

ARTICULATE STORYLINE 3 BASED INTERACTIVE MEDIA TO EXPLORE MATHEMATICAL COMMUNICATION ABILITY: DEVELOPMENT AND IMPLEMENTATION

NANI RATNANINGSIH^{1,*}, SHARIFAH KARTINI SAID HUSAIN², HETTY
PATMAWATI¹, S. SUKIRWAN¹, EDI HIDAYAT¹, NISA SRI ROMDIANI¹

¹Universitas Siliwangi, Tasikmalaya, Indonesia

²Universiti Putra Malaysia, Selangor Malaysia

*Corresponding Author: naniratnaningsih@unsil.ac.id

Abstract

The purpose of this research is to develop articulate storyline 3 based interactive media to explore mathematical communication ability. The method used was research and development (R and D) with the ADDIE development model including the stages of analysis, design, development, implementation, and evaluation. Data collection techniques used tests, observations, questionnaires, and interviews. The results found that articulate storyline 3-based interactive media is feasible and effective to use to explore mathematical communication ability. Mathematical communication ability reached completion, and the use of articulate storyline 3 had a strong effect. Students' response to the use of articulate storyline 3 interactive media is very good. This is because articulate storyline 3 interactive media has the advantage of various features that present contextual problems that are related to everyday life. Students explore mathematical communication skills through the problems presented and videos of social arithmetic material. This research has implications for improving mathematical communication skills and learning motivation, students can learn independently regardless of space and time and do not have to be under the guidance of a teacher.

Keywords: Articulate storyline 3, Effect size, Interactive media, Mathematical communication ability.

1. Introduction

Mathematical communication skills are one of the important competencies that must be mastered by students in learning mathematics. It is an ability that enables one to convey, discuss, and evaluate mathematical ideas clearly and effectively. This includes the ability to share thoughts, explain concepts, and interact in mathematical discussions, as well as supporting the development of mathematical literacy and problem-solving. This is in line with the expert opinion which emphasizes that this ability helps students critically evaluate mathematical ideas, which is important for the development of problem-solving skills and mathematical literacy [1].

Communication in mathematics acts as a means to deepen students' understanding through exploration and interaction, enabling them to articulate their thinking more clearly and effectively [2]. Mathematical communication skills in the use of Articulate Storyline 3 can be through the design and development of interactive learning media that utilize the various features available in the platform. Articulate storyline 3 allows the creation of learning scenarios that encourage students to actively communicate, either through interactive tasks, quizzes, or simulations.

The results of the research that has been done include student-centred teaching and involving them actively in the learning process can effectively develop mathematical communication ability [3]. There was a significant improvement in students' mathematical communication ability. Students not only became more able to explain their mathematical ideas but also more confident in participating in class discussions and were able to connect mathematical concepts with real-life situations. In mathematics learning, communication not only plays a role in expressing mathematical ideas but encourages one to think critically and creatively. Thus, they can survive in various situations in the future [4]. Mathematical communication ability is an important component of mathematics learning that must be developed intentionally through appropriate teaching practices. These skills not only improve students' learning outcomes but also prepare them to succeed in everyday life which requires critical thinking and the ability to solve problems effectively [5].

Interactive learning media based on the articulate storyline with a case method on cellular respiration material developed has been proven to be very valid according to the assessment of material, media, and pedagogic experts. The development of this learning media can be a significant innovation in improving the quality of learning and 21st-century skills of students. Especially in the context of the industrial revolution 4.0 which demands the integration of technology in education [6].

The novelty in this research is to develop articulate storyline 3-based interactive media that explores mathematical communication skills, and teaching materials presented in problems associated with everyday life. In addition, the effect size of the implementation of articulate storyline 3 has never been studied by previous researchers

2. Literature Review

2.1. Interactive learning media

The development of technology and information has had a significant impact on the world of education. Thus, the use of learning media must continue to adapt to

the changes that occur. Interactive learning media is one of the technological innovations that has been widely applied in education. Interactive media changes the way we learn by presenting a participatory environment, where students can take an active role in their learning journey.

Interactive learning media are tools that allow users to interact directly with content, practice skills, and receive feedback from the material presented [7]. It combines a material with computer control. Thus, users not only watch or listen but also provide active responses that affect the pace and sequence of learning. Overall, this media provides an opportunity for students to respond directly to the material learned. This is supported by various results of previous research on interactive learning media (see Table 1).

