Articulate Storyline Learning Media on Speed and Discharge Concepts for Elementary School

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Abstract: The low level of understanding among fifth-grade students in learning the concepts of speed and discharge causes difficulties in solving story problems. This research aims to develop a learning media using an Articulate Storyline for the concepts of speed and discharge in the fifth grade of SDN Krian IV. The Articulate Storyline learning media contains concepts of speed and discharge presented in a narrative form, accompanied by triggering questions and interactive quizzes. The Research and Development method with the 4D model was used, but only up to three stages: Define, Design, and Development. Time constraints were a consideration for the researcher in determining the research stages. Data collection techniques used in this research included interviews with fifth-grade teachers and questionnaires for validation. The research results are as follows: 1) the development process of Articulate Storyline learning media for the topics of speed and discharge went through several stages and product revisions; 2) the Articulate Storyline learning media for the concepts of speed and discharge meets the criteria for suitability to be used in the learning process, as indicated by the validation results from an expert in three aspects: media, content, and language assessment, all of which received the category of Very Feasible.

Abstrak: Tingkat pemahaman siswa kelas V yang rendah dalam pembelajaran materi kecepatan dan debit menyebabkan mereka kesulitan dalam menyelesaikan soal-soal cerita. Tujuan penelitian ini adalah mengembangkan media pembelajaran Articulate Storyline pada materi kecepatan dan debit untuk kelas V SDN Krian IV. Media pembelajaran Articulate storyline berisi materi matematika bab kecepatan dan debit yang disajikan dalam bentuk narasi dilengkapi pertanyaan pemantik dan kuis interaktif. Dalam penelitian ini menggunakan metode penelitian Research and Development model 4D namun hanya sampai tiga tahap yakni Define (tahap pendefinisian), Design (tahap perancangan), dan Development (tahap pengembangan). Keterbatasan waktu menjadi pertimbangan peneliti dalam menentukan tahapan dalam penelitian ini. Teknik pengumpulan data yang digunakan dalam penelitian ini adalah wawancara kepada wali kelas V dan angket untuk validasi. Hasil penelitian adalah: 1) proses pengembangan media pembelajaran Articulate storyline pada materi kecepatan dan debit melalui beberapa tahapan dan revisi produk; 2) media pembelajaran Articulate storyline pada materi kecepatan dan debit memenuhi kriteria kelayakan untuk digunakan dalam proses pembelajaran sesuai hasil validasi beberapa validator ahli yang mencakup tiga aspek yakni penilaian media, penilaian materi dan penilaian bahasa yang mendapatkan kategori sangat layak.

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A. Introduction

Mathematics education for elementary school students brings long-term benefits in various aspects of their lives. Understanding mathematical concepts is to fulfill academic requirements and help students develop skills and abilities relevant to the modern world. Mathematics learning aids students in developing logical thinking skills that are useful in addressing everyday problems (Putri & Munandar, 2021). Mathematics is a fundamental discipline for scientific and technical subjects at higher educational levels, so a firm grasp of mathematical concepts assists students in studying technical subjects like physics, chemistry, and computer science at advanced levels. Therefore, mathematics education is compulsory at every level of education (Mboeik, 2023).

The abstract nature of mathematical science can be relatively challenging for elementary school students to grasp (Kasturi et al., 2022). Learning should be adapted to their cognitive development level for easy comprehension. In this regard, Bruner's theory emphasizes presenting concepts in concrete and visual forms (Agustina et al., 2020). In abstract mathematical concepts, learning media such as images, diagrams, animated videos, or teaching aids can help students relate abstract concepts to more easily understandable visual representations. Abstract concepts can be introduced through animations, simulations, or stories that connect concepts to real-life situations or everyday experiences, making them more relevant and comprehensible for students. Thus, learning media can facilitate a more practical understanding and learning process, especially for elementary school students' abstract mathematical concepts (Hasiru et al., 2021).

