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Development of digital science literacy based on Articulate Storyline based on objects' material for class VIII junior high school

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ABSTRACT

One solution to overcome the low quality of Indonesian education is to innovate education by developing digital tools for learning. Based on a literature review, digital tools in the form of Articulate Storyline software have many advantages in science learning, especially physics. Therefore, the development of students' digital science literacy based on an Articulate Storyline material on forces on objects for grade VIII junior high school students is important. The purpose of this study was to determine the level of validity and feasibility of Articulate Storyline as a learning medium to develop students' digital science literacy. The method used to develop this media uses 4D (Define, Design, Develop, and Disseminate). Data collection techniques for media validity use media, material, and readability validation instruments, while for students' digital science literacy skills, use practice questions and questionnaires. As supporting data, we also conducted interviews, which were then analyzed descriptively. Respondents in this study were expert validators (Lecturers), Teachers, and Students. The results we obtained showed that (a) the results of the validity of the media, materials, and readability were declared 'very valid' with values of 89.4%, 100%, and 75.8%; and (b) the students' digital science literacy skills was declared 'very good' with a value of 80.0. These results indicate that the development of digital science literacy based on Articulate Storyline is worthy of being developed as an innovative learning medium. We recommend that digital science literacy be developed in other science materials, such as biology and chemistry.

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INTRODUCTION

Education is very much needed in various social activities, so education is the most important part and will not be separated from the aspect of human life. According to Hartono (2017), the quality of education in Indonesia is still of concern. The results of data according to the Education For All (EFA) Global Monitoring Report 2011: The Hidden Crisis, Armed Conflict and Education which has been determined by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the education development index score or Education Development Index (EDI), Indonesia according to data in 2008 was at a score of 0.934. EDI is said to be high if it reaches a score of 0.95 to 1, medium if it reaches a score above 0.80, and low if it reaches a score below 0.80

(Hartono, 2017). The data places Indonesia at a medium level in achieving EDI scores and is in 69th position out of a total of 127 countries in the world registered. This is very worrying considering that the quality of education in Indonesia is still not satisfactory.

The low quality of education in Indonesia is caused by various factors, one of which is educational innovation. One form of educational innovation is the use of Information and Communication Technology (ICT) in learning. Teaching and learning activities using ICT can be implemented by using various digital devices as learning media. These digital devices are used by students during learning in class. Therefore, students' ability to use digital devices is important for students to have a smooth learning process in class.

Digital literacy is a skill needed in the 21st century. Digital literacy is the ability to use digital tools to support primary goals in various life situations (Reddy et al., 2020). Digital literacy is also a form of life skill, so it is not only mastering the ability to use technological, information and communication devices, but also mastering the ability to socialize, innovate in learning, and have an attitude, think critically, creatively and inspiringly as digital literacy skills (Febliza & Oktariani, 2020). Digital literacy is not only in the definition aspect, but also in the evaluation aspect of individual digital competence (Zaenudin et al., 2020).

Digital literacy is needed by humans to master digital competencies to carry out tasks and solve various problems in the digital age. Digital literacy competencies consist of four core competencies, namely (1) Internet Searching: a person's ability to operate, use, and carry out activities via the internet, (2) Hypertextual navigation: reading and understanding dynamically on a hypertext, to be able to understand a hypertext in the search window, (3) Content Evaluation: the ability to think critically and evaluate through various things found online also includes the ability to identify the validity and completeness of the information provided, (4) Knowledge Assembly: a person's efforts in carrying out the compilation of knowledge, construction of a collection of information obtained from various sources and collecting and evaluating facts and opinions that are not based on prejudice (Zaenudin et al., 2020). This digital literacy competency is important for students so that they can adapt to advances in technology and information, accompanied by increasingly sophisticated digital devices from the industrial world and institutions.