Table 1. Previous research related to interactive media.

No.	Title	Ref.
1	Game based learning media on system of units material based on assessment analysis result for children with mathematics Learning difficulties	[8]
2	Interactive multimodal learning environments: special issue on interactive learning environments: contemporary	[9]
3	Interactivity in multimedia learning: an integrated model.	[10]
4	Web based teaching and learners' control: a research review.	[11]
5	Instructional video in e-learning: assessing the impact of interactive video on learning effectiveness.	[12]
6	The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability	[6]
7	Interactive multimedia based on a scientific approach.	[13]
8	Development of interactive multimedia learning media for traditional cooking tools based on ethnomathematics.	[14]
9	Design of interactive mathematics learning media for 5th grade elementary school students.	[15]
10	Interactive multimedia-based mathematics learning media with a contextual teaching and learning approach.	[16]
11	Development of digital-based interactive teaching materials in draping courses.	[17]
12	An assessment strategy using visual basic application in PowerPoint: A free interactive quiz application for ICT class	[18]
13	Interactive multimedia design of motion graphics using a project-based learning approach for vocational education students: Experiments in cooking tallowing chicken	[19]
14	A concept and implementation of instructional interactive multimedia for deaf students based on inquiry-based learning model	[20]

Various kinds of interactive media are often used in the learning process, including articulate storyline 3, a platform specifically designed to create learning materials that allow user interaction with various elements such as quizzes, b simulations, videos, and animations. Articulate storyline 3 is the third version of the software, released in September 2017, following the previous versions, Articulate storyline 1 and 2, which were launched in 2012 and 2014 respectively

[21]. This version addresses the major shortcomings of the previous versions, such as in publishing HTML5. Articulate storyline 3 is software with interactive tutorials that can be published online or offline in various formats such as HTML5, CD, or LMS [22]. The publication results can be accessed on various devices such as laptops, tablets, and smartphones. Articulate storyline 3 is a type of authoring application for interactive e-learning content creation (see Fig. 1).



Fig. 1. Initial view of articulate storyline 3.

It allows educational content creators to create interactive online courses that include various elements such as quizzes, simulations, animations, interactive videos, and others. Users can design storylines that allow learners to interact with the content dynamically, such as selecting options, answering questions, and viewing the results in real time.

2.2. Mathematical communication ability

Mathematical communication Ability is a person's ability to convey and explain mathematical ideas, concepts, procedures, and thoughts effectively, either orally, in writing, or through symbols or other mathematical representations. Communication skills, which are one of the basic skills that students must master, are defined as the process of sending and receiving messages that allow the message to be understood by the recipient.

The ability of students to convey mathematical ideas, both orally and in writing, is called mathematical communication skills [23]. Oral communication includes the activities of asking questions, answering, expressing opinions, and presenting, which occur through interaction. Meanwhile, written communication involves the use of words, pictures, tables, graphs, and algebra to model problem situations and compose descriptions of mathematical solutions or proofs.

Indicators of mathematical communication skills, namely: expressing everyday events with mathematical language or symbols, explaining mathematical ideas, situations, and relationships using tables and algebra, analysing, and evaluating mathematical thinking (see Fig. 2). These indicators were chosen because they are relevant to social arithmetic material that involves the context of everyday life, explaining problem-solving, and analysing students' thinking in solving problems [24].

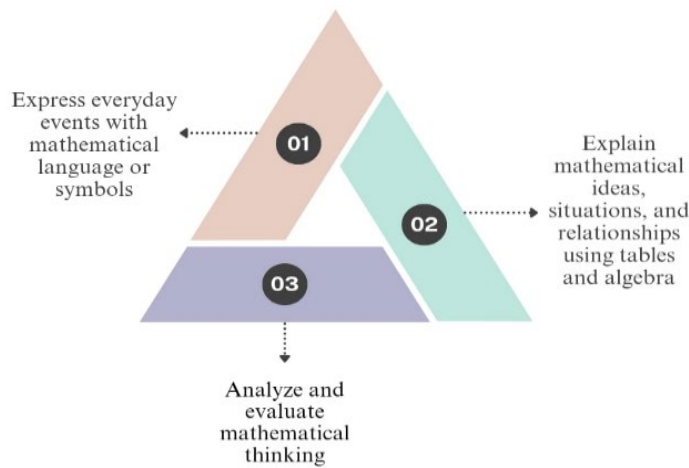


Fig. 2. Indicators of mathematical communication ability.

