

# Development of Fractional Interactive Multimedia by Strengthening Independent Character of Grade III Elementary School Students

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**Abstract**—This study aims to produce interactive multimedia assisted articulate storyline 3 by strengthening the independent character of grade III fractional material at Bulusidokare elementary school, Sidoarjo. The model used in this research and development is the ADDIE model. Interactive multimedia validation is assessed by material experts, media experts, and users. Furthermore, field trials were implemented in 22 grade III students at Bulusidokare elementary school. Material expert validation reaches a validity rate of 89.28% and media expert validation of 99.47%, which means it is very valid. While in terms of practicality obtained the results of 96% of users, third-grade teachers, and 99.09% of students, which means very practical. Interactive multimedia has potential in learning and students can be helped to learn independently.

**Keywords**—*interactive multimedia, fraction, independent*

## I. INTRODUCTION

Basic science mathematics must be mastered since at the elementary school level. According to Ministerial Regulation No. 22 of 2006, there needs to be a briefing of critical thinking skills, with logic and analysis, coherent, and creative, as well as the ability to collaborate on students by providing math subjects from the elementary school level [1]. Mathematics aims to make students have good reasoning power in solving math problems [2]. Thus, mathematics becomes a very important branch of science to master.

The existence of covid-19 causes the implementation of learning in schools running online. In its implementation, there are undeniably obstacles and challenges. Some of the obstacles in online learning are in terms of economics and learning methods. There are still many teachers in online learning who only give

questions to students [3]. Thus, learning tends to be less exciting and less motivating for students in learning. Therefore, product innovation development is needed to support the learning process.

One of the materials that must be mastered since elementary school level is fractional material that is very related to daily life. The concept of fractional numbers is important to master because it becomes a basic material for studying mathematics and outside mathematics [4]. However, the result of a survey conducted by Apriyasha et al., with a questionnaire distributed to Grade III elementary school teachers showed that the understanding of grade III elementary school students on fractional material is still not good enough. [5]. The low understanding is also evident from the students' learning outcomes on fractional materials below the average Minimum Completion Criteria (KKM). This is in line with the observations made by Alibowo in Grade III elementary school Majalaya VII showing that students' ability to compare simple fractions is still inadequate [6]. An interview with a Grade III teacher at Bulusidokare elementary school on January 23, 2021, showed students had difficulty with fractional material, especially comparing fractions. This is because students are less interested in math content. Therefore, it is necessary to develop fractional material learning media to attract students. The results of a previous interview conducted on October 27, 2020, with Mrs. Nani Budiarti as a grade III teacher at Bulusidokare elementary school, showed that grade III students at Bulusidokare elementary school Sidoarjo were less motivated in the implementation of online teaching and learning activities during the Covid-19 pandemic.

The development of learning media that utilizes technology can make students' motivation rise and

make students more active in learning. The results of research by Setyaningsih et al. show that the implementation of interactive multimedia based articulate storyline can improve students' motivation and learning outcomes [7]. Thus, it can be concluded that interactive multimedia is a learning medium that is worth developing to make students' learning outcomes improve and arouse student motivation.

Interactive multimedia can be accessed by each student in learning. That way interactive multimedia can encourage students to be independent and construct their knowledge. This is in line with the value of character education, namely independent character in the 2013 curriculum. Mustadi et al. suggested that character education should be done since elementary school because at this level instilled the basics of all knowledge and character values that will affect children in the future [8]. Thus, the independent character must be instilled early on. Mandiri refers to the Great Dictionary of The Indonesian Language (KBBI) is defined by one's independence from another [9]. Students who have independent character will be able to develop and control themselves so that the expected goals are realized [10]. There needs to be more attention to character education in elementary school so that students become aware of the importance of good values and have an attachment to do good in their formal educational environment or their daily lives [11]. Character education can be done in an integrated manner in the learning process as well as habituation programs.

