Development of articulate storyline-based interactive learning media on arithmetic sequences and series

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Abstract:

Research in learning media development is driven by the common problem of student disengagement, which hinders their understanding of the material. The specific problem addressed in this research is students' lack of attention and comprehension while studying arithmetic sequences and series. The purpose of this study is to document the process and outcomes of developing interactive learning media using Articulate Storyline specifically for the material on sequences and arithmetic series. The research follows the Research and Development (R&D) approach, employing the Thiagarajan model (Model 4-D) consisting of four stages: 1) the definition stage (define), 2) the design stage (design), 3) the development stage (development), and 4) the dissemination stage (disseminate). The research was conducted with a sample of 31 students from class X B at SMA Tunas Luhur. The results of the media validity test showed a score of 4.82, indicating high validity. Furthermore, the practicality and effectiveness tests conducted with both small and large groups achieved a perfect score of 100% in all aspects. This research indicates that the interactive learning media for arithmetic sequences and series based on Articulate Storyline meet the criteria of validity, practicality, and effectiveness.

Keywords: Arithmetic Sequence, Arithmetic Series, Articulate Storyline, Learning Media

Introduction

Mathematics learning is a dynamic process that encompasses the acquisition of mathematical knowledge, skills, and problem-solving abilities. By actively engaging with mathematical concepts, students foster a profound comprehension of mathematical principles and their practical applications in the real world. They learn to analyze problems, apply appropriate strategies, and communicate their mathematical thinking

effectively (Tong et al., 2021). Mathematics learning promotes critical thinking, logical reasoning, and abstract reasoning skills. It encourages students to explore mathematical patterns, make connections between different mathematical ideas, and develop a solid foundation for further mathematical study. Moreover, mathematics learning fosters the development of quantitative and analytical skills, which are essential in various academic disciplines and real-life situations. By actively engaging in mathematical activities, students enhance their mathematical proficiency and cultivate valuable skills that contribute to their overall cognitive development and problem-solving abilities. Mathematics learning is an evolving process that is increasingly intertwined with technology. Incorporating technology in mathematics education has brought about a paradigm shift in how students interact with mathematical concepts and employ problem-solving strategies. Technology provides tools and resources that enhance the teaching and learning experience.

Today's technology can be utilized in all kinds of ways, one of which is in the world of education. Technology in education proves beneficial in addressing learning challenges holistically, as it allows for the observation and analysis of interconnected conditions as both a process and a product (Raja & Nagasubramani, 2018). One of the problems in learning mathematics in real life can be based on the technology used in learning media. The utilization of mathematics learning media is able to bring up new experiences and can encourage students to solve problems in mathematics. Based on this premise, technology holds the potential for a positive impact in the realm of education as it enables the creation of interactive learning materials.

Media serves as a powerful tool for conveying messages in various activities (Silaški & Đurović, 2019). Specifically, learning media encompass graphical, photographic, and electronic elements that facilitate the transmission of information through written content, images, videos, and audio (Sumantri & Rachmadtullah, 2016). However, the utilization of interactive learning media in the Indonesian educational context remains relatively low. One significant barrier to its widespread adoption is the limited technological proficiency among teachers, hindering their ability to effectively incorporate interactive learning media into the teaching and learning process.

Learning media can utilize various kinds of software, one of which is Articulate Storyline. Based on an explanation on the Articulate Storyline website, its founder, Adam Schwartz, was founded in 2002 with the vision and mission to make learning easier by designing as attractively as possible using the features of Articulate Storyline (Flannery Quinn & Parker, 2016). Articulate Storyline has various features, including images, audio, video, characters, a timeline, survey questions, quizzes, screen recorders, transitions, and animations. Learning media created through Articulate Storyline without using programming languages or scripts can be published offline or online. The results of published learning media can be displayed without installing Articulate Storyline on a PC or laptop first.

Learning arithmetic sequences and series often poses challenges for students. The abstract concepts and complex patterns are difficult for them to comprehend. Conventional teaching methods that rely on formula memorization tend to result in shallow understanding. Interactive learning with an articulate storyline can provide an effective solution. Students can actively engage with and explore arithmetic sequences and series by utilizing interactive media and simulations, enhancing their conceptual understanding. Choosing arithmetic sequences and series as the focus of interactive learning is justified because these concepts are fundamental and have practical

applications. Interactive learning enables students to develop problem-solving skills, critical thinking abilities, and a deeper conceptual understanding. Through this approach, the challenges in learning arithmetic sequences and series can be more effectively addressed, strengthening students' comprehension and improving their success in mathematics.