Research on mathematical communication ability has been done quite a lot. As in Table 2 shows the results of previous research on mathematical communication ability.

Table 2. Previous research on mathematical communication ability.

No.	Title	Ref.
1	Developing mathematical communication skills for students in grade 8 in teaching congruent triangle topics	[25]
2	Students' mathematical communication skills in mathematics learning	[26]
3	Interactive whiteboards and student engagement in mathematical communication	[27]
4	Effective questioning strategies and mathematical communication	[28]
5	Enhancing mathematical communication through peer collaboration	[29]
6	Developmental stages in mathematical communication	[30]
7	Assessing mathematical communication: a rubric approach	[31]
8	Gender differences in mathematical communication	[32]
9	Dynamic feedback and peer assessment in mathematical communication	[33]
10	The role of metacognition in mathematical communication	[34]

2.3. Social arithmetic

Social arithmetic is a branch of mathematics that focuses on the application of basic arithmetical concepts in the context of everyday life. It involves the use of mathematical operations such as addition, subtraction, multiplication, and division in situations related to financial transactions, trade, and other aspects of the economy. Social arithmetic is often taught at primary to secondary education levels to help students understand and apply maths in practical situations. The scope of social arithmetic content is shown in Fig 3.

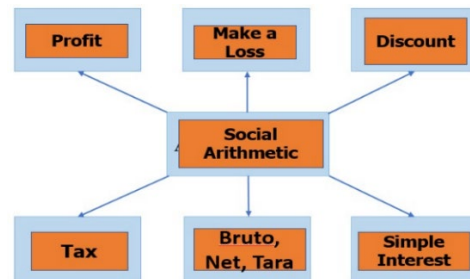


Fig. 3. Social arithmetic content

Social arithmetic can be applied in everyday life, such as in:

- (i) Personal financial management, developing a household budget, calculating loan instalments, and managing savings.
- (ii) Business and trade, determining product selling prices, calculating profits, and managing inventory.
- (iii) Banking and investment, calculating interest on loans or savings, evaluating investment returns, and understanding various financial products.
- (iv) Tax planning, calculating the amount of tax to be paid based on certain income or transactions.

Here is an example of the application of social arithmetic in trade (see Fig. 4). Mrs Kasih, a peanut porridge seller. In this picture, Mrs. Kasih is seen at the market, buying ingredients such as mung beans, coconut milk, and sugar. She is then seen cooking peanut porridge in a large pot. Next to her, there is a small stall with 110 servings of peanut porridge on display, each costing IDR 6,000. Mrs Kasih is happy to serve customers, and by the end of the day, she has sold 105 servings of peanut porridge.



Fig. 4. Application of social arithmetic in daily life.

3.Method

This research uses the research and development (R and D) method which aims to produce a product called articulate storyline 3-based interactive media. The development model used is the ADDIE model, namely analysis, design, development, implementation, and evaluation [35]. The development design model is presented in Fig. 5.

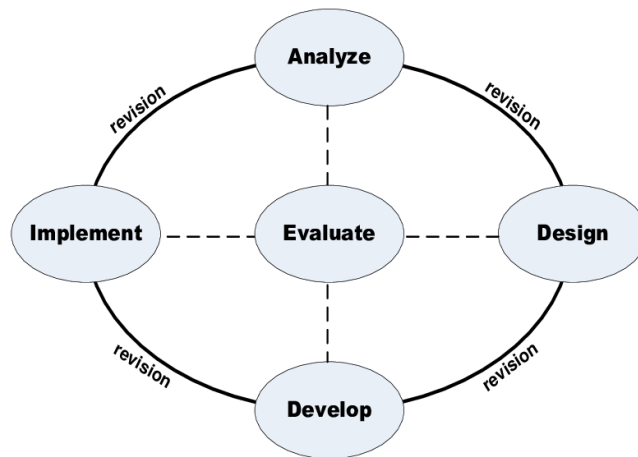


Fig. 5. ADDIE model development design.