Multimedia based on The Great Dictionary of Bahasa Indonesia (KBBI) means all kinds of means or information provided by voice, graphics, animation, and text on a computer [9]. Multimedia can be interpreted as the ability of the system in conveying information in the form of text, images (graphics and photos) or animated images (animations and movies), sounds, and others [12]–[15]. The merging of some of these elements if it causes interaction between multimedia and its users, it is said interactive multimedia. Thus, it can be concluded that interactive multimedia is a medium that involves various senses in learning and there are instructional steps for users to be actively involved and gain hands-on experience.

The application of use of interactive multimedia as a learning medium has several advantages. The advantage of interactive multimedia is to attract senses and interests because it combines views, sounds, and movements. Multimedia that combines various senses can facilitate a variety of students who in fact have different types of learning [16]. Furthermore, Ingsih et al., explained that the use of interactive multimedia can make motivation and efficiency increase and provide facilities for students to learn actively, with experiments, and still with teaching and learning activities that make students as the center of learning in order to learn better [17]. Learning media has several

components so it can be said as multimedia. The characteristic of interactive multimedia spoken by Ummah is that with interactive multimedia students can interact during the course of learning [12]. Articulate storyline according to Leztiyani is a tool that becomes a material in teaching with interactions that can build the spirit of students in the learning process because it has a variety of practical menus and several facilities that can support the learning process to be more enjoyable [18]. Articulate Storyline according to Rafmana & Chotimah is software that is used for information delivery tools or tools to present something with a template that can be created by yourself or from what has been provided by choosing as desired [19]. Products produced from this software in the form of web-based media (html5) or application files (.apk) can be operated on a variety of devices including laptops and computers, tablets, and gadgets.

Implementation of interactive multimedia based on articulate storyline can make students motivated to rise and stimulate students in learning activities when planning the proper utilization of users, useful as a medium to increase and expand knowledge. So that students can be helped in behaving, thinking, and developing further, and giving high motivation [19]. The advantage of Articulate Storyline app according to Amiroh is that articulate storyline feature is very similar to the feature that Microsoft PowerPoint has [20]. So this app is easy to use for early users who already have basic media making skills by utilizing Microsoft PowerPoint. Meanwhile, advanced users can produce more interactive and powerful learning media. In addition to these advantages, the file size of the publication and conversion of the application is relatively small, so it is lightly installed on the device. The advantage of articulate storyline according to Leztiyani is that it can produce delivery tools in very interesting learning [18]. Through articulate storyline can be made a practical menu for additional quizzes to allow students to interact directly.

Fractional materials are studied at the elementary school level from both low and high grades. Fractions defined by Prindle & Prindle are a part of a whole, meaning fractions are part of the whole [21]. Fractional numbers are represented by  $\frac{a}{b}$ , where  $b \neq 0$ . Fractions consist of numerators and denominators. The fragments spoken by Nuraini et al. include basic concepts that are nothing but concepts of science that become an important requirement to study and understand materials in mathematics [22]. Mastery of the basics of strong mathematics is required [23]. So students must master fractional material which is basic knowledge.

Based on the urgency of the above problems developed interactive multimedia with the title "Development of Multimedia Interactive Fractions to Encourage Independent Character of Grade III Elementary School Students". This is because, in previous research, students' learning outcomes proved

to be improved through interactive multimedia. Students love to take advantage of interactive multimedia [24]. Articulate storyline application used has several advantages, among others, the results of publications are relatively small and lightly installed, and are interactive and can produce interesting media.

## II. METHOD

Research conducted using research development or Research and Development (R&D). The ADDIE model developed by Lee & Owens was applied in this study. According to Darlen et al., Lee & Owens model or commonly known as the ADDIE model includes five stages, namely: (1) analysis; (2) design; (3) development; (4) implementation; and (5) evaluation [25]. This model was chosen because the consideration of the steps in this model has complete stages.

The first stage of analysis and assessment of needs. This stage includes two activities, namely need assessment analysis and front-end analysis. The assessment of needs is carried out by applying observation and interview methods. Front-End Analysis is implemented to find techniques that can be used as solutions to gaps. Front-End Analysis includes user analysis, technology, situations, important events, objectives, and media. The second stage is design, this stage is the stage of making material structures and evaluation tools, manuals, storyboards, as well as validation and practical instruments. Furthermore, after the results of the design, consultation was conducted on the supervisors and teachers of Grade III Bulusidokare elementary school, Sidoarjo Regency.

