



Development of Rujuku Mobile Learning Apps on Integer Operation Material as Alternative Media

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Abstract

Since the Covid-19 pandemic in early 2020, Indonesia has implemented distance education by optimizing the use of technology. Therefore, the researcher developed the Rujuku *Mobile Learning* Apps Development on Integer Operation Material in Class VII SMP/MTs to support the implementation of distance learning during the pandemic. This study aimed to develop the RUJUKU application and determine student responses in learning after using the developed media. This development research uses the ADDIE method. The data collection technique used a questionnaire with data processing techniques analyzed using percentage data analysis techniques. The results showed that RUJUKU was suitable for use, attractive, and easy to use. This is based on the validation results in terms of material, an average of 89.70%, and in terms of media, an average of 88.81%. Student response is quite good, with a percentage of 89.06%. Based on that result, this research significantly impacted the integers' learning process of addition and subtraction operations during this pandemic.

Keywords: development; integer; interactive electronic module; student response

I. Introduction

Indonesia was once in a state of national emergency. The death rate due to Covid-19 has continued to increase since it was first announced that there were people who were positive for the Covid-19 virus in early March 2020. This affected changes and policy reforms to be implemented. New policies have also occurred in the world of education to change learning that has to come to class or a building. Education in Indonesia has been transferred online (on the network) since the emergence of the Covid-19 pandemic. Nevertheless, education must still be carried out optimally, because education is the spearhead of the progress of the nation's civilization. In line

with the statement of Hidayah (2014), Ninsiana (2016), and Santika (2021), a prospective and futuristic educational policy can prepare Indonesian to face the intense global competition in this era of the industrial revolution 5.0 by making them not only reliable, but also have good character, for example, high productivity, creativity, and innovation.

Technology is becoming a wide-applied new trend during the pandemic to maintain and improve the quality of education (Arrum & Fuada, 2021; Fuada & Marhamah, 2021). Internet-based technology utilization in online learning can also provide the most comprehensive access to the availability of learning materials

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without being limited by space and time (anytime-anywhere learning) and reduce the high cost of printing materials (Kyzy Nurakun, Ismailova, & Dündar, 2018).

Distance Learning (PJJ) has become the primary choice due to the pandemic. Distance learning is a learning approach that does not meet face-to-face in the classroom. Learning media is usually used in these conditions because it is internet-based, so there is no need to come to class (Pardede, 2011; Shodiq & Zainiyati, 2020; Yaumi, 2007). Moreover, implementing PJJ using technology-based learning media is increasingly becoming an option because it can save costs and time and is more flexible (Kusuma Ningtyas, Virnawati, Paramitta, & Wayan Simri, 2008).

Mobile learning is one of the implementations of distance learning. In implementing mobile learning, learning utilizes information and communication technology. Mobile Learning brings benefits in the form of the availability of teaching materials that can be accessed at any time and the visualization of exciting material (Widodo, 2015). The use of technology in education can make the learning process easier (Hanan, Fajar, & Pramuditya, 2018). Therefore, teachers as educators are required to be able to use technology in the learning process. Mobile learning allows manipulation to facilitate the learning process and encourage alternative learning media development, especially in mathematics (Lisnani & Pranoto, 2020; Nur Atika & Zubaidah Amir MZ, 2016).

Learning media that students often use to learn math from home during a pandemic is video which has audio and visual elements. Videos are fun and do not make students feel bored in learning, thereby increasing student learning motivation (Hadi, 2017). In addition, games are also a popular learning medium for students to learn mathematics during this pandemic. Educational games can teach students a certain amount of knowledge and foster a higher curiosity in students so that students want to learn. This can

happen because games are entertaining (Johansen, 2017; Mulyanto, Apriyadi, & Prasetyawan, 2018).