Arithmetic sequences and series are important topics within high school mathematics. However, many students face challenges in understanding word problems related to arithmetic sequences and series, leading to errors in the calculation process and, ultimately, incorrect answers (Nur et al., 2018). A sequence is a collection of numbers arranged based on a specific pattern, while an arithmetic series represents the sum of the terms within an arithmetic sequence (Sinaga et al., 2014). In the development of Articulate Storyline-based learning media, the material concerning arithmetic sequences and series will be utilized as the foundation for creating engaging and interactive educational content.

This research includes research and development (R&D) to develop Articulate Storyline-based learning media. This study aimed to investigate the results of both the process and feasibility testing of learning media developed using Articulate Storyline. The novelty of the research is the development of learning media using Articulate Storyline, which is published in html5 form. Learning media contains learning achievements and learning objectives, materials, exercises and discussions of questions, and links to test questions. The test questions use a live worksheet in the form of Minimum Competency Assessment (MCA) questions such as multiple choice, drag and drop, true or false, matching drop-down, fill in the blank, and join with arrows.

Previous research on developing Articulate Storyline-based learning media has yielded promising results. For example, a study by Pratama (2018) exemplified the validity, practicality, and effectiveness of such learning media. Similarly, Mareta (2019) also conducted research that produced valid, practical, and effective Articulate Storyline-based learning materials. These findings serve as a strong foundation for the current research, which aims to provide valuable insights and serve as a reference for developing similar learning media. Moreover, this research seeks to enhance teachers' knowledge and understanding of effective learning media by showcasing the potential and benefits of Articulate Storyline. By building upon the findings of previous studies, this research contributes to the advancement of instructional design and promotes the adoption of innovative and interactive approaches in educational settings; some relevant studies can be found (Ariani, 2020; Hadza et al., 2020; Istyadji et al., 2022; Jubaerudin et al., 2021; Nasution & Darwis, 2021; Nissa et al., 2021; Nugroho & Arrosyad, 2020; Rianto, 2020; Saadah et al., 2022; Yolanda et al., 2022).

Tunas Luhur High School is a school that will be used as a research location. The results of the interviews with the Tunas Luhur High School math teacher indicated that the facilities they had were adequate for developing and using learning media at the school. Still, the math teachers only used them occasionally and in the form of test questions. Learning media that have been used in class are Classpoint and Quizizz. Based on the results of these interviews, it can be concluded that the problem at Tunas Luhur High School is the occasional use of learning media, even though there are adequate facilities. Learning that tends to be monotonous makes it difficult for students to understand the learning material. Research on the development of learning media is expected to solve existing problems.

Research Methods

This research is included in Research and Development (R&D) or development research. The model used in this study is the Thiagarajan Model (Model 4-D), which consists of four stages, namely: 1) the definition stage (define), 2) the design stage (design), 3) the development stage (development), and 4) the dissemination stage (Nugroho & Arrosyad, 2020). The subjects in this study were students of class X B Tunas Luhur high school for the 2022/2023 academic year, a total of 31 students. This research develops interactive learning media products based on Articulate Storyline. The materials used are arithmetic sequences and series.

Articulate Storyline-based interactive learning media offers a powerful platform for engaging and effective educational experiences. With its user-friendly interface and robust features, Articulate Storyline enables the creation of interactive content that promotes active learning and enhances student engagement. By integrating multimedia elements such as videos, quizzes, and simulations, learners can actively engage in learning and gain a more profound comprehension of the subject matter. The interactive nature of this media encourages problem-solving, critical thinking, and decision-making skills. Furthermore, the capability to monitor and evaluate learners' progress offers valuable insights for both students and instructors. Interactive learning media based on Articulate Storyline empowers educators to deliver dynamic and immersive learning experiences, promoting student-centered and impactful instruction.