The development of learning media in the form of digital devices can help students improve creativity, learning motivation, critical thinking, and problem solving (Daryanes et al., 2023; Kurnisar et al., 2023; Nurrahma et al., 2023). One of the digital tools used in previous research is Articulate Storyline. Articulate Storyline is an application software that is useful for creating interactive programs that can be published by users to present information for interactive learning purposes. This application produces a display of material in the form of an attractive presentation so that it motivates students in learning activities (Khusnah et al., 2020). The Articulate Storyline application has a simple appearance like PowerPoint, but the integrated Flash feature in this application can be used to create interactive videos. This application makes it easy for users to publish online or offline, so it can be used in products such as word processing, Compact Disk (CD), personal pages (web), and learning management systems.

Articulate Storyline has four main features that excel as learning media, namely: a) Features for designing interactive learning media (Articulate Storyline engage); b) Features for designing various interactive questions with various variations, such as multiple choice, matching, true-false, and so on (storyline quiz maker); c) Features for combining the results of articulate storyline engage and quiz maker (articulate storyline presenter), d) Features for editing videos and sound recordings (Articulate Storyline video encoder), such as cutting parts of videos or sound recordings that you want to delete, being able to edit the sound level of videos and recordings that have been entered, and being able to make direct sound recordings in this feature (Khusnah et al., 2020).

Previous research related to the development of Articulate Storyline has been widely used by researchers in science learning. For example, the development of interactive multimedia using articulate storylines has been successfully developed in chemistry materials, namely thermochemistry of substances (Herdini et al., 2021) and atomic structures (Lestarani et al., 2023), while in biology materials, namely about cells (Suhailah et al., 2021). Furthermore, an Articulate Storyline research using a contextual approach was also developed in physics material for college

level (Wahyuni et al., 2023). More specific material in physics for secondary school level, Articulate Storyline research has been developed on Newton's laws (Husna & Fajar, 2022) and heat (Fitriyah et al., 2023), while for elementary school level, it has been developed in thematic learning (Alfirzan, et al., 2024). From the literature review above, the development of an Articulate Storyline on physics material about force for high school level has never been done, so we are interested in conducting this research. The novelty of the research we conducted lies in the material and level of education. The benefits of this learning media for students are that it can help in delivering science material, especially physics material, which is abstract and difficult to understand (Suhailah et al., 2021). In physics, force is a form of pull or push that can change the shape, direction, and speed of an object (Zubaidah et al., 2017). There are generally two types of forces, direct (touch) force and indirect (non-touch) force. Direct force is a force that directly touches an object. Indirect force is a non-touch force that acts between two objects (Maduretno, 2017).

The use of Articulate Storyline as a learning medium is expected to improve students' digital science literacy skills in the field of force. The application of an articulate storyline is also able to provide new insights for teachers to innovate learning in the classroom. This aims to produce better learning quality. The purpose of this study was to determine the level of validity of the development of digital science literacy based on an articulate storyline on the material of force in physics for the Junior High School (SMP) level. In addition, this study also aims to determine the level of feasibility of the products we develop. In the future, this study is also expected to be able to increase students' interest in learning so that teachers can develop an Articulate Storyline media on other science materials.

METHOD

Our research is a development research oriented towards product development in the form of an Articulate Storyline. This research was conducted in one of the schools, namely Junior High School 1 Kandat, Kediri Regency, East Java. The subjects of the research were students of class VIII H in the odd semester. Data collection techniques were conducted by conducting interviews with science teachers and giving questionnaires to junior high school students. The research method used was the 4D research method, which was implemented in class VIII H of Junior High School 1 Kandat. The research method in product development used the 4D method by Thiagarajan (Thiagarajan et al., 1974). The stages of the 4D method are Define, Design, Develop, and Disseminate (Yahya, 2020). Details of the stages are explained as follows.

Define

This stage analyzes learning devices and student analysis. Then investigates the problems that arise during the learning process. Researchers also analyze learning devices and learning objectives in order to find several solutions that will be applied during learning activities. In addition, researchers conduct observations at schools to be studied to analyze student needs and determine learning media that are appropriate for students.