In the analysis stage, observations were made at the school by identifying the learning situation and the condition of school facilities and infrastructure, interviews with teachers, and conducting tests on mathematical communication skills. Furthermore, the design stage designs articulate storyline 3 interactive media including making flowcharts, navigation structures, storyboards, and designing learning materials. At the development stage, the designed product was developed based on suggestions and input from the interactive media expert validators and mathematics material experts. Furthermore, limited trials and field trials.

From the results of limited and field tests, interactive media are still being improved based on responses from students. The implementation stage is implementing learning in one of the schools in Tasikmalaya city on social arithmetic material with the help of articulate storyline 3 interactive media. The evaluation stage is a review stage of the implementation results to determine student responses to the interactive media developed and describe the achievements and effect size of using articulate storyline 3-based interactive media on mathematical communication ability. In addition, revisions to the product are made at each stage following suggestions, input, and findings that recommend the need for improvement of the developed product.

Data collection techniques used mathematical communication ability tests, observations, questionnaires, and interviews. Tests to determine the achievement of students' mathematical communication before and after learning. Observation was conducted during the learning process; questionnaires were given after learning both in the limited test and field test to find out student responses. Interviews were conducted to follow up on the results of questionnaires and observations and explore various research findings. The research instruments used were mathematical communication ability test questions, expert validation sheets, observation sheets, questionnaire sheets, and interview sheets. The mathematical communication ability test was in the form of a comprehensive test that included indicators: expressing everyday events in mathematical language or symbols; explaining mathematical ideas, situations, and relationships using tables and algebra; and analysing and evaluating the mathematical thinking used.

The expert validation sheet consists of material expert and media expert validation sheets, covering the components of content, presentation, and suitability of evaluation questions with indicators of mathematical communication skills. While the material expert validation sheet includes components: graphics, appearance, content, and application features. The observation sheet includes aspects of media use and learner activeness. The questionnaire sheet is a readability test that includes clarity of text, images, audio, and animation, clarity of language used, ease of use of interactive media, and ease of learning the material. Finally, conduct interviews with students to dig deeper into the difficulties experienced by students in learning social arithmetic material with the help of articulate storyline 3 interactive media.

Data analysis was conducted using qualitative descriptive, data tabulation, data presentation, and data description. Criteria for the eligibility of interactive media are presented in Table 3 [36]. The Effect size is presented in Table 4 [37]. Data was then calculated using SPSS. Detailed information regarding the use of SPSS is explained elsewhere [38].

Table 3. Interpretation of interactive media feasibility [36].

No.	Achievement	Category
1	81-100%	very feasible
2	61-80%	Feasible
3	41-60%	feasible enough
4	21-40%	not worth it
5	0-20%	very unfeasible

Table 4. Interpretation of the effectiveness of using interactive media [37].

Effect Size (ES)	Interpretation
0 - 0.20	weak effect
0.21 - 0.50	modest effect
0.51 - 1.00	moderate effect
> 1.00	strong effect

4. Results and Discussion

4.1. Articulate storyline 3 interactive media analysis

The result of this research is articulate storyline 3 based interactive media application on social arithmetic named ABAS to explore mathematical communication ability. The feasibility of interactive media, the effectiveness of using interactive media, and the achievement of mathematical communication. articulate storyline 3 based interactive media was developed using ADDIE model with flowchart shown in Fig. 6.

Articulate storyline 3 based interactive media produced in this research is a multimedia-based application that can be used in learning social arithmetic. This application has features that are practical, easily accessible, and compatible with desktop computers and android. The specifications of this application are presented in Table 5.

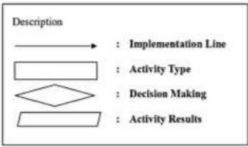


Fig. 6. Interactive media development flowchart.

Table 5. Articulate storyline 3 based interactive media specifications.