Technological advancements have transformed how students access, share, and manage information (Bimansah et al., 2023). In the creation of learning media, technology has played a significant role in providing more varied, easily understandable, and interactive learning experiences for students (Saadah & Hasanah, 2023). Technology enables the development of interactive learning media, where students can actively participate in the learning process. Technology also allows for better and more in-depth visual representations. Two-dimensional graphics and animations help explain complex mathematical concepts more understandably. Multimedia technology has provided significant opportunities to enhance the quality of learning media for elementary school students (Nata & Putra, 2021).

The subject matter of speed and water discharge is part of natural science education taught to elementary school students in Grade V (Hapsari et al., 2021). Speed refers to the time required to cover a certain distance, while water discharge refers to the volume of water flowing through a channel in a specific unit of time. Both concepts are relevant to students' daily experiences but require a more profound understanding due to the complexity of the relationships among their elements, such as distance, volume, and time. Learning speed and water discharge using textbooks makes it difficult for students to grasp the calculations required to solve the problems because of the abstract nature of the content. Interactive learning media can assist in making the learning process more concrete and understandable through visualization and engaging animations.

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Learning media are tools teachers use to deliver information, concepts, and learning materials to students more engaging, effectively, and easily (Hakam et al., 2022). The purpose of using learning media is to help students better understand concepts, increase engagement in learning, and stimulate deeper understanding. The criteria for selecting learning media can be analyzed by considering four criteria: suitability for the content, student characteristics, student learning styles, and supporting facilities (Salim & Utama, 2020). Using learning media makes abstract mathematical concepts more accessible for students to comprehend. Learning media significantly motivates and encourages students to learn more actively (Isnaeni & Hildayah, 2020). Interactive learning media provides engaging and enjoyable learning experiences. Interactivity allows students to participate in learning, stimulating their interest and motivation. By leveraging technology to develop interactive learning media, teachers can create a more inspiring and engaging learning environment for students (Novitasari et al., 2020). This can awaken new aspirations and interests, enhance motivation, and incentivize students to participate in learning activities actively.

Interactive learning multimedia combines various media elements such as text, images, audio, video, animations, and interactivity in one platform or software (Yahya & Lutfi, 2023). Its primary purpose is to enhance the quality and effectiveness of learning by providing a more engaging, in-depth, and interactive learning experience for students. With visualization and interactivity, abstract mathematical concepts can be explained more effectively (Kusumawati et al., 2021). Students can delve deeper into the subject matter, leading to better comprehension.

Articulate Storyline is software that can create interactive learning multimedia (Pratama, 2019). This software enables teachers to design and develop interactive, engaging, and effective learning content without requiring extensive programming background (Juhaeni et al., 2021). The advantages of Articulate Storyline include supporting various animation features like Adobe Flash while having a simple and intuitive interface similar to Microsoft PowerPoint. By utilizing the features of Articulate Storyline, teachers can create a more engaging, interactive, and practical learning experience for students in understanding the concepts of speed and water discharge. This helps overcome difficulties in understanding abstract concepts and makes learning more relevant for elementary school students (Riyana et al., 2022).

Articulate Storyline is a popular e-learning development software tool (Nurmala et al., 2021). This software allows teachers to design, develop, and deliver interactive learning materials without requiring deep programming expertise (Anggraini & Reinita, 2021). The selection of Articulate Storyline as learning media for elementary school mathematics is based on its potential to use images, graphics, and animations to help illustrate mathematical concepts or processes more clearly. Articulate Storyline makes learning activities more interactive, concrete, and engaging (Sari & Harjono, 2021). This can help students better understand mathematical concepts and their practical applications.

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Based on initial interviews with fifth-grade class teachers, students need help understanding relatively complex concepts of speed and discharge. They need more motivation to learn due to difficulty grasping abstract concepts. The impact of these issues is reflected in the low learning outcomes on speed and discharge. In previous research, students faced various challenges, such as symbol misuse, method selection errors, formula writing, and difficulty comprehending word problems (Andriani et al., 2022). Furthermore, the teacher's approach, which prioritizes using textbooks as learning media, hinders student participation in learning. Learning becomes one-directional, leading to student boredom. This aligns with previous research where teachers underutilized technology in learning media development (Saputro & Lumbantoruan, 2020).