Design

In this stage, we conduct the plan of the material, learning strategies, learning media, and learning models. Then, we design the teaching materials, assignments, and quizzes as final evaluations. These designs were compiled in articulate storyline applications that support various devices (laptops, computers, or smartphones) for students in classroom teaching.

Develop

The development of an Articulate Storyline as a digital science literacy learning media is carried out at this stage. After the Articulate Storyline media has been successfully developed, a validation process is carried out to determine whether this learning media is feasible to be applied or not in learning activities. The validation process carried out consists of media, material, and readability validation. Media and readability validation uses a Likert scale using 4 classifications (very good, good, not good, and very bad), while material validation uses a Gutmann scale with 2

classifications (true and false). The media and material validators in this study are expert validators (lecturers), while the readability validators are teachers and students. After obtaining the validation results, the scores obtained are calculated as quantitative data to determine the rating scale expressed in percentages. The calculation of the results used the following Formula 1 (Yahya, 2020):

$$P = \frac{\sum R}{N} \times 100\% \quad (1)$$

P = Percentage of the score
$\sum R$ = Score of answers given by the validator
N = Maximum score

After obtaining the percentage of the score, the next step is to convert P (in Table 1) to find out whether the learning device is good/or valid.

Table 1. Category of the Percentage of Score

No.	Percentage	Description	Category
1	75.01% - 100%	Very Good	Very Valid, can be used without Revision
2	50.01% - 75.00%	Good	Quite Valid, usable, and needs a little Revision
3	25.01% - 50.00%	Less Good	Less Valid, Recommended not to use, and needs Revision
4	0.00% - 25.00%	Not Good	Invalid, should not be used

Disseminate

After the product is declared valid, learning is then carried out using Articulate Storyline media using the blended learning model. Blended learning is one of the learning models in its implementation that combines traditional learning models with technology-based learning (Yahya, 2020). The combination of blended learning model is a form of face-to-face learning model with mobile phone media (smartphones), as well as a combination of offline learning experiences with online learning experiences (Hrastinski, 2019). The principle of blended learning is learning that combines oral communication and written communication directly on electronic media online, so that a unique learning experience is created according to the desired educational context and objectives (Fathullah, 2020). In addition, interviews were also conducted with science teachers at the school as additional supporting data in this study. Data on students' science abilities in studying the material on the force of objects was obtained using the practice question instrument contained in the media, while data on students' digital literacy with articulate storyline media was obtained using an instrument in the form of a questionnaire in the form of Google Form questionnaire.

RESULTS AND DISCUSSION

Results

Articulate Storyline is software that is useful for creating interactive programs that can be published by developers to present information for interactive learning purposes (Khusnah et al., 2020). The result of our product development, in Figures 1 & 2, is an Articulate Storyline as interactive learning media that can be accessed online by students. This articulate storyline media discusses the material on forces on objects consisting of phenomena, definitions, types of forces, formulas, laws that apply to forces, and applications. In addition, it is also equipped with learning videos, basic competencies (KD), instructions for use, and practice questions to improve students' learning abilities. This interactive media can be accessed on computers or smartphones to improve students' digital science literacy skills. For more complete references, you can access the interactive media available here https://bit.um.ac.id/digscilit_as. This interactive media feature begins with a brief introduction, then a command to log in. However, users can skip the login feature via the menu (red box) provided.