The third stage is the development for the realization of the product. In the development there is a prevalidation by consulting the product to the supervisor, then assessment of eligibility or validation by material experts, media experts, and field practitioners or users. The fourth stage is the implementation, the product that has been developed is tested on the targeted party. Subjects in the trial were categorized into two types: limited trial subjects and field trial subjects. The subject of the limited trial was 4 grade III students at Bulusidokare elementary school for a small-scale trial. While the subject of field trials is 22 grade III students of Bulusidokare elementary school for field trials. After the learning process, students fill out a product practicality questionnaire. The last stage is an evaluation to assess the level of conformity of the product to the required.

Instruments used to collect data in this study in the form of interview instruments, questionnaires analysis of student needs, instruments of validity and instruments of practicality, and documentation. The data obtained in this interactive multimedia research and development is qualitative and quantitative data. Qualitative data is analyzed using qualitative techniques, while the results of the filling of validity instruments and practical instruments are analyzed

using quantitative techniques. The quantitative data obtained is then analyzed with descriptive quantitative techniques with scores and percentages that will show the level of criteria. The scale used is the Likert and Guttman scales. Guttman's scale is utilized to analyze the practicality of interactive multimedia. According to Sugiyono, the Guttman scale is the scale to obtain answers from respondents by utilizing only two intervals [26]. In this development research, the word used is "yes-no". Then the total score of the answer is accumulated. The data obtained from the validation instrument is then determined by the level of criteria by using a validation formula that refers to Akbar [27]. The formula is as follows.

$$Vah = \frac{Tse}{Tsh} \times 100\%$$

Vah = Tse/Tsh x 100%

Vah = Expert validation

Tse = Total empirical score achieved

Tsh = Total expected empirical score

After the data is obtained then conducted data analysis with quantitative descriptive analysis techniques with the distribution of scores and percentages on the criteria of the assessment scale that has been determined. Criteria are distinguished based on the degree of achievement obtained. 85.01-100 is categorized in very valid criteria so that the test decision can be used or implemented without improvement. 70.01-85.00 means valid enough that it can be implemented but needs to be fixed small. 50.01-70.00 is interpreted as invalid so that it can be implemented with major improvements. 01.00-50.00 means invalid so it is not worth using [27].

The next analysis is the analysis of student questionnaire data with Guttman scale that presents a choice of firm answers that is "yes-no". The answer "yes" gets a value of 1, while the answer "no" gets a value of 0. Furthermore, analysis of the results of the questionnaire using the formula from Yamasari [28] as follows.

$$P = \frac{xi}{xmax} \times 100\%$$

Keterangan:

P = Percentage score

Xi = Number of selected scores

Xmax = Maximum score amount [28]

From the data of the above analysis results are then obtained conclusions about the student's response to interactive multimedia. The percentage of criteria and the level of practicality of the assessment results are described as follows. Based on the level of achievement in percentage, the criteria of practicality level are divided into four, namely the level of achievement  $76 < P < 100$  means it is very practical, so that it can be implemented without improvement,  $51 < P < 75$

means practical, so that it can be implemented but needs to be fixed small,  $26 < P < 50$  means less practical and can be implemented with major improvements,  $0 < P < 25$  impractical so it should not be implemented.

**III. RESULT**

This research and development produces a product that is interactive multimedia with independent character reinforcement through articulate storyline 3 on fractional materials of grade III SD. The product is made attractively equipped with visual and audio offerings that match the characteristics of grade III elementary students, as presented in Figure I below.



Figure 1. Interactive Multimedia Home Page

After product development is then validated. Validation results are obtained from due diligence by material experts and media experts, as well as practicality tests from users, namely grade III teachers and 22 grade III students. The assessment by the material validator obtained a result of 89.28% which means very valid. Thus interactive multimedia products with independent character reinforcement can be implemented in the implementation of learning without improvement. However, the lecturer material expert gives a note. So, before conducting product trials, the product is first repaired according to the records provided by the lecturer material expert.

