

## **Development of an android-based fractional education game with independent character strengthening**

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**Abstract:** Media use in mathematics learning in elementary schools is crucial. One technology-based media that can make it easier for students to learn while playing is educational games. This development research aims to produce an android application in the form of an educational game with independent character strengthening that is feasible and practical to be used as a learning medium for mathematics fractional material for grade 4 elementary school students. This research uses the ADDIE model's research and development, which consists of five stages: analysis, design, development, implementation, and evaluation. Media feasibility assessments are carried out by material experts, media experts, and teachers. The students assessed the practicality of the media after using the media at the time of the trial. The data collection instruments used in this study were questionnaires, interviews, observations, and evaluation tests. The results showed that: (1) validation results from material experts, media experts, and teachers show that educational game media is very suitable for use in learning, (2) the results of student response questionnaires in large and small group trials show that practical educational games are used as mathematics learning media for fractional material for grade 4 students, (3) learning outcomes and student independence character increase after learning to use the media.

**Keywords:** Educational Games, Android, Fractions, Independent Characters.

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## INTRODUCTION

An important component that plays a role in achieving learning objectives is learning media. Learning media is a tool to convey messages in the form of material to fulfill student learning activities so that students can actively participate in the learning process (Widodo, 2018). Puspitarini & Hanif (2019) stated that the use of media appropriately could support learning goals effectively and efficiently. Using appropriate and interesting media can also increase achievement and motivate students in their learning activities (Sunarti et al., 2016). One of the learning content that requires media in the learning process is mathematics.

Mathematics is essential to learn because it is the basis for developing other fields of science, including science and technology and its role is never separated from life. Mathematics becomes the main content taught at every level of education. According to Kemendikbud (2006), teaching mathematics can train students' ability to think critically, logically, systematically, and creatively. One of the mathematical materials that fall into the scope of numbers is fractions.

Fractions include fundamental concepts and are one of the prerequisites for understanding and studying other mathematical materials, so students need to master the concept of fractions (Nuraini, Suhartono, & Yuniawatika, 2017; Suciati, 2020). However, the fractional material is still difficult for students to understand. Fractions have long been problematic in elementary schools (Kyriakides, 2011). The problem is related to students' mastery of the understanding of fractional material, such as how they solve problems related to simplifying fractions, to feel confused to determine the process of solving them (Firdaus, 2020; Mandarsary & Tika, 2017).

Seeing that there are several problems regarding fractional material, teachers, as educators need to find solutions to overcome these problems. The concept of fractions is used to study the mathematics of the other. So that if students have difficulty understanding the concept of fractions, students will undoubtedly have difficulty in learning the following mathematical material.

There are several efforts that teachers can make to help overcome student learning difficulties, including by providing learning media that are tailored to the characteristics of students at their age level (Ekayani, 2017). Elementary school-age students enjoy physical activities such as playing and doing things in person (Agustina, 2018; Kurniawan, 2015). So learning designs with games can be used as a strategy in realizing mathematics learning that is more fun and meaningful for students. Game-based activities can be an alternative to teaching material to students compared to traditional teaching methods (Yagmur, 2020). Through games, students can explore complex mathematical ideas and have various mathematical experiences (Buchheister, Jackson, & Taylor, 2017).

The rapid development of information technology has also affected the field of education, especially in learning media. This is in line with Patmanthara's opinion which states that the development of technology and education is inseparable (Patmanthara, 2014). The existence of increasingly sophisticated technology gives rise to new innovations in learning and provides convenience in making learning media. (Faridy, Untari, & Mudiono, 2019; Jamun, 2018). The use of digital technology makes learning more innovative and interesting, thereby increasing student learning motivation (Budiarto, Joebagio, & Sudiyanto, 2020).

Android smartphones are a popular communication technology and are much loved by all circles, from children to adults. In addition to being a communication tool, smartphones can be expanded as a learning media (Sinaga, Trisnarningsih, & Pujiati, 2019). Smartphones can be used as an innovative, creative, interactive, and interesting learning media for students (Putra, Nugroho, & Puspitarini, 2016). One interactive media that smartphones can create is educational games. Educational games are a form of media that integrates games with education designed to provide a learning experience to students (Krisbiantoro & Haryono, 2017; Putra et al., 2016).

Educational games can also be used as a learning medium as well as a learning resource by students independently without being limited by space and time (Sari, Saputro, & Hastuti, 2014). As a source of independent learning, educational games can help students in their learning activities, whether with the help of teachers or not.

