning media is being tested on a small group, specifically 6 students from SMP Negeri 35 Pekanbaru who have varying levels of cognitive ability. Table 1 below presents the results of the small group test of the learning media for each aspect.

Table 1. Practicality Results (Small Group)

Assessment Aspect	Average	Category
Goal	0.89	Very practical
Content Material	0.96	Very practical
Display	0.94	Very practical
Average	0.93	Very practical

Through Table 1, it is known that the aspect of "objectives" received a low score of 0.89, while the aspect of "content" received a high score of 0.96. Referring to Sudijono (in Habibah et al., 2017), who stated that a product is considered very practical when it achieves a result of more than 0.8. Therefore, this learning media is considered very practical. The next step is to analyze the students self-regulated learning questionnaire data summarized in Table 2.

Tabel 2. The results of students' self regulated learning (Small Group)

Assessment Aspect	Average	Category
Responsible	83.34%	Very good
Initiative	85.90%	Very good
Self-confident	85.22%	Very good
Not relying on others	76.56%	Good
Able to make decisions	85.42%	Very good
Self-control	79.69%	Good
Average	82.69%	Very good

Based on the processing of student self-directed learning results, it is evident that the indicator "not depending on others" received the lowest average score of 76.56%, while the indicator "initiative" achieved the highest average score of 85.90%. The overall average score for student self-directed learning is 82.69%. Referring to Zamani & Nurcahyo (2016), which states that self-directed learning is categorized as very good if it exceeds 81%. Thus, the level of student self-directed learning falls into the Very Good category.

The Field Test or large group test is aimed at 25 students from SMP Negeri 35 Pekanbaru, which is useful for obtaining feedback on the learning media and

confirming the final results of the practicality of the learning media. The summary of the analysis of the student response questionnaire is included in Table 3.

Tabel 3. Practically Result (Field Test)

Assessment Aspect	Average	Category
Goal	0.90	Very practical
Content Material	0.89	Very practical
Display	0.92	Very practical
Average	0.90	Very practical

Based on Table 3, the learning media is categorized as very practical with a practicality score of 0.90, in accordance with Sudijono (in Habibah et al., 2017), who states that a product is categorized as very practical when it achieves a score of more than 0.8. The next step is to analyze the students self-regulated learning questionnaire data summarized in Table 4.

Based on the processing of students self-regulated learning results, it is evident that the indicator "not relying on others" received the lowest average score of 76.56%, while the indicator "initiative" received the highest average score of 85.90%. The overall average score for students self-regulated learning is 82.69%. Referring to Zamani & Nurcahyo (2016), who state that learning independence is categorized as very good if it exceeds 81%, it can be concluded that the level of students self-regulated learning falls into the Very Good category.

The Field Test or large group trial is aimed at 25 students from SMP Negeri 35 Pekanbaru, which is useful for obtaining feedback on the learning media and confirming the final results of the practicality of the learning media. The summary of the analysis of the student response questionnaire is included in Table 5.

Tabel 7. The results of students' self-regulated learning (field test)

Assessment Aspect	Average	Category
Responsible	79.00%	Good
Initiative	80.56%	Very Good
Self-confident	74.63%	Good
Not relying on others	75.00%	Good
Able to make decisions	79.92%	Good
Self-control	80.00%	Very Good
Average	78.18%	Good

Based on the students self-regulated learning questionnaire obtained from a large-scale trial, the learning media is categorized as good with a learning independence percentage of 78.18%, in accordance with Zamani & Nurcahyo (2016), which states that learning independence is categorized as good if it achieves a result of more than

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61%. Thus, a final product has been obtained because the developed learning media has met the qualifications of being valid and practical.

Next, the results of the research that has been conducted are discussed comprehensively. In the define stage, the activities carried out include initial and final analysis, student analysis, concept analysis, task analysis, and learning objective analysis. The results obtained at this stage are based on interviews with teachers and the distribution of pre-research questionnaires to students at SMP Negeri 20 Pekanbaru and SMP Negeri 35 Pekanbaru. From the results of the activity, students' learning independence is still considered low. This is in line with the opinion of Maria and Yuli (2019) that the low learning independence of students is caused by a lack of self-confidence, leading them to still rely on others. Another issue that the researchers found is that in the teaching process, teachers still use lecture methods and more often rely on textbooks and worksheets, and have never utilized learning media. Thus, the researchers are seeking solutions to the problem by developing learning media to facilitate students' independent learning. This is in line with Mahayukti (2018) research, which states that the effective use of mathematical learning media can enhance students' learning independence.Then the researcher organized the learning outcomes based on the core competencies to determine the learning objectives according to the 2013 curriculum. From the learning outcomes, the researcher identified four meetings in the learning process using learning media. The researcher also developed a concept map in accordance with the material based on the core competencies.