Previous research has shown the development of learning media using Articulate Storyline for subjects such as ecosystems (Safira et al., 2021), energy sources (Lubis & Sukmawarti, 2023), waves and sound (Cahyanto et al., 2022), English (Uzmi et al., 2023), and social sciences (Sari & Harjono, 2021). Besides improving subject understanding, Articulate Storyline has also been developed to enhance creativity (Nurmala et al., 2021) and critical thinking abilities (Heliawati et al., 2022). Based on previous research, there needs to be more research concerning using articulate narratives in the context of mathematical concepts. While previous studies have explored the application of Articulate Storylines in various subjects, there seems to be limited research that focuses explicitly on its utilization in mathematics education. This gap suggests an opportunity to explore and develop learning media using Articulate Storyline for teaching and learning mathematical concepts.

The novelty of the research lies in the unique approach of presenting mathematical concepts related to speed and discharge using Articulate Storyline. Mathematics education often relies on textbook-based learning and formal problem-solving. This research introduces a narrative-based approach where mathematical concepts are embedded within a storyline. Including trigger questions at crucial points in the narrative engages students actively with the content. Furthermore, interactive quizzes within Articulate Storyline can provide immediate feedback to students, allowing them to assess their understanding of the material and make corrections as needed. This formative assessment approach can enhance the learning process and help students identify areas needing additional support.

The research's objective is to develop Articulate Storyline learning media for fifth-grade elementary school students covering the topics of speed and discharge. The research aims to contribute to developing Articulate Storyline-based learning media for mathematics, specifically on speed and discharge, that fifth-grade students easily understand. Articulate Storyline learning media offers a multifaceted approach to enhancing students' comprehension of story problems in mathematics. Visual representation, interactivity, narrative context, and other features provide a dynamic and engaging platform for students to develop their problem-solving skills and achieve a deeper understanding of mathematical concepts. The practical goal of the research is to create learning media that can assist teachers in improving the participation of fifth-grade students in mathematics learning, thereby enhancing learning outcomes.

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B. Method

This research falls under the Research and Development (R&D) category, specifically focusing on developing a product and testing its effectiveness (Zakariah et al., 2020). The research model employed is the 4D model, which stands for Define, Design, Development, and Dissemination. However, this research only progressed to the Development stage due to limited time constraints. The research's primary focus was on the development process and the feasibility of the Articulate Storyline learning media up to the Development stage, following the approach of several previous R&D studies (Yuniastuti et al., 2021). The research procedure is shown in Figure 1 below:

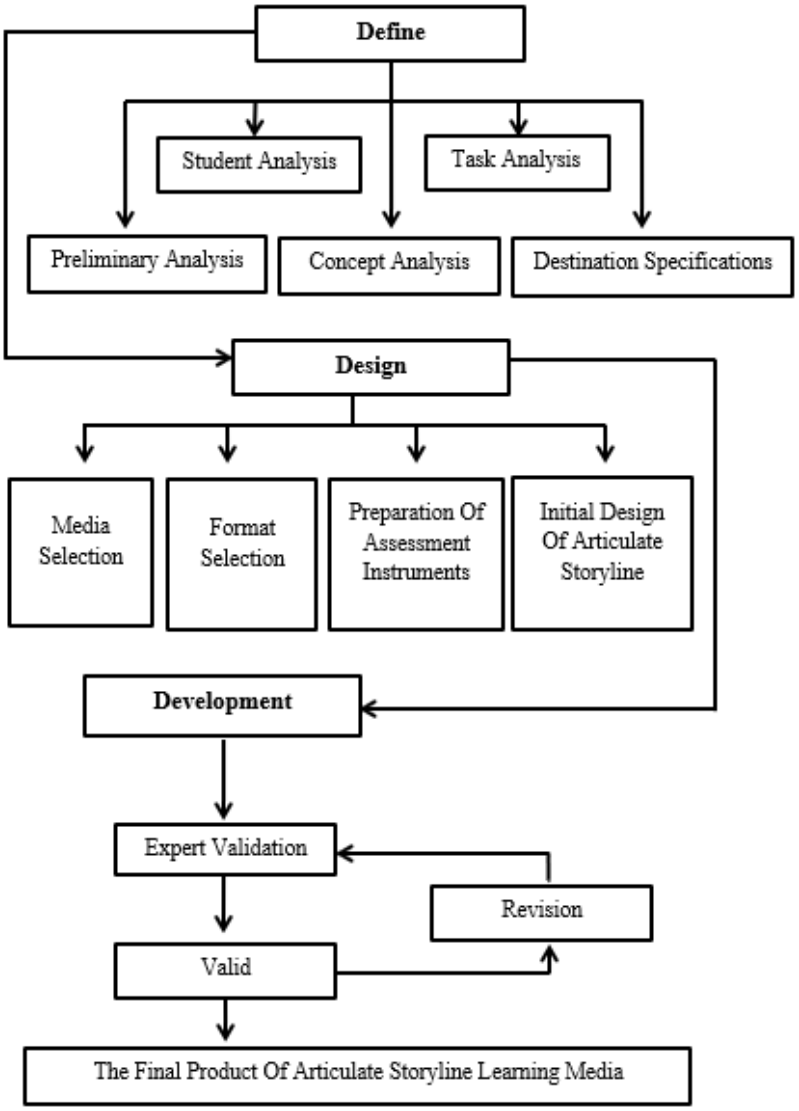

Figure 1. Research Procedure Chart

Based on Figure 1, the research begins in the Definition stage. This stage includes student analysis, task analysis, preliminary analysis, concept analysis, and destination specifications. Afterward, the study progresses to the Design stage with procedures such as

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media selection, format selection, preparation of assessment instruments, and the initial design of the Articulate Storyline. The final stage involves developing the Articulate Storyline learning media through expert validations. At the end of the research, the final product is completed.

The development of articulate storyline learning media on speed and discharge concepts for elementary school is limited to the validation stage due to time constraints for its implementation in the 5th-grade elementary school. The researcher focuses on the development process and the feasibility of the Articulate Storyline learning media from a 4D Model that can be completed within the specified timeframe.

Data collection techniques utilized in this research included interviews and questionnaires. Initial data on the learning conditions were obtained through interviews with the fifth-grade homeroom teacher at SDN Krian IV. Meanwhile, questionnaires were employed to assess the alignment of the developed media with the predefined objectives and to evaluate the feasibility of the Articulate Storyline learning media provided to experts. Consequently, the questionnaire contained questions related to validating learning material content standards. The questionnaires were distributed to three types of experts: media experts, subject matter experts, and language experts.

Table 1. Data Collection Instrument Grid for Media Experts

Variable	Indicator	No.	Amount
Material Aspects	Suitability of material, learning objectives, and images	1,2,5	3
	Ease of understanding the material	3,4	2
Physical Aspect	Composition of layout elements	6, 8, 9	3
	Use appropriate letters	7	1
	The attractiveness of learning media	10	1
	Presentation of learning media flow	11	1
	Language selection	12	1
	Ease of access	13	1
	Use of navigation keys	14	1
	The accuracy of the use of animation and content	15	1
Utilization Aspect	The use of media facilitates learning	16	1
	Media is flexible (can be used anywhere and anytime)	17	1
	Student involvement in the learning process	18,	1
	Learning media can attract and increase student learning motivation	19, 20, 21	3
	Total Questions		21

Source: Adapted from Nuril (2021)

Table 1 shows the quality assessment sheet for developing *Articulate storyline learning media,* which media experts will validate. The validation obtained from media experts is used to test material aspects, physical aspects, and aspects of the utilization of learning media.