This research produces interactive learning media products with the help of Articulate Storyline software, then these products are tested for validity, practicality, and effectiveness. The validity test is to see whether the learning media is valid in terms of material, questions, language, and format before testing it on students. The practicality test is to see whether learning media are practical based on student response questionnaires, and then the results obtained are calculated and classified based on the percentage of student response data categories. The effectiveness test is to see whether the learning media is effective based on increasing the results from the pre-test to the post-test.
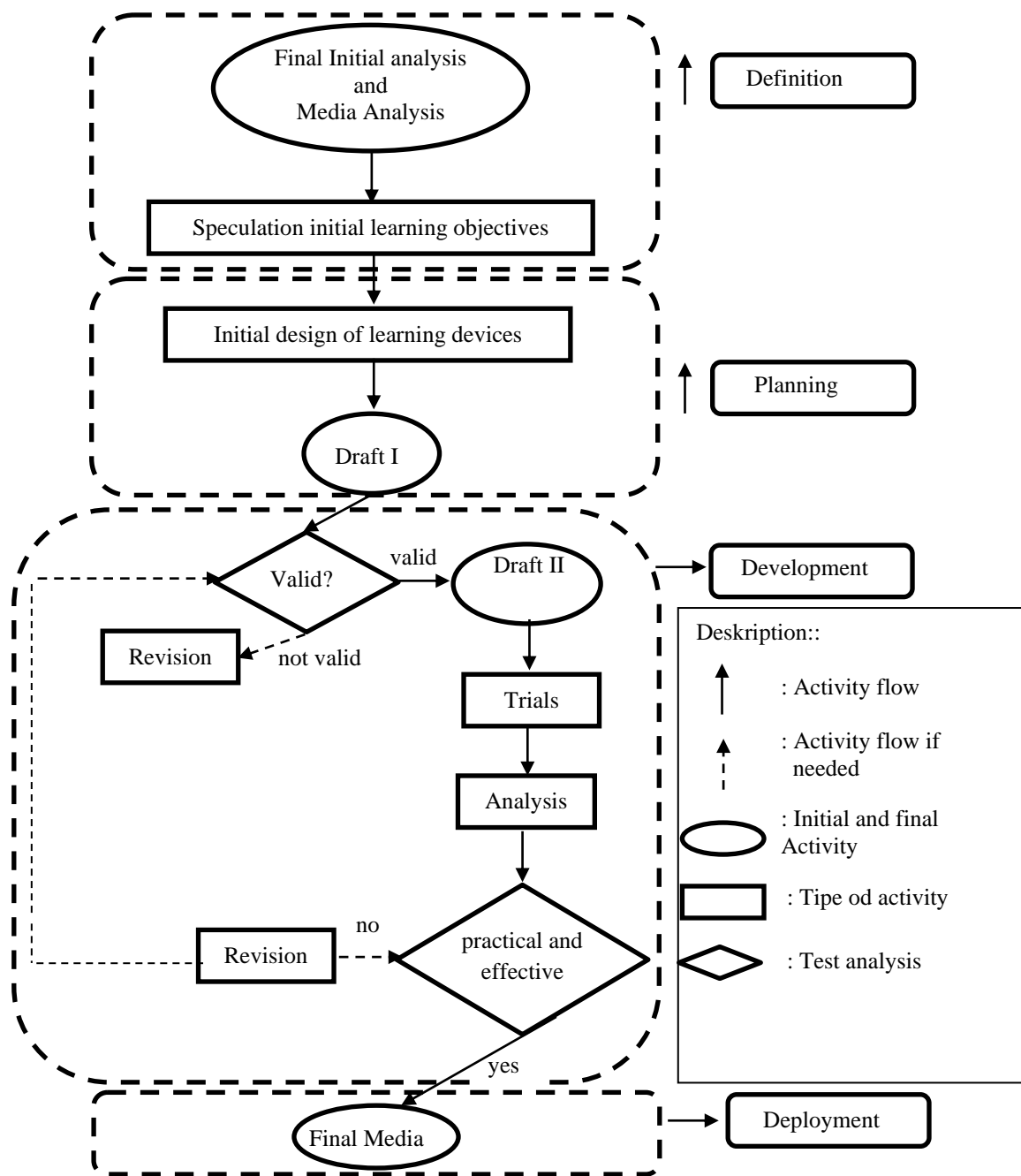
Picture 1. Modified Thiagarajan (4D) Development Model

The steps for developing the Thiagarajan model in development research are:
Define

At this stage, pre-analysis was carried out in the form of validating teacher interviews, student interviews, and Lesson plans. The pre-analysis process that has been completed will then be followed by an initial-end analysis and media analysis, as well as the specification of the initial learning objectives.

Initial-end analysis and media analysis

At this stage, interviews with teachers, interviews with students, literature reviews, and making lesson plans are carried out. The media analysis stage aims to ascertain the necessity of learning media for the material under study and whether similar media exist. The created learning media will be tailored based on the initial and final analyses, encompassing characteristics, context, material sources or concepts, and academic skills relevant to the learning material. Specification of learning objectives

Specifying learning objectives involves ensuring the inclusion of learning achievement indicators based on the analysis outcomes.

Design
a. The selection of media serves to select the media to display learning material.
b. The choice of format determines the design of content, characters, and others in learning media.
c. The initial design of the media includes the overall design that must be done before the trial. The initial media design was draft I, validation sheets, student response questionnaires, and learning achievement tests. The basis for preparing these test questions is the media analysis contained in the specification of learning objectives. The test questions will be in the form of a pre-test and a post-test.