Today, many mathematics learning media have been developed as a companion to mobile learning that contains games or videos. Among them are media development research conducted by Batubara (2015) who develop learning media using games and Aisiyah (2021) who develop learning media using video. However, neither has researched the development of mobile learning companion learning media that combines games and videos in an application with procedures for use without the internet, focuses on integer operations, and has various game questions even though these things are needs that have not been met in student learning activities since the beginning of PJJ until now, where students are still faced with many obstacles in the implementation of online learning, including the limited internet facilities (perhaps this is related to the problem of the availability of electricity, telephones, or computers) so that there are still many students who have not been able to take full advantage of earning technology which results in delays. The formation of values in the teaching-learning process (Munawaroh, Fathimah Ahmadah, & Purbaningrum, 2021).

The integer operation material was chosen because it is one of the problematic materials for seventh-grade junior high school students in semester 1. According to research conducted by Hati (2015), Mandasari & Rosalina (2021), Nengsih & Pujiastuti (2021), and Sidik & Wakih (2019) students have difficulty solving problems in integer arithmetic operations because of the abstract concept of numbers even though the concept of integers is a concept that absolutely must be mastered by anyone who studies mathematics.

With this urgency, it is very important to develop a learning media that can be a solution to educational problems during the pandemic. So, the researchers initiated an alternative technology-based mobile learning companion mathematics learning media, which is given the

name RUJUKU (in Indonesian it has the abbreviation of "Rumah Jumlah Kurang", that is by taking the first 2 syllables of each word): Interactive Addition and Subtraction Home Application for Mobile Learning, with the subject of Integer Operations for Class VII in the first semester. RUJUKU was developed with the main aim of providing new experiences to students in terms of learning through audio and visual media. Students can open applications, videos, and games anytime and anywhere because this media was developed as a low space and low internet data medium. The advantage of developing this learning media is using a structured, systematic operation flow. There are learning videos and games with an unlimited number of variations of questions.

The material discussed in RUJUKU is integer operations. Integer operations solve many fundamental problems in everyday life. However, students often find it difficult to understand it. Based on the research of Sidik & Wakih (2019), it is known that students have difficulty understanding the meaning of questions in integer operation material and have difficulty operating numbers with negative signs. Therefore, it is hoped that RUJUKU is feasible as an online learning media, making students more enthusiastic about studying even though they are independent at home; the contextual side and the use of combining games and learning videos in one application in RUJUKU learning media will also make it easier for students to use the media and understand the concept of integer operations. By using this media, it is hoped that science, especially mathematics, can develop in harmony with the rapid flow of technological developments in the current 5.0 era.

II. Method

This development research uses the ADDIE method. The main steps in ADDIE research are Analysis, Design, Development, Implementation, and Evaluation (Dick & Carey, 1996). The first stage is the analysis stage; this stage is carried out by identifying problems before

developing the product. Therefore, a literature study was conducted from books, journals, and the latest news regarding online learning, learning media, basic subject syllabus, integer operations material, and other matters relevant to the research. The analyzes carried out include needs analysis, curriculum analysis, and media analysis.

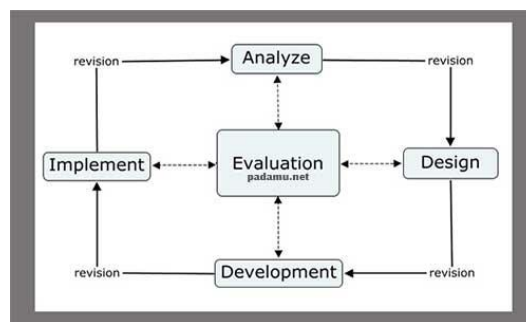


Figure 1. Main steps in ADDIE

The next stage is the design stage. The design stage determines what software will be used in this development research. Moreover, designing the display design of the application that will be developed, starting from the cover design, layout, and design of video and game content. In addition, the preparation of the application layout sequence and the contents of each layout is also carried out at this stage.