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Table 2. Data Collection Instrument Grid for Material Experts

Variable	Indicator	No.	Amount
Content Eligibility	Suitability of material with KI and KD	1	1
	The suitability of the material with the learning objectives	2	1
	Clarity of material	3	1
	Correctness of content/concept	4	1
Presentation	The suitability of the material with the ability of students	5	1
	Suitability of material with learning media	6.13	2
	Learning media can add insight	7	1
	Clarity and ease of instructional media instructions	8	1
	Material completeness	9	1
	Can increase student learning motivation	10,11	2
	Excellent and correct use of Indonesian	12	1
Total Questions			13

Source: Adapted from Nuril (2021)

Table 2 shows the quality assessment sheet for the results of developing the Articulate storyline learning media, which material experts will validate. Validation obtained from material experts is used to test the suitability of the content and presentation of learning media.

Table 3. Data Collection Instrument Grid for Linguists

Variable	Indicator	No.	Amount
Conformity with the rules of language	Use of precise and appropriate terms	1	1
	The use of language makes it easier for students to understand the flow of the material.	2	1
	Use of language by applicable linguistic rules.	3	1
Communicative and Interactive	The language used in the learning media *Articulate storyline* is communicative and interactive	4	1
Total Questions			4

Source: Adapted from Nuril (2021)

Table 3 shows the quality assessment sheet for the results of developing the Articulate storyline learning media, which language experts will validate. Validation obtained from language experts is carried out to test the appropriateness of the language used in learning media.

The qualitative data analysis technique from interviews with class V teachers at SDN Krian IV is Content Analysis, which consists of collecting, reducing, presenting, and drawing conclusions. Meanwhile, quantitative data analysis was carried out on validation data from media, material, and language experts. The results of the questionnaire using the expert validation checklist technique, which has been filled in by media experts, material experts, and language experts, will be analyzed using the following percentage calculation formula:

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$$P = \frac{\sum X}{N} \times 100\%$$

P : Percentage
∑X : The total number of respondents' answers to all items
N : Total ideal score

After obtaining the feasibility percentage, it is then converted into qualitative criteria data for evaluating product feasibility as follows:

Table 4. Feasibility Assessment Criteria

Aspect	Information
81% - 100%	Very Feasible
61% - 80%	Feasible
41% - 60%	Feasible Enough
21% - 40%	Less Decent
< 20%	Very Inadequate

Source: Rindiani & Hasanah (2022)

C. Result and Discussion

Result

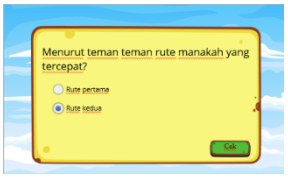
Articulate storyline learning media in speed and discharge concepts, which consists of three stages: Define, design, and development. The first stage is defining the product that will be developed and its specifications. This stage consists of five activities: front-end analysis, learner analysis, concept analysis, task analysis, and formulation of learning objectives. The next stage is the design stage, namely creating an initial design of learning media consisting of media selection, format selection, preparation of research instruments (criterion-test construction), and initial design.

The development stage is the final stage of the research. At this stage, expert validators and educational practitioners have carried out validation. In addition, the learning media has been revised based on suggestions by experts. The development stage consists of three activities: making learning media, validating learning media, and changing learning media.