After that, the feasibility test is conducted by media experts, namely media experts lecturers, and media experts users or teachers. Media validation results obtained a result of 99.47% which is declared very valid. So that the product can be implemented without improvement in the implementation of learning. The last validity test was conducted to the user, namely a grade III teacher by presenting 47 aspects of the question that include an assessment of the material and the appearance of the product. From the results of user validation obtained results of 96% which is stated to be very practical. So that the product can be implemented without improvement in the implementation of learning. The following is a detailed explanation of the validation results that have been obtained in Table 1.

TABLE I. FEASIBILITY TEST RESULTS

No.	Validator	Validation Value	Criterion	Information
1.	Material Experts	89.30%	Very valid	Can be used without revisions
2.	Media Experts	99.47%	Very valid	Can be used without revisions
3.	User Experts	96.00%	Very practical	Can be used without revisions

After validation, the students of grade III Bulusidokare elementary school were tested. Implementation through trials is carried out twice, namely small-scale trials and field trials. Here are the test results are shown in Table 2.

TABEL II. TEST RESULTS

No.	Trial	Validation Value	Criterion	Information
1.	Small-scale	96.42%	Very practical	Can be used without revisions
2.	Large-scale	98.68%	Very practical	Can be used without revisions

From small-scale trials conducted on 4 students, the practicality of the product was obtained by 96.42%. So that the product is categorized as very practical and can be implemented without improvement. Then field trials conducted on 22 students showed practicality results of 98.68%. So that the product is categorized as very practical and can be implemented without revision. Meanwhile, the learning results obtained by students through the evaluation question work showed the overall score reached above the Minimum Completion Criteria (KKM) and passing score, with an average score of 88.6.

Referring to the results of field trials obtained positive responses from students on interactive multimedia developed. Based on the trial concluded that (1) Students easily understand learning materials with interactive multimedia, (2) Students can learn independently using interactive multimedia, (3) Students are interested and like interactive multimedia, (4) Interactive multimedia displays that display images, animations, and videos with clear sound and liked by students. Overall, students are helped to self-study with interactive multimedia and the activities in it can make students excited and feel good about learning.

The results of the research that has been presented show that interactive multimedia developed is very feasible and very practical to be implemented in fractional teaching and learning activities. Interactive multimedia assisted articulate storyline 3 with self-contained character reinforcement produced is appropriate and feasible to be implemented. It is based on the assessment of the material expert validator, media expert, user (grade III teacher), student response as a test subject, as well as student learning outcomes.

So that interactive multimedia products assisted articulate storyline 3 with self-strengthening characters can be used in learning.

IV. DISCUSSION

Interactive multimedia is a medium that involves various senses in learning and there are instructional steps for users to be actively involved and gain hands-on experience in learning. Interactive multimedia developed brings interaction between media and students. This is similar to that revealed by Paseleng &Arfiyani that interactive multimedia is interactive with the ability to respond to users [29]. The material presented in this interactive multimedia is easy to learn because it is equipped with visual assistance in the form of images. Students are invited to explore the material through the presentation of questions with reciprocity according to the student's answers. So that makes learning interactive and not boring. Display the material in interactive multimedia as shown in Figure 2.

This interactive multimedia is equipped with a guidebook and instructions for use contained in the interactive multimedia. There are six menus in interactive multimedia, namely the Let's Learn menu for materials, objectives, instructions, developers, exercises, and evaluations. The material is presented through the story systematically from easy to difficult material and with a methodical plot. Students in learning are given interacting experience and knowledge related to fractions that are closely related to daily life. The product is presented according to the thematic learning of grade III on fractional material, namely the theme of weather.

Interactive multimedia developed can respond to the answers chosen by students not only during evaluation work, but also at the time of material. Similar to what was revealed by Hadi et al. that interactive multimedia makes the person who operates it can manage what and when the components in the multimedia will be displayed [30]. In this multimedia, students are given questions and questions that will later display the response according to the student's answer. Thus, students are trained to construct their own knowledge. Broadly speaking, there are several components that become interactive multimedia elements developed, namely text, graphics, audio or sound, video, animation, and interactive elements.