The success of previous research that is relevant to this research is one of the proofs that educational games are effectively used. One of them is research that Shela Dwi Ariyanti and Ika Rahmawati developed an Android-Based Happy Chef Game for material comparing fractions considered feasible to use, interesting, and can increase students' enthusiasm for learning (Ariyanti & Rahmawati, 2019).

Considering that the learning of the 2013 curriculum is character-based, the development of learning media carried out must be accompanied by character strengthening. It aims to form students with character even though they are in the digital age. One of the character values that can be integrated and strengthened in the learning process is an independent character (Kholil, Bali, & Fatimah, 2021). Based on the interview results, the teacher said that the independent character of the students has not yet developed. Most students still rely on the help of teachers, friends, and parents to complete their tasks. Thus, the character of this independence needs to be a concern for teachers.

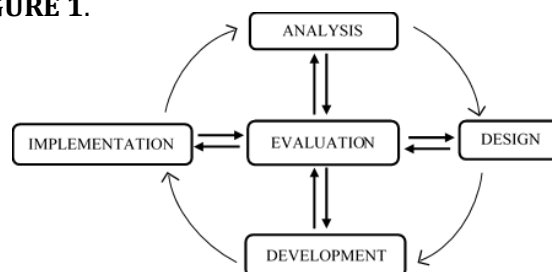
Independent character is one of the crucial characteristics owned by students. Independent character will improve a student's life better, not always tied to the help of others, and can train the student to overcome the problems he faces independently (Husna, 2017). Ahmad Tafsir said that the implementation of character education in learning could be done in various ways, namely through subjects, the learning process, as well as in the selection of teaching materials and learning media (Julaiha, 2014).

Departing from several problems that occurred and relevant previous research, it was used as the basis for research on the development of android-based fractional material educational games. The development of educational games is carried out so that students and have practical mathematics learning media, can help students to understand fractional material, and train students to learn independently. Thus, this development research aims to produce android-based fractional educational game media with independent character strengthening for grade 4<sup>th</sup> elementary school students that is valid according to material experts, media experts, and teachers and practical according to students.

## METHODS

### Research Design and Procedures

The research method used is a research and development method, in other terms it is called research and development (R&D). R&D are research method used to produce a product and test its effectiveness of the product (Sugiyono, 2015). This development research method uses the ADDIE model which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation (Tegeh & Kirna, 2013). In general, it can be shown in **FIGURE 1**.



**FIGURE 1.** ADDIE research model

The stages of research and development of the ADDIE model can be described as follows: (1) The analysis stage, is carried out to determine the needs of developing learning

media and problems experienced by students in mathematics learning. Needs analysis is carried out through disseminating of questionnaires to students and interviews with class teachers. After the analysis is carried out, it is then evaluated to determine the solution of the existing problem. (2) The design stage consists of two steps: product design and validation instrument preparation. The first step in product design is to arrange materials and questions based on fractional material indicators, as well as create a game framework in the form of flowcharts and storyboards. The second step is to develop validated instrument to assess the feasibility of educational games in terms of material and media. (3) Development stage is the product realization stage where android educational game products are made and developed according to the design that has been designed in the previous stage. At this stage, the finished product is validated by validators for feasibility. The results of input and suggestions are used as a basis for product revision or improvement. (4) Implementation stage, this stage is the product trial stage for students. Trial activities were carried out in small and large groups. (5) Evaluation stage is the product review stage to see and correct errors that were still present in the previous stage. This evaluation is carried out at every stage of the research.

### Research Subjects

The research subjects in small and large group trials have different abilities, learning styles, and motivations. The students who were the subjects of the study in the small group trial and the large group came from two different schools, but they both had almost the same characteristics. Both schools are located in rural neighborhoods close to residential areas. However, the environment of these two schools is safe and comfortable for student learning activities. The availability of learning media facilities in these two schools is limited. The teaching and learning methods used by teachers from both schools are conventional. Characteristics of the subject of the study can be seen in **TABLE 1**.

### Data Collection and Analysis Techniques

The data obtained from the study are qualitative and quantitative data collected using data collection instruments. The data collection instruments used in this study were in the form of interview guidelines, needs analysis questionnaires, validation questionnaires, evaluation tests, and student response questionnaires.