Opening part

Main course


Material



Trigger questions

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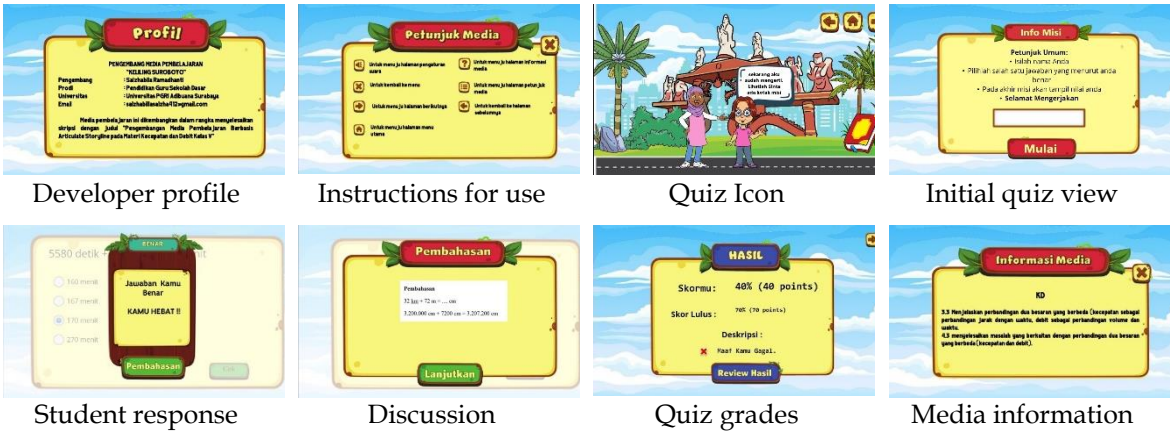

Figure 2. Initial Results of Learning Media

Figure 2 shows the results of creating Articulate storyline learning media, which consists of twelve parts. The process includes content development, developing a storyboard, designing the layout, incorporating interactive elements, integrating multimedia elements, recording audio narration, implementing articulate storyline's triggers/variables, creating quizzes, setting up navigation controls, and publishing an articulate storyline project in the desired format.

After the process, the next activity is validating learning media, which Ms. Nur Fathonah, S.Pd., M.Pd., and Mr. Dr. Reza Rachmadtullah S.Pd., M.Pd. as a media expert, carry out. Then, Mrs. Erlin Ladyawati, S.Pd., M.Pd., and Mrs. Nur Fathonah, S.Pd., M. Pd, as material and language experts. The results of the validation of learning materials are presented in the table below:

Table 5. Results of Validation by Media Experts

Aspect	Score obtained		Maximum score
	Validator 1	Validator 2	
Material	21	22	25
Physical/Appearance	42	45	50
Utilization	26	25	30
Amount	89	92	10 5
Average	84%	87%	
Total Average	85.5 %		
Criteria	Very Feasible		

Based on Table 5, the average assessment of learning media based on material, physical/appearance, and utilization aspects is 86.5%, included in the very feasible category.

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Table 6. Results of Validation by Material Experts

Aspect	Score obtained		Maximum score
	Validator 1	Validator 2	
Content Eligibility	18	18	20
Presentation of Material	39	38	45
Amount	57	56	65
Average	87%	86%	
Total Average	87 %		
Criteria	Very Feasible		

In Table 6, the average assessment of learning media based on the appropriateness of content and presentation of material is 87%, which is included in the very feasible category.

Table 7. Validation Results by Language Experts

Aspect	Score obtained		Maximum score
	Validator 1	Validator 2	
Content Eligibility	4	4	5
Language use	5	4	5
Conformity with the rules of language	5	5	5
Communicative and Interactive	5	4	5
Amount	19	17	20
Average	95%	85%	
Total Average	90%		
Criteria	Very Feasible		

In Table 7, the average assessment of learning media based on aspects of content feasibility, use of language, conformity with language rules, and communicative and interactive is 87%, which is included in the very feasible category.

Based on the validation results from media experts, material experts, and linguists, the *Articulate storyline learning media* on speed and discharge material for grade V SD has an excellent feasibility level. Then, the *Articulate storyline learning media* gets suggestions and improvements as revisions to make it more efficient and attractive to students according to the following table:

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Table 8. Learning Media Before and After Revision

Revision Components	Before Revision	After Revision
Eliminate text conversations	 There is dialogue text between characters, so the material delivery takes too long, and the pages become too many, making it less efficient.	  Dialogue text is removed so that the presentation of the material is more concise using only audio.
Addition of trigger questions	There are no trigger questions yet	 There are trigger questions to stimulate students' knowledge and understanding of the material.
Added animation	There are no animations yet	  Added animation to maximize and make it easier for students to understand the material

Based on Table 8, revisions were made to make learning materials more efficient in the use of time by changing conversational text into audio. In addition, adding trigger

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questions and engaging animations can increase student participation so that they are more active in using learning media.

