

DEVELOPMENT OF ANDROID-BASED LEARNING MEDIA ON OPERATIONS OF INTEGERS**Nur Afifah**Pendidikan Matematika, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Surabaya,
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atikwintarti@unesa.ac.id**Abstrak**

Berlangsunya proses digitalisasi pendidikan menjadikan pemanfaatan teknologi dalam pengembangan media pembelajaran sangat diperlukan. Penelitian ini bertujuan untuk menjelaskan proses pengembangan media pembelajaran dengan model *ADDIE* dan mengetahui kevalidan serta kepraktisan media tersebut. Materi yang dipilih adalah Operasi Hitung Bilangan Bulat karena menjadi prasyarat bagi banyak materi matematika lainnya. Subjek penelitian ini adalah 9 siswa kelas VII SMP Negeri 5 Jombang karena di sekolah tersebut siswa belum pernah menggunakan media pembelajaran matematika berbasis Android. Subjek penelitian terdiri dari tiga kategori siswa berkemampuan matematika rendah, sedang, dan tinggi untuk mengetahui apakah mereka dapat memahami penyajian materi pada media sehingga mampu mencapai ketuntasan belajarnya. Data yang diperoleh kemudian dianalisis menggunakan teknik analisis deskriptif kualitatif dan kuantitatif. Hasil penelitian dan pengembangan meliputi: 1) Media pembelajaran yang sudah dikembangkan diberi nama *Math Moist* yang berbasis Android; 2) Media memenuhi kategori sangat valid berdasarkan hasil validasi media dan materi dengan presentase kevalidan 83.541%; 3) Media memenuhi kategori sangat praktis berdasarkan perolehan skor angket respon siswa dengan presentase kepraktisan 88.7301%; 4) Berdasarkan perolehan nilai tes hasil belajar, 8 dari 9 subjek penelitian tuntas belajar setelah menggunakan media yang telah dikembangkan.

Kata Kunci: pengembangan, media, *android*, *ADDIE*, bilangan bulat.

Abstract

The ongoing digitalizing education makes the use of technology is necessary to develop the learning media. Therefore, this research describes the development process of android-based learning media with the *ADDIE* model and find out the validity and practicality of it. The material is operations of integers because it's a prerequisite for many other mathematics material. The research subjects were nine 7th-grade students in SMPN 5 Jombang since they had never been given the kind of math learning media based on Android in that school. They were consist of three categories of low, medium, and high mathematical ability to determine whether all types of students can understand the presence of media to achieve their learning mastery. The data analyzed using qualitative descriptive and quantitative data analysis techniques. The result of this research and development are : 1) The Android-based learning media called *Math Moist*; 2) The learning media is very valid based on the results of media and material validation with a validity percentage of 83.541%; 3) The media is very practical based on the student's response questionnaire scores, with a percentage of practicality is 88.7301%; 4) Based on the result of learning outcomes test, 8 of the 9 research subjects have completed learning after using media.

Keywords: development, media, android-based, *ADDIE*, integer.

INTRODUCTION

Learning media is an intermediary tool to deliver the learning material to the students in a better prepared situation (Nuraini, Sutama and Narimo, 2020:63). In line with this, Kurniawarsih and Rusmana, (2020:40-41) state that learning media are teaching aids that become concrete

intermediaries so that students learn abstract things more easily. Meanwhile, according to (Nurhayati, Rahmawati and Farida, 2021:12), learning media is an intermediary to support in achieving learning goals successfully. So, learning media is an intermediary tool for students to get

better understanding the materials and for teachers to deliver learning materials.

Through good learning media, students' learning motivation will increase (Tafonao, 2018:103). The high learning motivation of students will affect the quality of learning outcomes. Therefore, we can not ignore the use of media in the learning process. However, the media development carried out by teachers is still not optimal, especially in developing media according to material and learning needs (Alwi, 2017:150). Learning is a gradual process of acquiring a concept or knowledge (Rohmah, 2017:196).

Mathematics is a subject that has characteristics that are interrelated material concepts with each other (Nasaruddin, 2013:65). This is challenging for teachers to pay attention to the student's understanding of the material presented, because an misunderstanding of the concept at one level can affect up to a higher level of education. In her research (Novitasari, 2016:9) stated that one of the causes of the failure of mathematics learning was student errors in understanding existing mathematical concepts. When students only memorize formulas instead of understanding them, they will have difficulty using these concept in different situation.

One of the materials in mathematics learning that contains a lot of conceptual understanding is the Operations of Integers. According to (La Hadi and Dedyerianto, 2020:20), the low essential ability of students in this material will affect their mathematical problem-solving skills. It can be held since the Operations of Integers is prerequisite for studying many other mathematical materials, such as Linear Equations and Inequalities, Line Equations, etc.