Development
a. Validation by three validators, including experts in Mathematics Education, Educational Technology, and subject teachers

The design of the learning media (draft I) was validated in order to create quality learning media. Validation is carried out by expert validators in the fields of media, materials, and mathematics teachers who can provide constructive suggestions for learning media. Suggestions and input from the validator are used to revise the learning media in Draft I to produce valid media in Draft II.
b. Trials

Learning media that reached the second draft stage were subsequently tested through small and large-group trials. Three representatives from class X A Tunas Luhur High School participated in the small group trial. X B Tunas Luhur High School students actively participated in the large group trial. The learning media tested contained competencies, materials, practice questions, and test questions. Test questions will be given before and after using learning media. The results of the test questions will serve as a metric to evaluate the effectiveness of the learning media. Student response questionnaire sheets are used to determine the practicality of learning media. Suggestions regarding learning media during small group trials will be revised, and then large group trials will be carried out.

Disseminate

This stage is carried out when you have obtained valid, practical, and effective results from the learning media that have been tested.

The research instruments needed in the development of this media, namely: 1) interview guide sheets to see or remind again regarding the questions to be asked, 2) validation sheets to find out the results of the learning media feasibility test, 3) student response questionnaires to find out students' responses regarding the learning media used, 4) learning achievement tests to determine whether or not students have achieved

understanding of the material using interactive learning media based on Articulate Storyline.

The data analysis methods used in this study were: 1) validity data analysis to see the validity of instruments and media carried out by Three validators, including experts in Mathematics Education, Educational Technology, and subject teachers, have been involved in evaluating the material and media used in this study. These validators possess extensive expertise in their respective fields, ensuring a comprehensive assessment of both the content and instructional technology aspects of the learning materials: 2) analysis of student response data to see the practicality of learning media; and 3) analysis of learning outcomes test data to see the effectiveness of learning media.

Table 1. Instrument Validity Level Category

Range V_a	Validity Level Category
$Va = 5$	Very valid
$4 \leq Va < 5$	Valid
$3 \leq Va < 4$	Quite valid
$2 \leq Va < 3$	Less valid
$1 \leq Va < 2$	Not valid

Source: (Hobri, 2021b)

Table 2. Category Percentage of Student Response Data

P(100%)	Category Percentage of Student Response Data
$P > 95\%$	Very Good
$80\% < P \leq 95\%$	Good
$65\% < P \leq 80\%$	Pretty Good
$50\% < P \leq 65\%$	Not Good
$P \leq 50\%$	Very Not Good

Source: (Murtikusuma et al., 2019)

The development of interactive learning media based on Articulate Storylines on material for arithmetic sequences and series is said to be effective if test results increase before and after using learning media by at least 70% of the number of students (Liliyan et al., 2021).

Result and Discussions

The results of this study are used to determine whether the utilization of articulate storyline-based learning media is effective, valid, and practical for the learning process of X B-grade students at Tunas Luhur Senior High School. This study's data include interactive learning media created with Articulate Storyline, validation data, pre-test and post-test scores, and student response questionnaire data.

At the defining stage, pre-analysis was carried out in the form of validating teacher interviews, student interviews, and lesson plans. Based on the validation results of teacher interviews, the average score for the content aspect with seven indicators was

5.00, and for the language aspect with three indicators, it was 4.89. The total average of the two aspects is 4.95 in a valid category. Based on the validation results of the student interviews, the average score for the content aspect with seven indicators was 4.95, for the language aspect with three indicators, it was 5.00. The total average of the two aspects is 4.98 in a valid category. Based on the validation results of the lesson plan, the average score for the content aspect with seven indicators was 4.86; for the language aspect with two indicators, it was 5.00; and for the format aspect with four indicators, it was 5.00. The total average of the three aspects is 4.95 in a valid category.

After the pre-analysis was followed by the research steps, namely the initial and final analysis and media analysis, and the specification of the initial learning objectives, in the final initial analysis step, interviews, literature review, and making a Lesson Plan were carried out. Structured interviews were conducted with Mr. Moh. Hariyadi S.Si, the subject teacher for class X at Tunas Luhur Senior High School, and two students from class X B at Tunas Luhur Senior High School. The results of teacher interviews showed that students had difficulty differentiating between Un, Sn, a, and b and using formulas. Learning media is used when there is time left at the end of the material and is only in practice questions packaged in online forms such as Classpoint and Quizizz. Interactive learning media based on Articulate Storylines has never been used at Tunas Luhur Senior High School. The available facilities are sufficient for producing and implementing learning media, including computer laboratories, individual laptops on every desk, LCD projectors, Wi-Fi connectivity, and air conditioning. The results of interviews with two students of class X B at Tunas Luhur Senior High School showed that students were happy when learning was done outside the classroom and was not focused on books, so students got lots of new experiences. Learning media in class is also rare, especially when learning media are used only for practicing questions and not for deepening the material so that students do not understand the material and are less active in learning.

The curriculum used at Tunas Luhur Senior High School, especially in class X, is the independent curriculum. The lesson plan uses the latest teaching module for class X, namely in phase E. The design of the lesson plan is prepared by adjusting the school format and the independent curriculum teaching modules. Lesson plan, which is arranged sequentially starting from the school logo and identity, general information on teaching materials, initial competencies, Pancasila student profiles, facilities and infrastructure, student targets and a number of students, learning achievements and learning objectives, learning activities, assessments, and the principal's signature and compiler.