Interview guidelines are aimed at grade 4<sup>th</sup> teachers to find out problems in learning and student characteristics. The interview data is then analyzed qualitatively. The grid of interview instruments is presented in **TABLE 2**. The questionnaire analyzes the needs of learning media, intended for students to find out students' needs for mathematics learning media. The grid of needs analysis questionnaire instruments is presented in **TABLE 3**.

This needs analysis questionnaire uses the Guttman scale with two answer options, "yes" and "no". The data collection results from the needs analysis questionnaire were then analyzed quantitatively in the form of percentages using the formula from Bungin (Munggaran, 2012). The expert validation questionnaire is aimed at material experts, media experts, and teachers to find out the feasibility of educational game media in terms of material and media. The grid of expert validation questionnaire instruments is presented in **TABLE 4**.

The questionnaire validation result was analyzed quantitatively using the Likert scale, which ranges from 1 to 4. The scores from the results add up the scale in each aspect of the questionnaire filled in by material experts, media experts, and teachers are converted into percentage forms by referring to the formula from Sa'dun Akbar (Akbar, 2015). Then, the inputs and suggestions of the validators are analyzed qualitatively.

Evaluation test, has aimed at students at the end of learning using educational game media at the time of the trial. The evaluation test is used to determine student learning outcomes on fractional material after using educational game media. The evaluation

questions consist of 15 questions in the form of multiple choices and descriptions. The examination grid of evaluation tests is presented in **TABLE 5**.

**TABLE 1.** *Research subjects*

No.	Trial Phase	Amount	Averager Age	Gender		Characteristics
				Man	Woman	
1.	Small groups	3	9 - 10 years	1	2	The level of student ability to understand the material is selected from high, medium, and low
2.	Large groups	16	9 - 10 tahun	10	6	The level of students' ability to understand the material varies

**TABLE 2.** *Interview grid with a grade 4 teacher*

Aspects	Indicators
Learning	a. Problems regarding learning b. Content that requires the development of learning media
Student Characteristics	a. Number of students b. Student learning outcomes c. Students' interest in learning d. Problems that often arise

**TABLE 3.** *Needs analysis questionnaire grid*

No.	Aspects
1.	Mathematics Learning
2.	Material that students have not mastered
3.	Availability of learning media
4.	Desired learning media
5.	Characters that can be integrated in educational games

**TABLE 4.** *Material, media, and teacher expert validation questionnaire grid*

No.	Aspects	Indicators
1.	Presentation of material	a. Completeness of presentation b. Supporting the presentation c. Material presentation technique
2.	Presentation of the display	a. Game presentation techniques b. Ease of Use c. Ministry of Presentation
3.	Linguistics and their readability	a. Use of Language b. Readability
4.	Independent Character	a. Demanding responsibility b. Train self-confidence

**TABLE 5.** *Evaluation Test Grid*

No.	Indicators	Questions Type	
		Multiple Choice	Essay
1.	Defining the concept of Fractions	3	2
2.	Simplifying Fractions	3	1
3.	Determining fractions worth	4	2
	Number of questions	10	5

The data of the evaluation test results are quantitatively analyzed. If the student answers each question correctly, they get a score of five on multiple-choice questions ten on description questions. If the student answers the question incorrectly, they will get a score of 0.

Questionnaires of student responses to find out the practicality of the media and assessments regarding the strengthening of independent character in educational game media. The student response questionnaire grid is presented in **TABLE 6**. Student response questionnaires are created using the Guttman scale. The Guttman scale has two intervals of "yes" and "no". If "yes" gets a score of 1 and if "no" gets a score of 0. After that, the results of the questionnaire were analyzed quantitatively using a formula from Suharsimi Arikunto (Arikunto, 2010)

**TABLE 6.** *Student response questionnaire grid*

<b>Aspects</b>	<b>Indicator</b>
Practicality	Ease of Use
	Ease of facilitating learning activities
	Ease of using language
	Ease of game guidance and hints
Independence	Demonstrate a sense of responsibility
	Showing self-confidence

### **Research Prosedure**

Data acquisition comes from interviews with 4th-grade teachers,, needs analysis questionnaires, material expert validation questionnaires, media experts, and teachers, student response questionnaires, and evaluation tests. The interview activity was carried out with the 4th-grade teacher on January 26, 2021. After conducting the interview, the next activity was filling out a needs analysis questionnaire by grade 4 students on February 12, 2021, through a google form. From the interview results, problems will be known and media development will be carried out. Furthermore, the media that has been developed is validated with material experts, media experts, and teachers on September 13, 2021. The validation results know the feasibility value, input, and suggestions for media improvement.. After that, a media revision was carried out based on expert input and advice.