In the design stage, it begins with the preparation of instruments used to assess the validity and practicality of the produced learning media. Next, the researcher chose the media to be used, which is the Articulate Storyline application. The researcher selected the Articulate Storyline application because it can be published in HTML5. This is in line with the characteristics of students, stating that learning media can assist students in independent learning and can be used outside of formal education. This aligns with research conducted by Armi et al. (2022), which concluded that Articulate Storyline-based learning media can facilitate independent learning very effectively, achieving a score of 84.33%. The next stage is the selection of the developed format. Then, the initial design was created.

The next stage is the development stage, in which the researcher conducts formative evaluation and improvements. In the self-evaluation, the researcher assesses the learning media that has been developed and seeks suggestions from colleagues, covering aspects such as content, language, design of the learning media, appearance of the learning media, and other elements related to the improvement of the learning media. After the self-evaluation, the learning media is consulted with the supervising lecturer. Then the researchers conducted expert reviews and subsequently had one-on-one sessions with three students.

In expert reviews, it was found that the learning media is very valid with a validity score of 3.75, in accordance with Sudijono (in Jalinus and Jessi, 2018), who states that learning media is categorized as very valid if it achieves a score of more than 3.25. In the one-to-one feedback, students responded to the learning media by saying that the homepage of the learning media is attractive, the material in the learning media is clear and easy to understand, the language used is easy to comprehend, and the color selection and image quality are good. There are some typos in the subtopic of triangle similarity and in exercise 1 on triangle similarity. From the suggestions received by the researcher during the one-to-one sessions, the researcher considered those suggestions and made improvements

After prototype I is declared valid, it is referred to as prototype II and is deemed suitable for the next trial, which is the small group test. A small group was conducted with 6 students of varying skill levels. (rendah, sedang, dan tinggi). Based on the student response questionnaire in the small group, the learning media is categorized as very practical with a practicality score of 0.93, in accordance with Sudijono (as cited in Ami Habibah et al., 2017), which states that it is categorized as very practical if it achieves a result of more than 0.8. Additionally, based on the students self-regulated learning questionnaire in the small group, the learning media is categorized as very good with a learning independence percentage of 82.69%, in line with Zamani and Nurcahyo (2016), which states that learning independence is categorized as very good if it achieves a result of more than 81%.

Next is the large group test, at this stage the researcher conducts socialization of the learning media through distribution, referred to as the large group trial. Based on the student response questionnaire in the large group, the learning media is categorized as very practical with a practicality score of 0.90, in accordance with Sudijono (in Ami Habibah et al., 2017), which states that it is categorized as very practical if it achieves a result of more than 0.8.

The researchers also provided a questionnaire on students' learning independence. Based on the students' learning independence questionnaire during the large group trial, the learning media was categorized as good, with a percentage of learning independence at 78.18%. This aligns with Zamani and Nurcahyo (2016), who state that learning independence is categorized as good if it achieves a result of more than 61%.

At the stage of disseminating learning media, it is packaged in the form of a user instruction sheet that contains the installation procedures for the learning media via computer or smartphone, which is then widely distributed to teachers and students.

Disseminate

The activity carried out is packaging and distributing the final product to teachers and students by sharing a learning media link.

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CONCLUSIONS AND RECOMMENDATIONS

Based on the findings, the Articulate Storyline-based learning media for the topic of similarity and congruence, developed using the 4D model, has proven to be valid and practical for junior high school students. The research highlights the importance of fostering self-regulated learning among students, which was measured through the learning independence questionnaire, yielding a good category score of 78.18%. This indicates that the developed media not only meets the criteria for validity and practicality but also supports students in becoming more independent learners.

The integration of interactive features and clear explanations in the media aligns with the objective of enhancing students' self-regulated learning capabilities. Students are encouraged to explore concepts independently, set their own learning goals, and reflect on their understanding, which is crucial for building their confidence and autonomy in learning mathematics. Future researchers are advised to further expand the development of similar learning media to cover additional mathematical topics and incorporate elements that explicitly support other aspects of self-regulated learning.

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