A literature review is useful for adding references in developing Articulate Storyline-based Learning Media for sequences and arithmetic series for class X B SMA Tunas Luhur semester 1 in the 2022-2023 academic year. References from various relevant sources include the Ministry of Education and Culture's books, (Hobri, 2021a; Oktaviana, 2020; Saniriati, 2020).

In the media analysis step, the teacher interviews showed that this interactive learning media based on Articulate Storyline had never been used. The materials used are arithmetic sequences and series. The created learning media is expected to help students understand and solve problems involving arithmetic sequences and series. Learning media can be accessed online in html5 format using a laptop/PC without installing Articulate Storyline software.

In the specification phase, the initial learning objectives are established based on the findings of the initial and final analysis and the media analysis. The results obtained are then used to develop learning objectives in accordance with the applicable learning outcomes (LO). Learning Outcomes (LO) are adapted to the independent curriculum, especially in class X/phase E namely, "At the end of phase E, students can generalize the properties of numbers with exponential powers (including exponential numbers). They can apply arithmetic and geometric sequences and series, including problems involving single and compound interest.

The design stage determines the media selection, format, initial design, and test questions. In the media selection stage, Articulate Storyline software is used to develop learning media by utilizing the features available in the software. SpongeBob text type was added to match the SpongeBob theme. In the format selection stage, the learning media format is determined as the overall visual presentation of the media students use during the learning process. The developed learning media is able to help and guide students in understanding the material and solving contextual problems. The initial design step was used to develop research instruments such as validation sheets, student response questionnaires, and test sheets (pre-test and post-test). The instrument will be evaluated based on the aspect criteria and indicators developed, resulting in Draft I. Draft I will then be validated by the validator, producing several revisions. The revisions will be carried out to obtain valid results and produce Draft II. The test questions consist of 5 MCA (Minimum Competency Assessment) questions, including multiple-choice, connecting with arrows, true or false, drag and drop, and drop-down. Test questions (pre-test and post-test) are done individually through a live worksheet with a time limit of 30 minutes.

At the development stage, the results of Draft I are then validated by the validator to produce draft II, which is ready for testing. Interactive learning media based on Articulate Storyline are designed according to needs, based on learning outcomes, learning objectives, and attractiveness. In the beginning, there is a login section where you enter your username and school origin. After successfully logging in, it will proceed to the home screen. The home display comprises four menus: competencies, learning materials, practice questions, and quizzes. The competency display contains learning outcomes and learning objectives. The material display consists of three menus: number patterns, arithmetic sequences, and arithmetic series. In the exercise display, the questions contain five questions in the form of MCA and their discussion. The quiz view contains instructions and a quiz link that will go to the live worksheet.
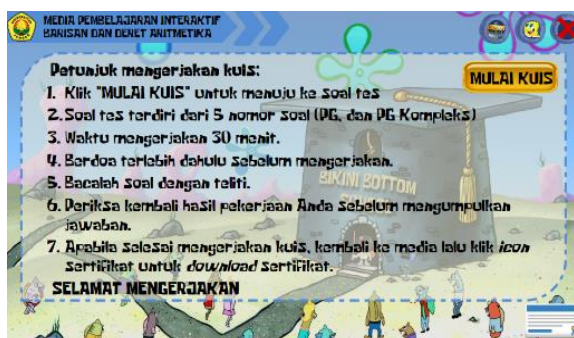

Picture 2. Home Display

Picture 3. Material Display

The home page can be seen in Picture 2. The competency display contains learning achievements and learning objectives. The material display consists of 3 menu items: number patterns, arithmetic sequences, and arithmetic series. The material display can be seen in Picture 3. The exercise display contains five questions in the form of MCA and their explanations.

Picture 4. Practice questions Display

Picture 5. Quiz Display

The exercise display can be seen in Picture 4. The quiz display contains instructions and a quiz link that leads to the live worksheet. The quiz display can be seen in Figure 5. This interactive learning media is created to facilitate students in understanding the concepts of number patterns and arithmetic sequences.

Validation ensures that the research instrument produces valid results and is suitable for testing. Revisions are made when the learning media do not meet the excellent score and when receiving suggestions from the validator so that the media can be said to be valid and feasible to test. The revisions made were to clarify the appearance of the arithmetic series material.

Picture 6. Display of Arithmetic Sequence Material Before Revision and After Revision

Picture 6 shows the display before revision and after revision. The improvements made include: 1) Clarifying the display in the number pattern material, 2) Clarifying the display in the arithmetic sequence material, 3) Clarifying the display in the arithmetic series material, and 4) Clarifying the "START" button in the exercise section.