Product Identity	Specification
Product Name	Articulate storyline 3 based interactive media
Content	Social arithmetic
Software	Articulate storyline V.3
System	Windows 8.1/10 (32-bit/64-bit)/Mac OS X/VMware
Operation	Fusion (latest version)
Hardware	CPU/RAM, 2GHz resolution 1280 x 800 pixels
Multimedia	Sound card, microphone, webcam
supporting software	- Microsoft.Net Framework V.4.5.2 - Microsoft Visual C++ 2019 Rdistribulatable - Canva
Font	Belleza, Jeepers, Kalam Bold, Comic Sans Ms, Muli Back
Audio Source	Bensound.com, mixtit.co
Navigation Structure	Login, respond login, Reference, Information Application, Developer Profile, instruction, competence, material, video, exercise, evaluation, games

Table 5 shows the product specifications supported by the use of tools for the standard version. The selected operating system uses windows 8.1 with 32-bit capacity, the system remains compatible with windows 10 with 64-bit capacity. Similarly, the use of the product is supported by hardware with a minimum CPU/RAM capacity of 2GHz and a minimum image resolution of 1280 x 800 pixels. The navigation structure is systematically designed to make it easier for

users to access all the content in the articulate storyline 3-based interactive media. The navigation structure also allows users to access the various menus presented freely without having to stick to the order of the material presented. The navigation structure is shown in Fig. 7.

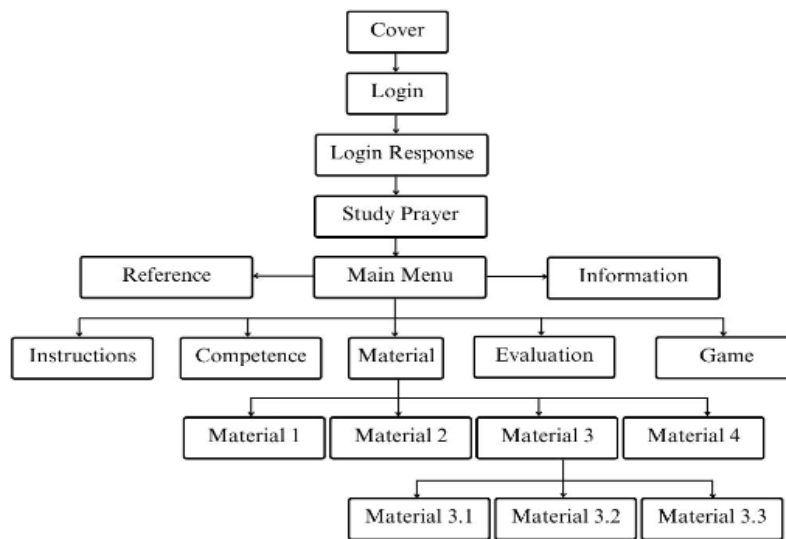


Fig. 7. Navigation structure.

4.2. Features on the articulate storyline

Navigation contained in the page menu is navigation to enter the main page of a particular chapter. To enter the page menu, the user first logs in through the page by filling in their full name and school name. The login content has been set by the researcher by default. Thus, when students click the login button, the user is automatically taken to the page menu. The initial display or start page is 9 seconds long by displaying the ABAS logo which is the name of the interactive learning media application and will switch to the login page when the duration ends. The initial appearance of this interactive media is explained by the ABAS LOGO (Fig. 8).



Fig. 8. Initial view of articulate storyline 3 interactive media.

Navigation is a button that brings the user to the main page of the destination page. There are 5 navigation buttons on the page menu, namely instructions, competence, materials, evaluation, and game. The instruction button contains guidance for users in accessing all content in the interactive media, including all navigation buttons used in the application. The competency button contains information about the competencies to be achieved after the user follows the learning with articulate storyline 3 based interactive media. The material button contains the main material about social arithmetic which is equipped with simulations, learning videos, and examples of problem solving. The evaluation button contains questions that must be solved by the user. Users are also given instructions if they make mistakes in solving the problem. The game button contains entertainment for users to relax. Thus, they do not feel bored during learning. The instructions page and menu are shown in Fig. 9.



Fig. 9. Interactive media instructions and menu features.

In addition, in the learning media based on story line 3, there are also competency pages, materials, and indicators of mathematical communication skills. Social arithmetic materials include social arithmetic phenomenon, profit and loss, interest, discount, tax, gross, net, and tare as shown in Fig. 10.



Fig. 10. Competency features, content, and instructions for use.