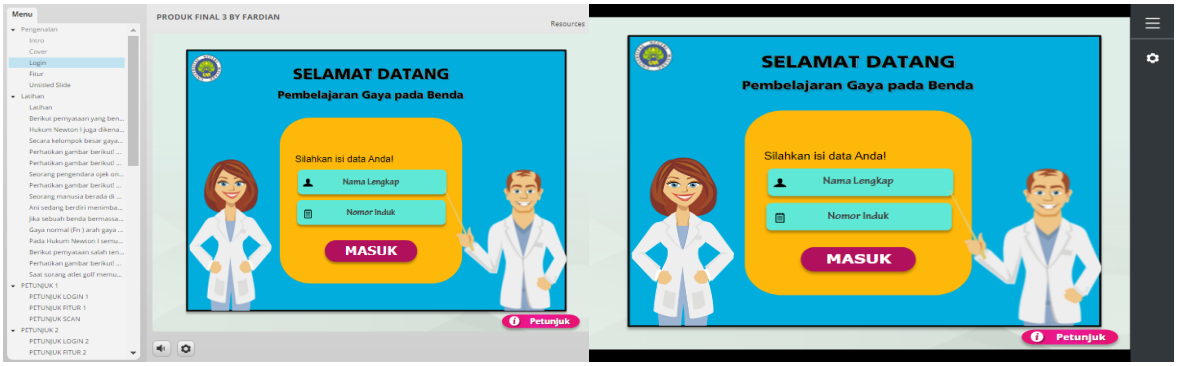

Figure 1. Differences in Interactive Media Display on Computers (Left) and Smartphones (Right)

Figure 2. Display Features on Interactive Media Divided into Various Options

After successfully logging in, users are presented with various features that can be freely accessed by users. The features are divided into basic competencies (KD), learning materials, learning videos, practice questions, product references, developer profiles, and usage instructions, as seen in Figure 3. This interactive media is divided into three main features that will be the object of research. The main features are learning materials, learning videos, and practice questions. Materials and videos are used to increase students' insight and understanding of the force on objects, while practice questions are used to train students' abilities in understanding science.

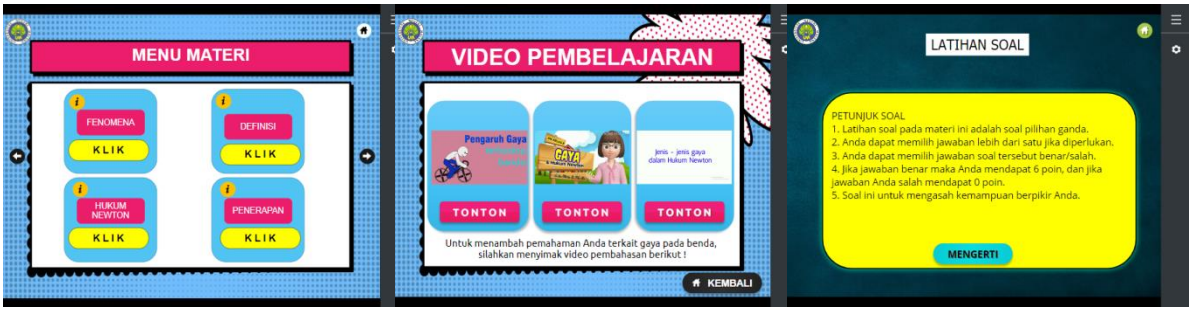

Figure 3. Material Menu Display (Left), Learning Video Menu (Center), Practice Questions (Right)

After successfully developing the articulate storyline media with the material of force on objects, we conducted product validation. The product validation that we conducted consisted of media validation, material validation, and readability validation. The results of media, material, and readability validation are shown in Tables 2, 3, and 4, respectively.

Table 2. Articulate Storyline Media Validation Results

No.	Rated aspect	Percentage (%)	Category
1	Media View	87.5	Very Valid
2	Presentation of Material	88.9	Very Valid
3	Benefits of Interactive Media	91.7	Very Valid
Average Score		**89.4**	**Very Valid**

Table 3. Material Validation Results in Articulate Storyline Media

No.	Rated aspect	Percentage (%)	Category
1	The Phenomenon of Force on Objects	100	Very Valid
2	The Definition of Force	100	Very Valid
3	Newton's Law	100	Very Valid
4	The Application of Force	100	Very Valid
5	The Videos of Force on Objects	100	Very Valid
6	Practice Question	100	Very Valid
Average Score		**100**	**Very Valid**