Based on the results of media validation, the average score was obtained for the material aspect and questions with four indicators of 4.92, for the language aspect with two indicators of 4.83, and for the format aspect with six indicators of 4.72. The total average of the three aspects is 4.82 with a valid category. Learning media is said to be

valid if it gets a score $4 \leq V_a \leq 5$, dan sangat valid apabila mendapatkan skor $V_a = 5$ (Hobri, 2021b).

Learning media can be considered valid if they fulfill three aspects: material and question, language, and format. Based on the results of the media validation, the average score for the material aspect and questions with four indicators was 4.92; for the language aspect with two indicators, it was 4.83; and for the format aspect with six indicators, it was 4.72. The total average of the three aspects is 4.82 with a valid category. Validation of test items: Based on the results of the validation of test items, the average score was obtained for the aspect of the instructions for the test item with one indicator of 5.00, for the aspect of the test item with three indicators of 4.78, and for the aspect of language with four indicators of 5.00. The total average of the three aspects is 4.93 with a valid category.

There are three aspects to validating student response questionnaires: questionnaire filling instructions, aspects of student response questionnaires, and aspects of language (Wahyuni et al., 2020). Based on the results of the validation of the student response questionnaire, the average value was obtained for the aspect of instructions for filling out the student response questionnaire with one indicator of 5.00, for the aspect of the student response questionnaire with two indicators of 5.00, and in the language aspect with four indicators of 4.92. With a valid category, the total average of the three aspects is 4.97.

Small group trials were carried out after obtaining validation results from the validator. The small group trial was conducted offline on October 5 and 6, 2022. The small group trial was conducted with three students randomly selected as subjects who came from a different class from the significant group trial subjects. Based on the learning achievement test data analysis, the developed learning media can be deemed effective as it has resulted in a 100% increase in scores. Based on the analysis of student response questionnaire data, the learning media developed can be said to be practical because it gets a maximum score of 5 with a percentage of 100%.

Large group trials were conducted after obtaining effective and practical results from small group trials. Large group trials were conducted offline on October 12 and 13, 2022, using interactive learning media based on Articulate Storyline and the live worksheet website for test questions and questionnaires. Based on data from the results of the large group trial, 31 students in class X B SMA Tunas Luhur experienced an increase in scores with a percentage of 100%. Based on the learning achievement test data analysis, the developed learning media can be considered effective as it has shown a 100% increase in scores. Based on the calculation of the student response data analysis, it was found that the student response chose a score of "5" for each indicator of 100%. Learning media can be said to be practical because they get a 100% response rate based on student response questionnaires.

The dissemination stage is to disseminate learning media that have been revised and tested for feasibility. The dissemination of interactive learning media based on Articulate Storyline is carried out to individuals and groups through offline distribution to Tunas Luhur High School mathematics teachers and online distribution via social media such as WhatsApp and Instagram by including the Google Drive link as follows: https://bit.ly/BARISTAICA.

Development of interactive learning media based on Articulate Storyline using the Thiagarajan model (4-D model). The Thiagarajan model comprises four stages: 1) define, 2) design, 3) develop, and 4) disseminate. This development has strengthened the

results of previous research conducted by Nugraheni (2018), which found that developing learning media using Articulate Storyline can help increase student motivation. In line with research conducted by Pratama (2018), the development of learning media using Articulate Storylines can help students understand the material. According to Saniriati (2020), learning media are appropriate if they fulfill three categories: valid, practical, and effective. This category is obtained after conducting trials on learning media. Based on this opinion, it can be concluded that the developed learning media is tested based on its level of validity, practicality, and effectiveness.

The validity of the developed learning media was obtained through the validation conducted by the validator. According to Tanjung and Nababan (2018), there are three aspects: content, language, and format. Based on the validation that has been carried out, the average score on material and content aspects is 4.92, the average score on language aspects is 4.83, and the score on the format aspect is 4.72, so the total average is obtained (V_a) of 4.82 with a valid category. This is in accordance with Table 1, where interactive learning media based on Articulate Storylines on material sequences and arithmetic series have obtained valid categories at intervals $4 \leq V_a \leq 5$. The media validation results can be seen in Table 3.

Table 3. The Media Validation Results

No.	Aspect	A_i
1.	Material and Question	4.92
2.	Language	4.83
3.	Format	4.72

The validity of the test questions was obtained through the validation conducted by the validator. Each indicator has a maximum score of 5. Based on the validation carried out, it obtained an average score on the instructions aspect of the test questions of 5.00, an average score on the aspects of the test questions of 4.78, and a score on the language aspect of 5.00. so that the total average is obtained (V_a) of 4.93 with a valid category. This is in accordance with Table 1, which shows that the test item instrument has obtained a valid category at intervals $4 \leq V_a \leq 5$. The results of the validation of the test questions can be seen in Table 4.