With the navigation buttons described above, this interactive learning media is also equipped with a video application of social arithmetic material in everyday life and student worksheets. Students discover the concept of social arithmetic, by working on practice questions through the worksheet (see Fig.11). This interactive

learning media is also equipped with educational puzzle games in the form of games related to social arithmetic material (see Fig. 12).



Fig. 11. Video and worksheet features.

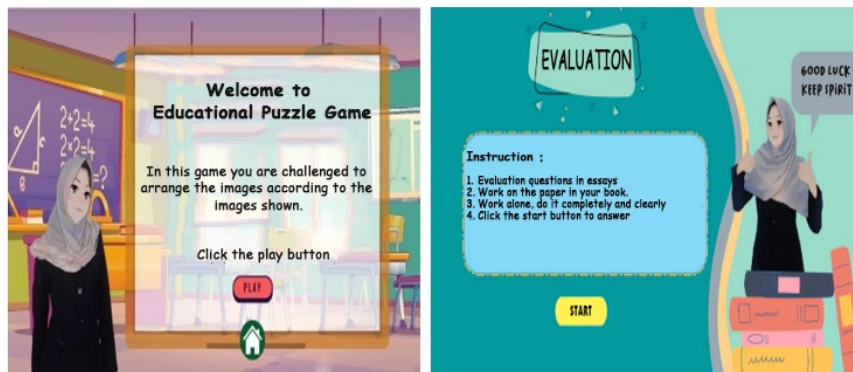


Fig. 12. Educational puzzle games and evaluation features.

To strengthen understanding of the material, there are practice questions and evaluation features to measure students' understanding of the social arithmetic material. The test questions are in the form of descriptions whose answers are separated in the worksheet.

Pre-test and post-test questions

Three sports shops sell the same type of goods. The list of item prices and discounts is as in the following table.

Item name	Price	Discount		
		Adison Shop	Omera Shop	Chioda Shop
Basketball	Rp.100.000/piece	12%	8%	16%
Futsal ball	Rp.80.000/piece	15%	10%	10%
Volleyball	Rp.75.000/piece	6%	14%	8%

The example is in the following:

Mr Riko, a sports teacher, will buy 2 basketballs, 1 futsal ball, and 4 volleyballs. Thus, he writes down the information obtained in the question using mathematical language or symbols. The question uses mathematical language or symbols. Then calculate using tables and algebra where Mr Riko should shop to get the cheapest

price. If Mr Riko has a capital of IDR 3000000 and wants to open a shop that can accommodate 40 balls, he will shop for 2 types of balls, namely basketball and futsal balls. He expects to make a profit of IDR 20000 for a basketball and IDR 15000 for a futsal ball. Which shop should Mr Riko buy to get the maximum profit?

Practice questions to explore communication skills can be seen in Table 6.

Table 6. Practice answering questions.

No.	Problem	Indicator
1	A trader buys 50 books at IDR 5000 for every book. He sells 30 books at IDR 6000 for every book and the rest at IDR 4500. What is the total profit earned by the merchant?	Explain mathematical ideas, situations, and relationships using tables and algebra.
2	Store B gives a graduated discount for two items purchased at once. The first discount is 10%, and the second discount is 5% of the price after the first discount. If the original price of both items is IDR 1000000, what is the total price to be paid after both discounts are given?	Expressing everyday events using mathematical language or symbols.
3	A fruit trader bought 200 kilograms of apples at IDR 15000 for every kilogram. After a few days some of the apples are rotten and he can only sell all the apples at IDR 12000 per kg. Calculate the loss incurred by the trader!	Explain mathematical ideas, situations, and relationships using tables and algebra.
4	Mrs Lina owns a grocery store and is subject to income tax at 15% of her income. If in one month Mrs Lina earns IDR 50000000. How much tax should Mrs Lina pay? Explain your calculation steps!	Analysing and evaluating mathematical thinking.

4.3. Articulate storyline 3 based interactive media feasibility test results

Before being implemented in the field, the articulate storyline 3 interactive media product was first tested for feasibility by interactive learning media experts and mathematics content experts. The results of the feasibility test are shown in Table 7.

Table 7. Results of the articulate storyline 3 interactive media feasibility test.