Table 4. Articulate Storyline Media Readability Validation Results

No.	Rated Aspect	Percentage (%)	Category
1	Ease of Reading Force Definitions in the Media	80.0	Very Valid
2	Ease of Reading Newton's Formulas and Laws in the Media	71.3	Quite Valid
3	Ease of Reading the Application of Force in the Media	80,0	Very Valid
4	Ease of Reading Text Integrated into Learning Videos	66.4	Quite Valid
5	Ease of Reading Practice Questions in the Media	85.0	Very Valid
Average Score		**75.8**	**Very Valid**

The average score percentage that we obtained was the media validation result of 89.4%, with a very valid category, the material validation result of 100%, with a very valid category, and the readability validation of 75.8% with a valid category. The percentage of material validation got a perfect score using the Gutmann scale after revision. This aims to ensure that all concepts in the physics material about the force on objects are correct. Unlike material validation, we use a Likert scale for media and readability validation. The lowest percentage (66.4%) that we obtained was in the aspect of ease of reading the text integrated into the learning video in readability validation. This low percentage is due to the appearance of the text in the video, which is quite small to read when the video is played in portrait mode on a smartphone. Therefore, we suggest that the video should be played in landscape mode. All of the validation data results can be concluded that the Articulate Storyline media that we have developed is valid and suitable for use as a learning medium.

After the media was declared valid, we implemented learning using the blended learning model using this Articulate Storyline media. At the end of the learning, we used the practice question instrument contained in the media to obtain data on students' science abilities in studying the material on forces on objects. In addition, we also used an instrument in the form of a questionnaire to obtain data on students' digital literacy with the Articulate Storyline media. In general, the results of these two datasets are presented in Table 5.

The results of students' digital science literacy skills in Table 5 obtained an average percentage of 80.0%. This means that grade VIII students at Junior High School 1 Kandat have very good digital science literacy skills. They not only have science skills, but also have good digital literacy skills after learning is carried out with blended learning. The articulate storyline media helps students understand science better, and they are skilled at using the software. Regardless of the learning method used by the previous teacher, the results of this study show positive things about the digital science literacy skills of students at Junior High School 1 Kandat.

Table 5. Results of Students' Digital Science Literacy Skills

No.	Rated aspect	Percentage (%)	Category
1	Students' Science Performance Related to the Material on Forces on Objects	79.9	Very Good
2	Students' Digital Literacy Skills using Articulate Storyline Media	80.2	Very Good
Average Score		**80.0**	**Very Good**

Discussion

The use of technology in learning in schools shows the existence of learning innovation by a teacher and has a positive impact on students in the classroom. Improving students' digital literacy skills can be done by getting students used to searching, processing, analyzing, and interpreting information and data during the learning process, both offline and online (Getenet et al., 2024). In addition to offline and online learning, students' digital literacy skills can also be improved through game-based learning, along with their learning motivation and involvement in learning (Zheng et al., 2024). The dimensions achieved when students have good digital literacy skills include their technical, cognitive, and socio-emotional skills (Ng, 2012). This further contributes significantly to students' self-efficacy (Prior et al., 2016). Further studies have found that digital literacy skills are an important element in fostering a passion and social entrepreneurial behavior that can benefit students in the future (Ip, 2024). Because previous studies have shown a gap between students' digital literacy in learning and their social lives (Smith & Storrs, 2023). The results of other studies also suggest improving students' digital literacy skills, because these skills are the basis for avoiding cyberloafing behavior and using the internet more for educational purposes (Arslantas et al., 2024). To facilitate students' digital literacy skills, support for conducive Information and Communication Technology (ICT) resources in schools is also needed (Chen & Xiao, 2024).