A preliminary studies have been carried out using online questionnaire to junior high school students in Jombang suggest that students still had difficulties in learning the material Operations of Integers. The mixed operations of integers is a topic that considered difficult by 60% of the total respondents. It is due to the many rules that must be understood in each operation. In line with research (Khalid and Embong, 2019:2) regarding the causes of errors and student misconceptions about Operations of Integers, students confused that there are so many rules to remember while the teacher only gives a lot of practice to memorize the operating rules. According to (Widodo and Wahyudin, 2018:155), junior high school students are not yet fully able to think formally, mainly grade VII students, because they are still transitioning from the concrete operational cognitive level to formal operations. Therefore, learning media is needed to bridge students' understanding of the rules of integer operations.

One way to innovate learning media is by utilizing technological advances. The use of technology in the

learning process can increase student interest in learning (Ahmad, Ilato and Payu, 2020:72). In addition, the ongoing process of digitizing education also makes technology in learning media indispensable. Data (StatCounter, 2022) on the Mobile Operating System Market Share in Indonesia shows that the android operating system in first ranks with more than 90% of users. In line with this, (Muflih, Hamzah and Puniawan, 2017:15) in their research, explain that students prefer using smartphones over discussing with their friends. Therefore, it is an opportunity for the development of android-based learning media.

The results of the study (Futri Basya, Faqih Rifa'i and Arfinanti, 2019:8) stated that using android-based smartphone as a mathematics learning media could support students understanding of concepts. Another research related to android-based learning media on operations of integers has also been carried out by (Karseno, Sariyasa and I.G. Astawan, 2021:24). The study results stated that the developed media were valid and practical in learning. The relevance of those research to the author's idea is a development of android-based learning media to understand the concept of integer operations. However, the questions in the media from the previous research can't be randomly. So, in this study, the learning media will develop with randomize's feature for presented material and evaluation questions. The media was developed as an additional medium for student's self learning. Thus, students are expected to understand the concept of Operations of Integers according to their respective learning speeds.

METHOD

This research is development research with the ADDIE model. The ADDIE development model was chosen because it has a simple and systematic flow with periodic evaluations and revisions to produce valid learning media (Nurhayati, Rahmawati and Farida, 2021:14). The stages of development with the ADDIE model include the analysis, design, development, implementation, and evaluation stages. The following Figure 1 is an schematic of the ADDIE procedures in this research adapting from (Sugihartini and Yudianta, 2018:280).

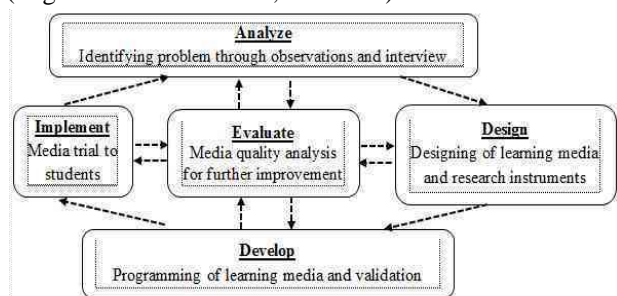


Figure 1. Research Schematic

The first stage is the analysis stage, consisting of : (a) Needs analysis, which is to identify student difficulties when studying Operations of Integers material so the learning media is needed; (b) Curriculum analysis, which describes the material according to the curriculum and essential competencies used by school institutions; (c) Technology analysis, which is to identify technology that can overcome problems according to the results of needs and curriculum analysis. The second stage is the design stage, i.e. the collection of materials, the preparation of storyboard, and the preparation of research instruments. Next, learning media programming is carried out at the development stage, followed by validation tests for media and material validators. Then at the implementation stage, the media was tested on students. Finally, at the evaluation stage, an analysis of the quality of the media was carried out referring to the results of the media trials. The analysis framework based on media evaluation criteria adapted from (Wahono, R.S., in .Permata and Rahmawati, 2018:284)

The subjects of this study were 7th grade students of SMPN 5 Jombang, because they have never been given the kind of math learning media based on android. According to the learning media evaluation from (Wahono, 2006), one of criteria is easy to understand so the students can achieve their complete learning. Therefore, the research subjects in this study were divided into categories of low, medium, and high mathematical ability. It is due to determine whether the presentation of media can be understood by those type of students or not. Each category consists of three students. The students mathematical ability is determined based on the math value of the report cards in the odd semester of the 2021/2022 academic year.

The data instruments in this study included media validation and material validation, student response questionnaires, and learning outcomes tests. Media and material validation are arranged according to the learning media evaluation criteria on the Table 1 below.

Table 1. Learning Media Evaluation

Aspect	Information
Software Engineering	Includes the efficiency, maintainability, usability, and compatibility of media, the media usage instructions.
Learning Design	Includes the clarity of learning objectives, the completeness of materials, the presentation of material whether easy to understand or not, the evaluation and feedback.