Expert	Aspect	Score	Category
Material	Contents	90.0	Very worthy
	Evaluation	82.0	Very worthy
Media	Layout	93.0	Very worthy
	Appearance	93.5	Very worthy
	Fitur	98.0	Very worthy

Based on Table 7 articulate storyline 3 interactive media is included in the very feasible category. In terms of content, expert justification reached a very high level of 90%, which indicates that experts provided very good justification for almost all criteria, especially for the criteria of the coherence of the material description, the suitability of the problems included to clarify the content of the material, the suitability of the language used, and the suitability between the material and basic

competencies, competency achievement indicators, and learning objectives. Several improvements were made to the content aspect, including providing additional material on the description of social arithmetic about discounts and profits obtained in sales and adding material on gross, net, and tare.

In the evaluation aspect, material experts gave a justification of 82%, this is included in the fairly high category because the expert justification is in the good criteria, especially in the aspect of the suitability of the question form with the indicator stating everyday events in mathematical language or symbols. In addition, the suitability of the question form with the indicator explains mathematical ideas, situations, and relationships using tables and algebra. Furthermore, the suitability of the question form with the indicator analyses and evaluates mathematical thinking and the strategies used. Improvements made in this aspect include presentation of context that is easier for students to understand, coverage of information in the question, and question commands to present answers in the form of tables and algebra.

The very decent category is also in the results of media expert validation. In the layout aspect, expert justification reached a percentage of 93%, providing very high justification in this aspect, especially in the ease of application access for computer devices and the speed of switching between windows when accessed using a computer. Meanwhile, for resolution, media experts recommend using a computer with higher specifications that allow the use of an operating system above windows 10. In the appearance aspect, media expert justification concluded a very high presentation, which was 93.5%. This can be seen from the media expert assessment rating which meets the very good category in almost all criteria, especially in the criteria for navigation display, colour and font size, and background. Meanwhile, for the feature aspect, media experts rated it at 98%. Expert justification in this aspect is the highest compared to other aspects, especially in the criteria for ease of login access, material access, games, and communication between slides.

The results of expert validation of interactive media following students' responses to the construction of articulate storyline 3 based on interactive media. Based on the results of the questionnaire given to students, the positive response to articulate storyline 3 based on interactive media with an average of 86.57% or is in the very feasible category. Students' responses to articulate storyline 3 interactive media are shown in Table 8.

Table 8. Student responses to interactive media.

Aspect	Score	Percentage	Category
Layout	220	87.3%	very worthy
Appearance	511	86.9%	very worthy
Feature	359	85.5%	very worthy

Looking at Table 8 it can be seen that students' responses to interactive media are in the very decent category. In the layout aspect, the percentage of students' assessment of interactive media reached 87.3%, some students gave quite high assessments, especially in the aspects of ease of access to media, speed of switching between windows, and suitability of screen resolution to be accessed using appropriate computer devices. In the appearance aspect, students' assessment reached 86.9% quite high. This can be seen from the criteria for the appearance of

navigation buttons, proportional and attractive fonts, the appearance of background images and animations, and clear, simple, and easy-to-understand language. In the feature aspect, the percentage of students' assessment reached 85.5% quite high in this aspect as seen from the criteria for ease of access. In the login feature, the material and media features help students to learn the material easily, as well as the evaluation feature to see learning progress easily.

4.4. Mathematical communication achievement and effect size

Effect size of the use of articulate storyline 3 interactive media is influenced by the results of the pretest and posttest of mathematical communication skills. The pretest score was obtained by students before receiving learning with articulate storyline 3 interactive media. The post-test score was obtained by students after receiving learning with articulate storyline 3 based Interactive. The results of the pretest and posttest are shown in Table 9, shows that the achievement of students' mathematical communication skills has increased by 37.67. This shows that the application of articulate storyline 3-based interactive media has a significant influence on the achievement of students' mathematical communication skills.

Table 9. Results of pre-test, post-test, and effect size

Activity	Average
Pre-test	36.57
Post-test	74.24
Pre-test completion	0.19
Post-test completion	0.62
Effect size	1.49

The minimum achievement of mathematical communication skills is set at 70, thus increasing by 19% pretest to 62% post-test. Meanwhile, the effect size is 1.49, thus the use of interactive is in the strong effect category. This shows that articulate storyline 3-based interactive media is very effective in exploring mathematical communication skills.