An Articulate Storyline has various features that are useful in carrying out more interactive learning activities to improve students' digital literacy. The advantages of this application have four main features (Khusnah et al., 2020): a) Features for designing interactive learning media (articulate storyline, engage), b) Features for designing various interactive questions with various variations. Among them are multiple choice, matching, true-false, and so on (storyline quiz maker), c) Features for combining the results of articulate storyline engage and quiz maker (articulate storyline presenter), d) Features for editing videos and voice recordings (Articulate Storyline video encoder). This feature can help teachers provide interactive learning activities to students in the future. From the results of the research that we found, the use of an Articulate Storyline has a positive effect on the digital science literacy skills of students at Junior High School 1 Kandat. However, the use of Articulate Storyline also has several disadvantages. The display of the results of the Articulate Storyline product when used via a smartphone is sometimes not full screen. Although it still works well, there is a margin of around 1 pixel to 3 pixels when turned on via a smartphone.

The results of this study are supported by the results of interviews with students, who felt very happy and very enthusiastic to learn science when using articulate storyline learning media. According to them, learning science using this media greatly facilitates the learning process. The teaching and learning process is essentially a communication process, namely the delivery of messages from the sender to the recipient. In order for communication to take place effectively, media is needed as a tool to convey the message. Therefore, learning media can be used by teachers to deliver material in science learning. Several research studies show the positive impact of developing Articulate Storyline in learning (Alfirzan et al., 2024; Daryanes et al., 2023; Fitriyah et al., 2023; Hadza et al., 2020; Lestarani et al., 2023; Wahyuni et al., 2023).

In addition to media and material aspects, readability aspects also greatly influence the success of learning. Valid readability aspects reflect the use of good language and are appropriate for the age of students, making it easier for them to understand science material. Therefore, learning success is also influenced by the use of appropriate language. Students will easily understand what the teacher is conveying if the teacher uses language that is appropriate to the level of understanding of the students. The advantages of articulate storylines as interactive learning media in science material, the

force on objects, show students' excellent science skills and digital literacy skills. This can foster students' motivation to continue learning and be more active in managing learning independently. The growth of this motivation is due to the attractive appearance of the media and its practical function. Thus, this media is important to be developed by junior high school teachers the future in various science materials.

CONCLUSION

The use of technology in education will produce good quality learning. Students become critical thinkers, have conceptual thinking, and can easily access various learning resources. The articulate storyline application is an interactive multimedia software that can be used by teachers or students. Learning using multimedia is based on the premise that interactions between students in the classroom will be more diverse. Multimedia contains several important elements, including text, graphics, photos, animations, and sound. With the combination of these important elements in teaching and learning activities, an articulate storyline can be used as an application for technology-based learning media.

The purpose of this study was to determine the validity and feasibility of Articulate Storyline as a learning medium to develop students' digital science literacy. The method used to develop this media uses 4D, which consists of Define, Design, Develop, and Disseminate. To get the data, we used several instruments, like media validity, material validity, and readability validity, while for students' digital science literacy skills, we used practice questions and questionnaires. Our results showed that (a) the media, material, and readability validity were declared 'very valid', and (b) the students' digital science literacy skill was declared 'very good'. These results indicate that developing digital science literacy based on Articulate Storyline is feasible as an innovative learning medium.

Our research results also showed positive things about the digital science literacy skills of students. An Articulate Storyline can improve students' digital literacy skills and science learning outcomes. This is in line with previous research that Articulate Storyline was able to improve students' understanding and train students' critical thinking skills. Therefore, this media can be the best learning innovation in the future. Thus, we recommend that the development of digital science literacy based on Articulate Storyline can be developed for various science learning activities, such as physics, biology, chemistry, and earth and space science. By looking at the needs of students and the time allocation required, teachers can adapt science materials in this application optimally and efficiently. Articulate Storyline is a new, innovative learning media that can be utilized by teachers in learning in the 4.0 era. Teachers should continue to develop students' digital science literacy at every level of education. In addition, support for the availability of information technology devices in schools is very much needed by the principal and the local government. Then, for students, it is hoped that they will be wiser in using their digital literacy skills and need assistance in using them.

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