Validation is performed after the product has been developed. The results of the interactive multimedia material expert feasibility test assessed by lecturers and material experts of teacher users obtained fairly high feasibility of 89.28%. So it is very good to be applied in the implementation of learning. The results can be concluded quite well because previous research conducted by Syabri & Elfizon that developed interactive multimedia assisted articulate storyline resulted in material validation of a total of 86. Material experts also commented that interactive multimedia

applications contain interesting multimedia [31]. This is similar to that revealed by Ingsih et al., which explains the advantages of interactive multimedia is to attract senses and interests, because it combines views, sounds, and movements [17]. In addition, material experts also provide feedback for product improvements by adding or improving the visual aids shown in some sections. In line with the results of the study by Selamat &Ketut who concluded that the use of visual media can make students' learning outcomes improve [32]. That way, the role of the visual aspect is very important so that students' understanding of the material learned becomes easier.

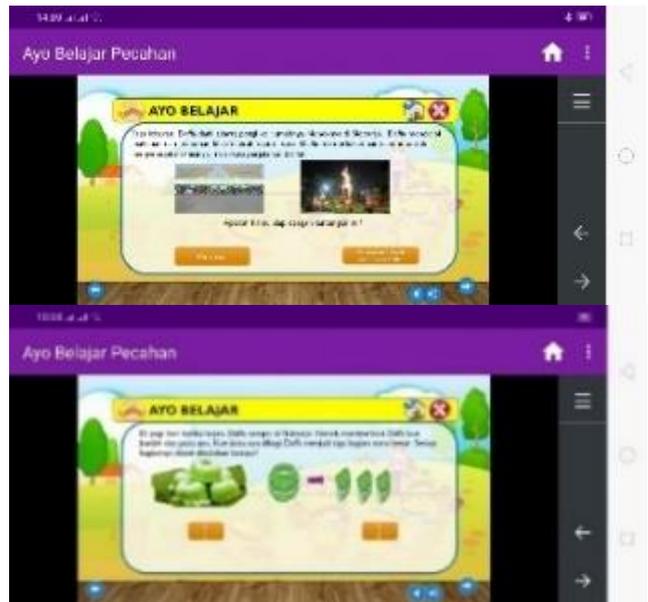


Figure 2. Display of Materials in Interactive Multimedia

The feasibility value of media experts also obtained a high yield of 99.47%. Thus, interactive multimedia products can be utilized in learning without improvement. The results of this media feasibility test are quite good because previous research by Aulia &Masniladevi has developed interactive multimedia with articulate storyline showing media feasibility of 95.55% [33]. Media experts reveal that the media is complete and good. Using the app is easy to understand, makes learning fun, and there are review questions. In line with what Leztiyani revealed that articulate storyline is a medium that can build the spirit of students because it has a variety of practical menus and some facilities that can support the learning process to be more enjoyable [18]. That way, it's proven that articulate storyline can make learning feel fun.

After the product is tested for feasibility by material experts and media experts, the next is the validation of users or field practitioners namely grade III teachers to assess the practicality of the product. Teachers rate the practicality of interactive multimedia quite high at 96%. That way interactive multimedia products can be implemented in learning without improvement. The

feasibility of this user is categorized as good enough because previously Aulia & Masniladevi developed interactive multimedia with user validation results of 92.22% [33]. Teachers or expert users comment on interactive multimedia that is the exposure of materials and questions in the application is easy to understand and there are reviews of questions, materials submitted accordingly, there are examples of questions and exercises, the weight of the problem is described from easy to difficult, as well as interesting, easy to use, and make learning fun. So it can be concluded that interactive multimedia applications are practical for teacher users.

After passing the validation stage, the product is tested on grade III students. Trials are differentiated into small-scale trials and field trials. Small-scale trials were conducted on grade III students with a total of 4 students. Student trials are conducted online through google meet. In small-scale trials, practicality was high at 97.5%. That way the product can be continued to the field trials. The field trial was conducted on grade III students of Bulusidokare elementary school with a total of 22 students. The field trials obtained a fairly high practicality result of 98.68% so that the product can be implemented without any improvement. The results of this trial can be said to have been very good because the results of previous research by Rianto who has developed interactive multimedia with an articulate storyline showed the results of the student response 84.75% [34]. So it can be concluded that interactive multimedia applications are practical for student users.