4.5. Discussion

Articulate storyline 3 based interactive media is a product of this research which is an interactive multimedia that can be used as a medium for learning social arithmetic for junior high school students. The results of the study indicate that articulate storyline 3 interactive media is declared feasible as a learning medium. The feasibility and effectiveness of the aspects of use in learning and the results of the evaluation conducted on mathematical communication skills. This shows that interactive media is very relevant to be used by junior high school students to explore students' mathematical communication skills.

At the design stage of articulate storyline 3-based interactive media, several revisions were made in terms of appearance and teaching materials, practice questions, and evaluation. The revisions were based on input from media and material experts when providing expert judgment and input from students after using interactive media. For example, the navigation between previous pages only contained forward and backward navigation, but experts and users suggested a back-to-home menu on each page to make it easier for users to switch to a specific

page they want. In terms of content, material experts and users provided input on the sequence of materials and contextual problems. For example, gross, net, and tare are terms that are not widely known in everyday life but are often listed in commercial goods. Material experts suggested that the presentation of problems be truly relevant to everyday life. Thus, students can understand them more quickly.

Complete navigation and features in interactive media need special attention from a media designer. This is because students do not experience a dead end in learning the material presented in interactive media. In addition, because the role of teachers in multimedia is only as a facilitator who directs, effective learning multimedia is expected to help students learn without knowing space and time, students can learn independently at home or outside the classroom. Therefore, interactive learning media designers need to anticipate stagnation in interactive multimedia by adding various facilities needed by students without requiring students to ask for help from other parties outside interactive media.

In addition, the sequence of materials and contextual cases are also important points in improving interactive media. In interactive media, materials need to be arranged sequentially. Thus, students can easily learn them [39]. Besides that, problems presented contextually can help students to start learning based on students' daily experiences. Contextual problems can be a starting point for learning where students are immediately involved in solving problems [40]. Furthermore, students use their previous knowledge to solve problems through a gradual mathematization process from simple to complex and from horizontal to vertical.

At the implementation stage of learning, the use of articulate storyline 3 based interactive media in learning does not immediately show effectiveness. The feasibility of interactive media found the advantages and disadvantages of articulate storyline 3 based interactive media. The advantages found from the implementation of articulate storyline 3 based interactive media include can be accessed on a computer offline. Thus, it is easy to use and has a relatively small size. It does not make the computer experience loading when running, elements of interactivity that can eliminate boredom, easy to learn because there are image and video features containing material that can help students understand social arithmetic material, and easy to develop. The weaknesses found from articulate storyline 3 based interactive media are that this interactive media does not have a database to collect student answers in the material menu. Teachers also cannot control how many times students work on the questions. They get the correct answer. In addition, evaluation questions in the form of essays are difficult to present interactively. Thus, students can immediately know whether the answer is right or wrong. Teachers are only able to correct answers manually if the evaluation questions are presented in essay form.

Finally, this study adds new information and ideas relating teaching and learning process in mathematics, as reported elsewhere. Application TJAM is The journey of math, as a mathematics learning innovation with various innovative features such as fun math and math stories, aims to make students love and understand mathematics more so that they no longer feel afraid of this subject.[41].

The results of the mathematical model developed in this study provide a more accurate method in determining the life of a power transformer. By using the 2-furaldehyde (2FAL) content value with Arrhenius parameters and Jacobi and Gauss numerical analysis techniques in MATLAB [42]. The application of ICT in

mathematics teaching in secondary schools is very important and effective in increasing student participation and learning and can be implemented widely [43]. The Journey of Math application has advantages when compared to similar applications, including the fun math and math stories of features, both of which make it easier for students to learn mathematics [44].

5. Conclusion

The development of interactive media based on articulate storyline 3 is effective in improving students' mathematical communication skills. This is following the needs of students from the results of the analysis stage. The ADDIE development method applied through the stages of analysis, design, development, implementation, and evaluation has succeeded in producing feasible media and providing a positive impact on mathematics learning. In addition, this interactive media not only helps students achieve better mathematical communication ability but also provides high motivation for students to learn independently and actively, regardless of space and time constraints. With its superior features, articulate storyline 3 interactive media can present contextual problems that are relevant to everyday life, thereby increasing student involvement and understanding of social arithmetic material.

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