Table 4. The results of the validation of the test questions

No.	Aspect	A_i
1.	Test Question Instructions	5.00
2.	test questions	4.78
3.	Language	5.00

The validity of the student response questionnaire was obtained through the validation conducted by the validator. Each indicator has a maximum score of 5. Based on the validation carried out, it obtained an average score of on the instructions aspect of the test questions of 5.00, an average score on the aspects of the test questions of 5.00, and a score on the language aspect of 4.92. So, the total average is obtained (V_a) of 4.97 with a valid category. This is in accordance with Table 1 that the student response

questionnaire instrument has obtained a valid category at intervals $4 \leq V_a \leq 5$. The results of validating student response questionnaires can be seen in Table 5.

Table 5. The validation results of the Student Response Questionnaire

No.	Aspect	A_i
1.	Questionnaire Filling Instructions	5.00
2.	Response Questionnaire	5.00
3.	Language	4.92

The practicality of the developed learning media was obtained from the score of the student response questionnaire. The student response questionnaire instrument consists of eight indicators, with a maximum score of 5 for each indicator. In the small group test, the average score obtained for each indicator was 5.00, resulting in an average total P of 5.00 with a percentage of 100%. In the large group test, the average score obtained for each indicator is 5.00, so that the total average is obtained P of 5.00 with a percentage of 100%. This is in accordance with Table 2 that the student response questionnaire instrument has received a very good category at the interval $P > 95\%$. These results are in line with research conducted by Murtikusuma et al. (2019), which found that instructional media can be said to be practical if the student response questionnaire is in the "good" or "very good" category. Based on this, it can be concluded that interactive learning media based on Articulate Storylines for arithmetic sequences and series material can be said to be practical because they can provide learning motivation, make it easier for students to understand the material, and help them understand the concept of arithmetic sequences and series. The results of the student response questionnaire can be seen in Table 6.

Table 6. The results of the student response questionnaire

No.	Criteria	Average	Percentage
1.	I find it easy to operate this learning media	5.00	100%
2.	I feel happy when learning arithmetic sequences and series using this learning media	5.00	100%
3.	I can understand the material for arithmetic sequences and series after using this learning media	5.00	100%
4.	I can repeat any part of the subject matter I want	5.00	100%
5.	I can solve problems involving arithmetic sequences and series after using this learning media	5.00	100%
6.	I am interested in learning how to use this learning media	5.00	100%
7.	I can understand the language used in this learning media	5.00	100%
8.	I feel motivated to learn mathematics after using this learning media	5.00	100%

The effectiveness of the developed learning media is determined by the scores obtained on the test questions. Before and after using learning media, test questions are administered. Based on the research that has been done, it was found that the percentage of students in the small group trial, namely, three class X A representatives of Tunas Luhur High School, experienced an increase in pre-test and post-test scores with a percentage of 100%. Based on the research that was conducted on class X B Tunas Luhur High School students, it was found that the percentage of students in the large group tryout was four students getting a maximum score of 100 on the pre-test and post-test with a percentage of 12.9% and 27 students experiencing an increase in score on the post-test with a percentage of 87.1%. Based on interviews with four students who got the maximum score during the pre-test, it was found that these students experienced an increased understanding of the material for arithmetic sequences and series. The percentage of students who experienced an increase of 100% means that it has exceeded the minimum percentage of 70% and can be said to be effective. This is in line with Liliyan et al. (2021). The results of the test items in the small group trial can be seen in Table 7. The results of the test items in the large group trial can be seen in Table 8.

Table 7. The results of the test items in the small group trial

| No. | Minimum Completeness Criteria (MCC) | Score | | Conclusion |
		Pre-test	Post-Test	
1.	80	64	100	Increase
2.	80	73	100	Increase
3.	80	64	100	Increase

Table 8. The results of the test items in the large-group trial

| No. | MCC | Score | | Conclusion | No. | MCC | Score | | Conclusion |
		Pre-test	Post-Test				Pre-test	Post-Test	
1.	80	91	100	Increase	17.	80	55	91	Increase
2.	80	91	100	Increase	18.	80	100	100	Increase
3.	80	73	91	Increase	19.	80	73	100	Increase
4.	80	46	82	Increase	20.	80	73	100	Increase
5.	80	82	100	Increase	21.	80	73	100	Increase
6.	80	73	100	Increase	22.	80	100	100	Increase
7.	80	64	82	Increase	23.	80	36	82	Increase
8.	80	73	100	Increase	24.	80	55	91	Increase
9.	80	55	82	Increase	25.	80	82	100	Increase
10.	80	100	100	Increase	26.	80	64	100	Increase
11.	80	64	100	Increase	27.	80	91	100	Increase
12.	80	73	91	Increase	28.	80	55	82	Increase
13.	80	46	82	Increase	29.	80	55	100	Increase
14.	80	64	100	Increase	30.	80	55	82	Increase
15.	80	82	100	Increase	31.	80	64	91	Increase
16.	80	100	100	Increase	Average	80	71,22	94,48	**Increase**