The use of interactive multimedia in learning needs to be identified whether it has benefits for students. These benefits can be characterized by student responses in learning, student response questionnaire results, and student learning outcomes. Students' learning outcomes can be known through evaluations conducted after learning. The evaluation presents 20 questions in the evaluation menu that will immediately display the students' learning results after completion. After working on the evaluation question, students can also review the answer.

Students' responses can be known through the learning process and the results of filling out questionnaires by students. Students' response to interactive multimedia products with the strengthening of the self-character of fractional material is very positive. Grade 3 students at Bulusidokare elementary school, 22 children, enthusiastically participated in the learning that utilizes interactive multimedia. This is seen in the student's response during learning. Students do not get bored while studying with interactive multimedia and are excited while learning. This is in line with the opinion of Rafmana et al. which states that students can be raised learning motivation and stimulated to be active in learning activities with interactive multimedia-based articulate storyline if the user is planned to use it appropriately, useful as a

medium to add and expand knowledge insights [19]. So, it can be concluded that the multimedia developed has been planned to use appropriately because it can encourage the spirit of students.

Students can be interested in interactive multimedia being developed and easier understanding of materials. In line with the statement by Leztiyani who stated that the advantage of articulate storyline is that it can produce a very interesting teaching material tool [18]. This is seen when learning to the end, students enthusiastically answer questions from the teacher. Students can also well conclude the material they are learning through the app. Students' understanding is also proven through the results of the evaluation question that is above the Minimum completion criteria (KKM). In line with previous research conducted by Setyaningsih that proves the use of interactive multimedia can make students' learning outcomes improve [7]. Students achieved an average score of 88.6. Thus, it can be concluded that the student has understood the material studied. Previously based on the results of a need analysis questionnaire, more than half of students experienced obstacles to fractional material and felt something was not understood from the material.

An interactive multimedia display featuring images, animations, and videos with a sound visible and loved by students. Thus, learning becomes more fun and fun by using interactive multimedia. This is similar to that revealed by Rafmana that the quality of learning can be improved with the interactive multimedia-based articulate storyline [19]. Students will play an active role in learning using interactive multimedia. So that students get their learning experience directly and learning becomes more meaningful.

Students can be trained to be independent in teaching and learning activities with the implementation of interactive multimedia. It can be seen in the learning process, students can operate interactive multimedia without the assistance of others. Students also have no difficulty in operating the app. The response questionnaire results showed most students were encouraged to be independent by using interactive multimedia. Self-reliance is the habit of individuals who are not easily dependent on other individuals [35]. Student independence is also seen when students reveal that this interactive multimedia is easy to use and the material is easy to understand. In line with what was revealed by Paseleng & Arfiyani that the characteristics of interactive multimedia one of them is to have independent nature, in the sense of presenting the ease and completeness of content that makes it operable by users can be without the need for guidance and help from others [29]. Thus, the interactive multimedia developed is quite feasible to form the independent character of the student.

Referring to the product trials that have been implemented, there are several advantages of

interactive multimedia that has been developed, namely interactive multimedia can be accessed with gadgets or on laptops or computers. In accessing students also do not need an internet connection so it saves costs and students can become more focused because it can be used when offline. The next advantage is that interactive multimedia is presented with an attractive and interactive display [16]. In accordance with ummah's speech, interactive multimedia learning media allows students to interact during the learning. That way students become not bored and encouraged [12]. The process of understanding students becomes easier to understand and interested in the materials studied.

## V. CONCLUSION

Referring to the due diligence of materials, media, and users, the product developed can be concluded to have been very valid. Material validation has a feasibility level of 89.28% and media validation of 99.47%, which means it is very valid. Meanwhile, in terms of practicality gained 96% of users namely grade III teachers, and 98.68% of students, which means very practical. Thus, the product can be concluded worthy of use in the field. Products can help students learn independently and provide some benefits in learning. Interactive multimedia development has a potential effect in uplifting students' learning. Product dissemination can be done by paying attention to the characteristics of the students and the intended school.

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