Furthermore, the media was tested twice, namely the small group trial on November 20, 2021, and the large group trial on November 22, 2021. During learning, observations are made regarding the independent character of students when learning to use media. At the end of the trial activity, students did the evaluation questions and filled out the student response questionnaire. From the results of the evaluation test, student learning outcomes will be known after using the media and from the results of the student response questionnaire, it will be known the practicality and strengthening of independent character in the media.

### **RESEARCH RESULT**

The results of the research and development of "Android-Based Fractional Education Game with Independent Character Strengthening" for grade 4 elementary school students are described based on the research and development stages of the ADDIE model, which are analytical, design, development, implementation, and evaluation. The research and development results of an Android-Based Fractional Education Game with Independent Character Strengthening are explained as follows.

## Analysis

The analysis is the initial stage of analyzing the needs of the problem, which occurs in mathematics learning. The analysis is carried out through three stages, needs curriculum and student characteristics Mathematics learning, especially in fractional materials, still encounters some problems. During an interview with a 4th-grade teacher, the teacher said "when learning mathematics, it is rare to use learning media. Because the mathematics learning media in schools is still lacking, we only use existing media such as LKS and package books in learning, and learning videos are also rare. Many students are still confused about understanding fractional material. There are also many students' scores on fractional material that have not met the minimum completion criteria. Because students may not understand the teacher's explanation and the book's material, they often ask the teacher and their friends when answering questions. So that the independent character of this student becomes undeveloped".

The results of the needs analysis questionnaire that was distributed to students supported the interview's results. The results of the questionnaire can be seen in **TABLE 7**.

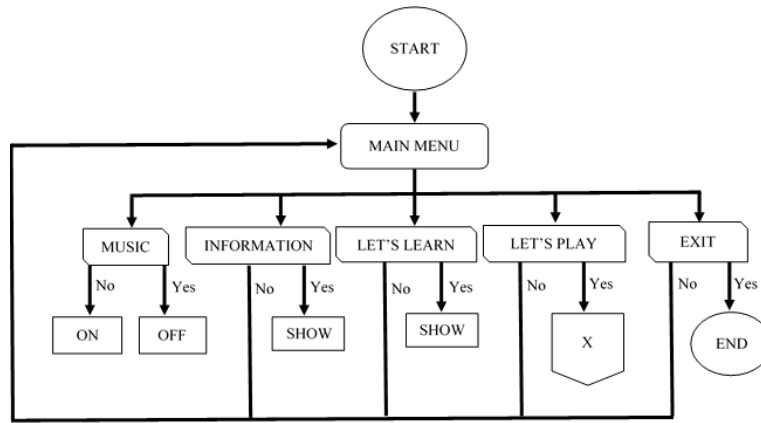
**TABLE 7.** Results of the needs analysis questionnaire

No.	Indicators	Percentage (%)	Average Percentage (%)
1.	Mathematics Learning	93,75	
2.	Mathematics material that students have not mastered	81,25	
3.	Availability of learning media	91,67	87,92 %
4.	Desired learning media	79,16	
5.	Characters integrated into educational games	93,75	

Referring to the percentage category adopted from Munggaran (2012), questionnaire results were input at 76%-99.9%, which showed that the level of needs was included in the category of most needs. The needs analysis results show that in mathematics learning, teachers and grade 4 students need learning media that support the mathematics learning process, especially in fractional material. This condition requires more attractive, practical media to facilitate student learning activities independently and fun. One of the appropriate media is educational games.