When the teacher used an interactive learning media based on Articulate Storyline to deliver material to students excitedly, they found it helpful. When the students did the trial, their responses when opening the learning media were happy, and they did not expect to use the SpongeBob theme. This learning media also helps students understand the material for arithmetic sequences and series in a new way. SpongeBob cartoon is a popular cartoon that is enjoyed by children of all ages, even adults, and has a positive response. This is in line with the research conducted by Setiadi and Hadi (2021) regarding students' opinions regarding the SpongeBob Squarepants cartoon. Based on previous research conducted by Mareta (2019); Nugraheni (2018); Oktaviana (2020); Pratama (2018); Saniriati (2020), there are differences in the "Barista" learning media developed, including 1) the theme used is SpongeBob Squarepants; 2) the type of font used is SpongeBob Squarepants; 3) the login screen can enter the username and school origin; and 4) the user gets a certificate with a custom name that can be downloaded after doing the practice questions.

At the small group trial stage, there were obstacles experienced, namely, laptops that could not be connected to the central laptop in the laboratory, so the distribution of media used flash drives. Based on this, before testing, it was ensured that learning media files were available on all laptops that would be used so as not to drag on time and the need for an internet network so that they could use learning media, work on test questions, and complete student response questionnaires. Other relevant research studies that align with the statement mentioned above can be found in Astra et al. (2015); Dewi et al. (2019); Lee (2016); Sumantri and Rachmadtullah (2016); Tabor & Minch (2013)

During the large group trial stage, there were several obstacles, including 1) there were learning media that disappeared by itself on almost all laptops in the IT laboratory, so they needed to be re-sent via the central laptop and use a flash drive for laptops that could not connect to the central laptop; 2) the internet user is not current when many people use it, so it is not possible for students if the learning media files have to be downloaded first. Based on this, before the trial, it was ensured that learning media files were available on all laptops that would be used so as not to drag on time and the need for an internet network to be able to use learning media, work on test questions, and student response questionnaires.

Based on the above explanation, interactive learning media based on Articulate Storyline on arithmetic sequences and series material is classified as valid, practical, and effective. Interactive learning media based on Articulate Storyline for arithmetic sequences and series material can be used properly to support the learning process.

Conclusions and Recommendations

Based on the process and results of developing interactive learning media based on Articulate Storyline for material sequences and arithmetic series, it can be concluded: The process of developing interactive learning media based on Articulate Storyline in this study used the Thiagarajan model (Model 4-D). The Thiagarajan model consists of four stages: 1) definition, 2) design, 3) development, and 4) dissemination. 1) The defining stage was obtaining information related to school learning, student characteristics, and the media used. Interviews were conducted with the math teacher of

class X Tunas Luhur High School and two students from class X B Tunas Luhur High School to obtain the results of the end-to-end analysis and media analysis. 2) The design stage is completed to create learning media on arithmetic sequences and series material for draft I. 3) The development stage includes validation by validators and trials of learning media. The learning media trials consisted of small group trials conducted by three students from class X A and large group trials from class X B Tunas Luhur High School, totaling 31 students. Trials of the learning media were conducted offline using the laptops available in the IT laboratory of Tunas Luhur High School. 4) The dissemination stage is to disseminate learning media offline and online. Offline dissemination was carried out at Tunas Luhur High School through a mathematics teacher. Online distribution is done via WhatsApp and Instagram. The results of the media validity test showed a score of 4.82, indicating high validity. Furthermore, the practicality and effectiveness tests conducted with both small and large groups achieved a perfect score of 100% in all aspects. The research provides a valid, practical, and effective approach to developing interactive learning media based on Articulate Storyline for the sequence and series material.

Based on the research findings, the following suggestions are provided: 1) Use this research as a guide: Other researchers aiming to develop similar interactive learning media can use this thesis as a reference and further refine the content and methodology, 2) Diversify the test questions: Future researchers should consider incorporating different levels of difficulty in the test questions. This could involve presenting questions that progress from low-level to high-level complexity, offering students a comprehensive learning experience; 3) Ensure accessibility of learning media files: It is important to ensure that the learning media files are easily accessible on PCs or laptops. Researchers should verify that the devices intended for use have the necessary learning media files readily available. By implementing these recommendations, future research can build upon the findings of this study and make significant contributions to enhancing interactive learning media in educational settings. Furthermore, this research provides valuable insights and practical guidance for researchers and educators interested in incorporating Articulate Storyline-based learning media into their teaching practices.

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