At the development stage, applications designed or designed in the previous stage are made. The development stage includes making content layouts, videos containing material, game content, validation, and revision.

In making the RUJUKU layout design, a learning video is made through the InShot application with the final MP4 file form. Furthermore, the RUJUKU application was built using the Android Studio application. In Android Studio, application components are combined, coding questions in games, giving animations to each layout, and converting the RUJUKU coding result file into an application form that can be installed and used on devices without a data package. Three material experts and Three media experts will validate the RUJUKU that has been developed. Furthermore, the validation results will be used as material for consideration in

revising the RUJUKU. The product was revised based on comments and suggestions from material experts and media experts so that it was suitable for use as well as according to the needs of students. If feasible, it will be continued at the implementation stage. If not, we will return to the design stage. If the RUJUKU has been declared feasible, the implementation phase will be carried out, namely being tested using a limited trial. This trial was conducted to determine whether students' responses to RUJUKU received a positive response or vice versa. The instrument used to determine student interest, and the response was a questionnaire about RUJUKU that had been prepared previously.

Furthermore, RUJUKU will be evaluated based on students' limited use of the application. Evaluation can be obtained from the results of a questionnaire on RUJUKU. Based on the respondent's questionnaire with consideration of the media validator, it can be used as evaluation material, so there is no conflict with the previous validation. This evaluation was carried out with the aim that RUJUKU deserves to be used more widely and learning improves.

This study used a limited trial. Therefore, the researcher limits the number of students studying for the research sample. The researcher selected 10 students of SMP class VII semester 1. The material used in the development of this RUJUKU was integer operations material. The instrument used to collect data is a questionnaire. The questionnaire used a material validation questionnaire, a media validation questionnaire, and a response questionnaire about RUJUKU to determine the students' feasibility and response to RUJUKU. The data obtained from material and media validation and analysis of the feasibility of the RUJUKU media were carried out. The input was used as a product revision using a material validation questionnaire and RUJUKU media. Data from student response questionnaires to learning using RUJUKU are processed using percent index calculations which are then carried out with interval analysis.

III. Result and Discussion

The results of this development research are RUJUKU or application-based learning media on integer addition and subtraction operations for seventh-grade junior high school students in semester 1. This product has been validated by media and material experts and tested limited to 10 seventh-grade junior high school students. In the analysis stage, several analyzes were carried out on different approaches. The first is an analysis with a needs approach; a needs analysis is carried out by outlining the problems of this development research based on the existence of a pandemic, the demand to carry out online learning, the lack of enthusiasm for students to learn during a pandemic, students' difficulties in adding and subtracting integer operations, and the need for learning media, which can be used without internet data usage. The second analysis with a curriculum approach, based on the 2013 curriculum, found that learning can use various learning resources and use technology and communication to improve the efficiency and effectiveness of learning. At the same time, the analysis with the media approach is done by analyzing what media is suitable for solving problems based on the needs analysis carried out, namely RUJUKU or application-based learning media on the operation of adding and subtracting integers.

At the design stage, a RUJUKU design is produced in the form of cover design, content or content, and cover. The front and back covers are adjusted based on the application theme, namely the material for adding and subtracting integers. The material for this RUJUKU application is the operation of adding and subtracting integers. This application contains learning objectives, indicators of competency achievement, material explanation videos, and quizzes (games). The material in the video includes the concept of the set of integers, the concept of operations in the set of integers, and the use of the number line in completing addition and subtraction operations on the set of integers. RUJUKU is equipped with a

quiz that allows students to work on as many questions as possible during the allotted time.

At the development stage, RUJUKU is made using a builder application, Android Studio, with several coding subfolders for each part. This application has 5 main parts: the front cover layer, application menu layer, learning media objectives layer and competency indicators, material layer, and quiz (game) layer. This media contains the objectives of learning media, material videos, and quizzes in the form of addition and subtraction questions. All designs and templates on this learning media were made with the Canva application, so the files are in png format. Material videos are made using the Inshot application. The music in the video material is added using the add sound feature in the Inshot application. The emulator of the application uses android. Furthermore, the application is saved in the form of an android application in apk format by using the convert feature in the Android Studio application.