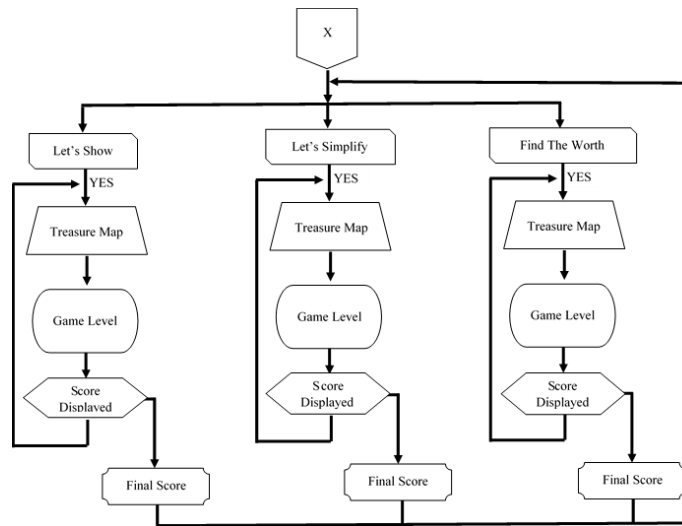
## Design

The design stage is carried out through three steps, namely, product design, product manufacturing, and preparation of validation instruments. Android-based educational game products are designed for mathematical content of fractional material of grade 4 elementary school, basic competencies 3.1 describe fractions worth with concrete drawings and models and 4.2 identify fractions worth of concrete drawings and models. Educational games contain basic competencies and indicators, materials, and games. The games in fractional education games are arranged into three types that are adapted to the selected sub-material, namely (1) "Let's Show" for fractional concept material, (2) "Let's Simplify" for fractional simplify the material, and (3) "Find the Worth" for fractional material worth. Each type of game consists of 25 missions that contain questions. Each type of game consists of 25 missions that contain questions. Furthermore, create flowcharts and storyboards to facilitate the process of compiling and programming games and compile validation instruments to assess product validity and student response questionnaires to measure product practicality. The flowchart of the fractional educational game can be shown in **FIGURE 2** dan **FIGURE 3**.



**FIGURE 2.** Flowchart of the main page of fractional educational games

The main page flowchart describes the process flow of the game when the player first opens the game. The main page flowchart can describe the course of the game from one menu to another.



**FIGURE 3.** Game page flowchart

The game page flowchart describes the flow of the process from the game when the player is on the "Let's Play" game page. The flowchart of the game page describes the course of the game from one game menu option to another.

**Development**

This stage is the product development stage, where the flowchart and storyboard of educational games' fractional material are realized into a complete form of educational game media. The materials that make up the educational game prepared at the design stage are then compiled and programmed into a complete game using Construct 2 software. However, the finished game product is still in Html form. Furthermore, educational games are transformed into the form of android applications (Apk.) using website 2 APK Builder software. The usage handbook was created using Microsoft Word 2013 and Microsoft PowerPoint 2013 software. Educational games have four main pages namely the main page, material page, game page, page and developer information. An example of a fractional educational game looks can be seen in **FIGURE 4** and **FIGURE 5**.





FIGURE 5. Sample Fractional Educational Games Material Page

The materials page displays fractional material presented in educational games. The existence of a material page will help students to learn independently easily anytime and anywhere. The material page contains the title of the material and several navigation buttons, namely the main menu navigation, voice settings, the "Let's Learn" page, Basic Competencies and Indicators, as well as navigation to the next/previous page. The existence of these navigations will make it easier for students to carry out learning activities independently.

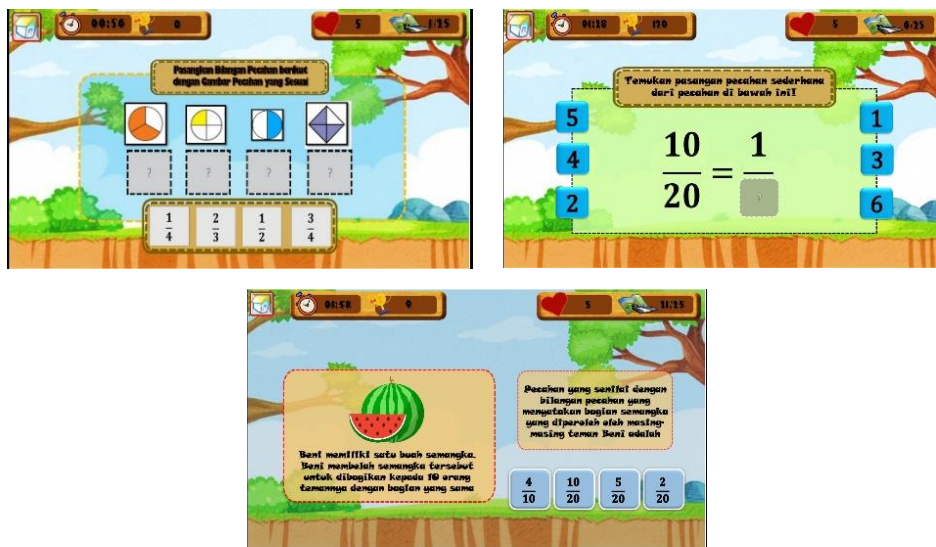


FIGURE 6. Samples of Educational Game Play Displays

The game page contains questions that are packaged in the form of game missions. These questions can be used as a medium for independent practice by students according to their abilities in a fun way. The gameplay in this educational game uses two types of games, namely pairing and choice. The game page displays the game field, time board, score, lives, mission sequence, and main page navigation.