Discussion

Based on the expert validation results, it can be concluded that the Articulate Storyline learning media for the topic of speed and water discharge received a "Highly Feasible" category in terms of media, content, and language aspects, making it suitable for use in fifth-grade elementary school mathematics education. This finding aligns with the research conducted by Mardiyani et al (2021), who developed Articulate Storyline media for poetry writing instruction, and Machmud et al (2022), who developed Articulate Storyline-based learning media for statistics and probability.

This learning media can assist students in learning the concepts of speed and water discharge enjoyably. These concepts can be challenging to comprehend through oral explanations or textbooks alone. Interactive media like Articulate Storyline allow students to view animations, graphics, and simulations that help them understand these concepts better and more concretely. Presenting the concepts through images, animations, and other visual elements can capture students' attention. Engaging visual experiences and trigger questions can help keep students engaged and focused on their learning. Furthermore, when using learning media, students are more motivated to participate. The presentation of media that combines animations with images packaged in a narrative story makes learning more conducive and captures students' attention (Suhailah et al., 2021).

One of the advantages of Articulate Storyline learning media for fifth-grade speed and water discharge topics is the delivery of content in the form of a narrative relevant to daily life. Developing learning media using Articulate Storylines can make learning more concrete and in line with the cognitive development stage of fifth-grade elementary school students. Typically, learning media content is presented in a textbook format, whereas in the media developed by the researcher, it is presented as a narrated story with audio. Additionally, this media is complemented with relevant images and animations related to speed and water discharge.

Another advantage is that this learning media includes trigger questions to facilitate student interaction. This media also provides missions or quizzes containing questions to assess students' understanding. Quiz presentation is typically directly within the learning media menu. However, the media developed by the researcher is presented in two forms: directly in the media menu and integrated into the learning material, marked by the appearance of a mission box. This learning media is published as a website, allowing students to access it anywhere and anytime.

However, there are some limitations to this learning media. Its online publication may restrict access due to the need for an internet connection. Creating interactive media like Articulate Storyline can be time-consuming, especially if teachers need to gain prior experience with the software. Therefore, preparing learning media requires expertise that

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teachers need to acquire. Additionally, to achieve the best learning experience, a device with a large screen or monitor is necessary.

D. Conclusion

This research employed the 4D development model to develop Articulate Storyline learning media for speed and water discharge for fifth-grade elementary school students. The Define phase revealed that students faced challenges understanding the subject matter and needed more interest in mathematics learning. The design phase resulted in a plan for learning media using Articulate Storyline, which was aligned with the learning objectives and student interests. The development phase created the final product of Articulate Storyline learning media after undergoing validation and revisions by various experts. Validation by media, subject matter, and language experts demonstrated that this learning media is highly suitable for learning. This research has produced interactive learning media that meets the needs of students and helps them better understand the concepts of speed and water discharge.

A practical recommendation for Krian IV Elementary School is to implement Articulate Storyline as a learning media to assess its effectiveness in improving the learning and comprehension of 5th-grade students about speed and water discharge. Theoretical suggestions for future research involve integrating constructivist learning principles into learning media development to enhance the realization of meaningful, student-centered learning experiences.

The implications of this research are significant for both practical application in the Krian IV elementary school and theoretical advancements in learning media development. The findings highlight the potential of Articulate Storyline as an effective tool for improving student engagement and comprehension in understanding the concepts of speed and water discharge. The theoretical suggestions pave the way for future research to integrate constructivist learning principles into designing and developing educational materials.

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