Figure 2. Cover’s design and menu on RUJUKU

The validation process involves 3 material experts and 3 media expert validations. Validation by experts was carried out to assess RUJUKU from the material and media aspects through a validation questionnaire. The results of expert validation of RUJUKU can be seen from the Table 1.

Table 1. The results for RUJUKU’s material

Aspect	Number of Questions	Average	Percentage
Software	9	4,5	89,60%
Visual			
Comuni- cation	5	4,4	88%
Total	14	8,9	88,81%

Table 2. The results for RUJUKU’s media

Aspect	Number of Questions	Average	Percenta ge
Material	7	4,7	94,28%
Question	6	4,0	81,11%
Language	2	4,5	90%
Implemen- tation	2	4,7	93,33%
Total	17	17,9	89,70%

The results of media validation show that this RUJUKU media is feasible with a percentage of 88.81%. Overall, the validators agreed or strongly agreed on the main points of media feasibility, including the ease of use, the media’s appearance, and the attractiveness of the media when used. At the same time, the results of material validation show that the material follows the essential competencies of the 2013 curriculum with a percentage of 89.70%. Overall, the validators agree or strongly agree on the main points of the feasibility of media content, including the suitability of the material with essential competencies, choice of language used, quality of questions, and achievement of learning objectives when using RUJUKU media. Moreover, from them, we get the learning media. So this reference follows the prerequisites of good learning media content as stated by Januarisman & Ghufron (2016) and Tafqihan (2011)

At the revision stage, the RUJUKU was revised based on comments from material and media experts. Here is advice from media and materials experts. In the revised media, the font

size is enlarged because the convenience of students in learning is one of the essential aspects. In addition, the size of the application is also reduced, and the practice questions are increased. At the same time, the revised material, namely the variation of questions on the quiz, is not following the material presented. This is because this media has additional questions about multiplication and division, so it is corrected and focused on addition and subtraction questions only following the purpose of making this RUJUKU media.

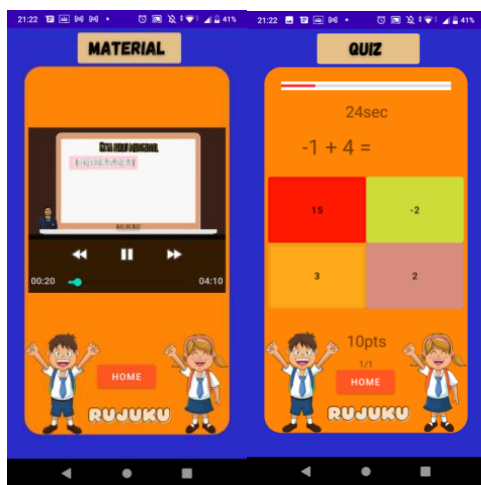


Figure 3. The RUJUKU has been revised

At the implementation stage, a trial was carried out on the test subject, the 10th-grade students of SMP class VII semester 1, who were asked to use RUJUKU and then gave their assessment using a questionnaire. The following is a table of student response results,

Table 3. Student's response

Aspect	Number of Questions	Average	Percentage
Software	9	4,6	91,91%
Application Design	12	4,3	86,21%
Total	21	8,9	89,06%

The questionnaire results show that the overall suitability of the media to students' expectations is 89.06%. Where on the points that discuss the ease of using the media, the

appearance of the media, the suitability of the media with the material, and the level of attractiveness of the game on the media in general, students agree and strongly agree on the scale. From this, it can be concluded that RUJUKU received a positive response from students. However, some of the students verbally said that the time allotted to play quizzes on the RUJUKU application was too short.