The last step of the development stage is to validate the product with material experts, media experts, and teachers to assess the feasibility of the product before being tested on students. Material experts, media, and teachers' product validation results are presented on **TABLE 8**.

When interpreted, the validation value from experts refers to the percentage of validity value according to Akbar (2015) is in the range of 85.01% - 100.00%, which means it is very valid.

In addition to obtaining product feasibility assessments from experts, input and suggestions were also obtained on product development which was used as product revision material before trials were carried out. Material experts provide advice and input to adjust the image size when used on a laptop or cellphone to make it clearer and easier

for students to understand. Media experts advise that installing the application is lengthy and complicated, so students need a user manual.

**TABLE 8.** *Validation results of android-based fractional education games*

No.	Validators	Validation Value	Category
1.	Material experts	90,63%	Very valid
2.	Media experts	97,22%	Very valid
3.	Teacher	95,89%	Very valid
	Average	94,58%	Very valid

## Implementation

After the product is revised based on the input and suggestions of the validators, the product is tested on the research subject. The educational game application product was tested two times, namely in a small group of three students and a large group of 16 students. The trial was carried out by using educational game media independently through each student's cell phone to learn fractional material mathematics. At the time of the study, observations were made about the students' independence. Based on the results of observations, the student's independent response and character obtained a good predicate. Students learn with the material and strive to complete each game mission. At the end of the lesson, students are given 15 evaluation questions, consisting of ten multiple-choice questions and five description questions, to see students' understanding of the material. After doing the evaluation questions, a questionnaire of student responses was distributed to determine the students' assessment of the media.

The results of the practicality score after a large small group trial based on student response questionnaires are presented in **TABLE 9**. The results of student evaluation scores in small and large groups after learning to use educational games are presented in **TABLE 10**. The practicality value of the results of the student response questionnaire, when interpreted referring to the practicality criteria according to Arikunto (2010) is included in the range of  $76 \leq P \leq 100$ , categorized as very practical.

**TABLE 9.** *Practicality value results from product trials*

No.	Trial Phase	Percentage of Practicality	Category
1.	Small groups	90%	Very practical
2.	Large groups	93,13%	Very practical
	Average	91,57%	Very practical

**TABLE 10.** *Student evaluation score results in small groups and large groups*

No.	Trial Phase	Number of Students	Average Evaluation Value
1.	Small groups	3	90
2.	Large groups	16	86,25

Based on the average score of the evaluation questions, it was concluded that student learning outcomes have a 100% completion criterion with a minimum completion criterion of 75.

## Evaluation

At this stage, the product is reviewed to see the errors that were still present in the previous stage. The educational game media has been revised based on input and suggestions from validators. The image size has been enlarged and a manual of use has

been compiled. After going through the evaluation stage, the android-based educational game that was developed was declared feasible and practical to use in learning. Educational games can help improve learning outcomes and strengthen students' independent character.

## DISCUSSION

At the analysis stage, it was found that practical and fun learning activities can be carried out using innovative and exciting learning media. One of the learning media that packages material in the form of games that are useful for directing students in fun learning is games (Winarni, Naimah, & Widiyawati, 2019). The use of games as an entertainment medium for children to adults has the potential to make games develop into interesting learning media. Games provide ease of use for teachers and students to achieve the expected learning goals. This statement is supported by the opinion of Noemí & Máximo (2014), who states that games are teaching and training tools that are effectively used for students in all situations because they can motivate students and communicate concepts and facts from the subject matter very efficiently.

Android game learning media is one of the innovations of technology-based learning media that is quite attractive to students at this time. Learning using games will provide a more meaningful experience for students and create a fun learning atmosphere. Griffiths argues that games can allow students to gain new things or experiences, increase curiosity, and challenges in games can awaken students in learning (Pane & Najoran, 2017). An interesting experience will make students more receptive to knowledge (Wati, 2020).

Educational games are included in interactive multimedia because they combine images, writing, audio, and animation. Educational games have an advantage that lies in the visualization of real problems (Vitianingsih, 2016). In addition, game-based learning media also has many benefits. Educational games can help improve brain development, train concentration, and solve problems quickly and precisely (Wibisono & Yulianto, 2012; Widyastuti & Puspita, 2020). The results of research by Peterson, Verenikina, & Herrington (2008) show that computer games help students set goals and think strategically, solve problems and make decisions, think critically, explore, and stimulate motivation, creativity, and train students' concentration. Based on the research results, educational games are declared feasible as learning media, both in terms of material and media. Wicaksono as quoted in Dewi (2012) stated that the feasibility of the game is seen from (1) the learning design includes the technique of presenting the material has been presented in a sequence, systematically, and in accordance with the student's thinking flow and (2) the visual communication aspect includes communicative and interactive layouts that already contain a sufficient introduction and are presented completely accompanied by supporting presentations such as images, text, and voice. Educational games present learning materials in the form of games to realize a fun way of learning while playing.

Android educational games can be used as an alternative media for learning mathematics in elementary schools. The use of educational games in learning activities can make learning activities more active, interesting, and fun. An interesting learning process will affect students' interest and motivation to learn, making it easier to understand the material. If student learning motivation increases, student learning outcomes will also increase (Dewi & Haryanto, 2019).

Student learning outcomes after using educational game media have reached the minimum completion criteria, so it can be said that student learning outcomes have improved compared to before using educational game media. Students are said to have reached the level of learning completion if the scores obtained by students are the same and even exceed the minimum completion criteria of mathematics subjects set by the school (Viorika, 2019). This is in line with the results of research by Alfian Lutfi

Rohmatulloh and Ulhaq Zuhdi, who stated that educational games can improve student learning outcomes (Rohmatulloh & Zuhdi, 2020).

Educational games are also declared practical as a medium for learning mathematics. Educational games can be used anywhere and anytime through the smartphones of their respective students (Pane & Najoan, 2017). Thus, educational game media has met the criteria as a learning medium. One of the criteria for a good educational game is that it is easy to access and use/usability (Irsa, Saputra, & Primaini, 2016). A usage guidebook for teachers and students supports the ease of use of educational games. Learning activities using educational games will be more enjoyed by students and can be used as an effort to build student character or personality (Wati, Yuniawatika, & Murdiyah, 2020). The use of games in the learning process gives birth to a pleasant learning atmosphere because students can adjust the learning speed according to their abilities (Kharisma & Arvianto, 2019). The statement indicates that the game can develop the independent character of the student. Pasani & Pramita (2014) stated that one of the indicators of independent character is to learn independently according to one's own abilities. Thus, students will be trained to solve their problems independently, without relying on others.

As a learning medium, android-based fractional material educational games have several advantages and disadvantages.. The advantages of android-based educational games include (1) the appearance that is practical and attractive; (2) can be used as a learning medium for fractional material; (3) can strengthen the character of self-reliance; (4) can be played via each student's mobile phone offline or does not require an internet connection anywhere and anytime; (5) materials and games are packed together in the game making it easier for students to learn; and (6) equipped with a usage guidebook to make it easier for students to use android-based educational games.

In addition, the product also has disadvantages, including (1) it can only be installed through an android phone at least version 5.0 or a lollipop version; (2) The installation process is quite long; and (3) only developed on fractional material including fractional concepts, simplifying fractions, and fractional worth.

## CONCLUSION

Based on the description of the results of the research and discussion, conclusions can be drawn regarding the development of android-based fractional education game media with independent character strengthening, including (1) the development of android-based fractional education games is carried out through five stages of development, namely, analysis, design, development, implementation, and evaluation; (2) the validation test results of the three validators in the material and media aspects show that fractional material educational games are suitable for use as mathematics learning media; (3) the results of student responses show that practical educational games are used in learning; (4) educational games can help improve learning outcomes and develop students' independent character.

Educational games as a learning medium, have advantages and disadvantages. For further development, it can be re-evaluated so that it can be disseminated to other subjects by paying attention to several things such as the situation and conditions, the characteristics of the subject, ease of access and use, and the scope of the material developed. Its use also needs to be considered by teachers and parents, because it involves using smartphones that prevent abuse of functions.

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