Based on the implementation stage, the RUJUKU application is evaluated. At this stage, a final product revision was also carried out based on the input obtained from the respondent's questionnaire with the media validator's consideration so there would be no conflict with the previous validation. It is intended that the application developed is genuinely appropriate and can be used by a broader range of students. Several evaluation results are based on student respondents' questionnaires, which require memory to store applications. These quizzes can be accessed repeatedly easily so that they can overcome the problem of the lack of duration given to take quizzes; besides that, students also suggest that the material video font be enlarged to make it more visible. Read. It is intended that the message in the learning process can be conveyed in its entirety. This will later follow the definition of learning media according to Munadi (2008), which said that learning media are everything that can convey and distribute messages from sources in a planned manner to create a conducive learning environment where the recipient can carry out the learning process efficiently and effectively.

The content of the material in RUJUKU follows the essential competencies that must be mastered by students based on the 2013 Curriculum. The essential competencies in the material for addition and subtraction operations on a set of integers are explaining and performing arithmetic operations on integers and fractions by utilizing various properties of operations which include finding (C4) the results of addition and subtraction operations on integers by utilizing the properties of addition and subtraction operations

(Minister of Education and Culture, 2016). So that RUJUKU with addition and subtraction operations material on a set of integers is feasible to be given to students. Validation of the media aspect was carried out to assess the appearance, attractiveness, and creativity of the design and the suitability of the media for the age of the students presented. In RUJUKU, there are figures, video material, learning objectives, and indicators, and a quiz (game) is added with direct feedback in the form of accumulated scores.

Student responses after using RUJUKU can be categorized as positive. With this, it can be concluded that RUJUKU can be well received by students in the learning process of adding and subtracting integer operations. Most students want to learn using RUJUKU again. Especially the quiz/game feature on RUJUKU makes students more interested in repeating to get a higher score than before. According to students, the existence of the quiz made the use of RUJUKU media not dull. This is following educational games that can teach students a certain amount of knowledge and foster sufficient involvement so that students want to learn because games are entertaining (Johansen, 2017). According to the results of Hasiru, Badu, & Uno (2021); Purwanti (2015); Ridha, Firman, & Desyandri (2021), the use of learning videos can streamline learning. Therefore, RUJUKU is equipped with various features, including the presentation of material in videos. So based on the results of material validation, media validation, and testing, it can be concluded that RUJUKU can be a proper, exciting, and easy-to-use learning media.

Moreover, here we can make sure that RUJUKU can complement the shortcomings of previous studies in making learning media that educates and entertains students both in the learning process and outside the learning process, especially on integer operations material. One of them such as the research conducted by Aisiyah (2021) & Batubara (2015), where both did not expand the scope of their research on the development of mobile learning companion

learning media that combines games and videos in an application with procedures for use without the internet, focuses on integer operations and has a variety of game questions even though these things are needs that have not been met in student learning activities.

IV. Conclusion

The results of the research on the development of RUJUKU learning media with the ADDIE method on the operation material of addition and subtraction of integers explain that according to the results of media validation, it shows that RUJUKU media is feasible with a percentage of 88.81%. Where overall the validators responded to agree or strongly agree on the main points of media feasibility. While the results of material validation show that the material is by the basic competencies of the 2013 curriculum with a percentage of 89.70%. Where overall the validators respond to agree or strongly agree on the main points of the feasibility of the media content. Meanwhile, the results of the student response questionnaire showed that the overall suitability of the media to students' expectations was at a percentage of 89.06%. Where on the points that discuss the ease of using the media, the appearance of the media, the suitability of the media with the material, and the level of attractiveness of the game on the media in general students choose a scale of agree and strongly agree.

The results of RUJUKU on the set material for SMP class VII semester 1 students are declared valid and feasible for learning the material for addition and subtraction operations on the set of integers. RUJUKU gets a positive response from students so that it can be developed to produce exciting and easy-to-use learning media to fit their needs.

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