Aspect	Information
Visual Communication	Includes the creativity of layout design, animation, audio, and interactivity of it.

Source : (Wahono, R.S. in Permata and Rahmawati, 2018) with modifications

Media validator should be: (a) Lecturers who are experienced in developing learning media; (b) Have a minimum education of S2 Mathematics or Mathematics Education. Meanwhile, the material validator criteria include: (a) Grade VII mathematics teacher; (b) Have a minimum education of S1 Mathematics Education. For student response questionnaires is arranged using *Likert Scale* based on assessment in the Table 2 below.

Table 2. Student Response Questionnaires Assessment

Aspect	Information
Media Design	Includes the attractiveness and creativity of media presentations.
Media Use	Covers the operation of media, language, and material clarity.
User Response	Regarding the results students feel after using the media, whether it is easier to understand or not, the more motivated they are to learn.

Source : (Suryani, 2018:217) with modifications

Meanwhile, the learning outcome test instrument arranged in the form of description questions to assess the correctness of the student’s concept on their counting process. The tests was developed based on basic competencies and learning indicators of curriculum that used in SMPN 5 Jombang. Then consulted with the mathematics teacher of SMPN 5 Jombang, who was also a material validator.

The analysis technique in this study uses descriptive qualitative and quantitative data analysis techniques. Qualitative data comes from input and comments from validators and students as a reference for media improvement. Quantitative data comes from validation results, student response questionnaires, and learning outcomes tests. Quantitative data is processed to determine the validity and practicality of the media.

The validity of media was reviewed based on the validation results. The practicality of media was reviewed based on the results of student response questionnaires. The following formula is used:

$$\text{Percentage (P)} = \frac{\text{Given scores}}{\text{Maximal scores}} \times 100\%$$

(Riduwan and Akdon, 2015:18)

The results are then interpreted according to the media validity categories in Table 3 and the media practicality categories in Table 4.

Table 3. Validity Categories

Range of P (%)	Categories
$80 < P \leq 100$	Very valid
$60 < P \leq 80$	Valid
$40 < P \leq 60$	Quite valid
$20 < P < 40$	Less valid
$0 < P \leq 20$	Invalid

Adaptation from (Riduwan and Akdon, 2015:18)

Table 4. Practicallity Categories

Range of P (%)	Categories
$80 < P \leq 100$	Very practical
$60 < P \leq 80$	Practical
$40 < P \leq 60$	Quite practical
$20 < P \leq 40$	Less practical
$0 < P \leq 20$	Not practical

Adaptation from (Riduwan and Akdon, 2015:18)

Meanwhile, the acquisition of learning outcomes tests is used to determine students' mastery of learning. According to (Yamasari, 2010), students are said to have completed learning when the test scores for learning outcomes are not less than or equal to the KKM (Minimum Completeness Criteria). The KKM score for mathematics at SMPN 5 Jombang is 70.

RESULT AND DISCUSSION

Based on the results of observations and interview to mathematics teachers and seventh-grade students at SMPN 5 Jombang, the results of needs analysis, curriculum analysis, and technology analysis are described as follows. In needs analysis, it is known that students have difficulty when calculating an equation that contains many number operations.

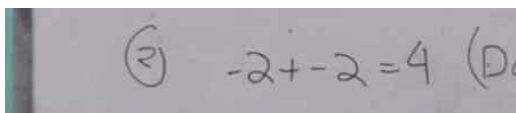


Figure 2. Student's Answer

From Figure 2, it is known that there is students who still confused about the operating rules. The students who answer 4 were think when negative integer meet negative, they will become positive. However, this rule only applies to multiplication and division operations.

The curriculum analysis shows that the 2013 Curriculum is a teacher's reference in compiling learning in SMPN 5 Jombang. The learning resource used is a class VII mathematics textbook. The teachers also often use PPT

or modules sent via Whatsapp groups to students. The following Table 5 is the composition of Basic Competencies (KD) and Learning Indicators for Operations of Integers in Curriculum 2013.

Table 5. Competencies and Indicators on Operations of Integers

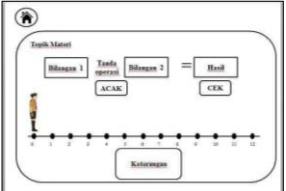

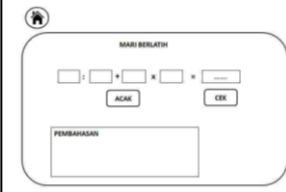
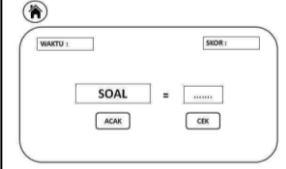
Competencies	Indicators
3.2 Explain and perform arithmetic operations on integers and fractions by utilizing various operations.	3.2.1 Determine the result of the addition of integers;
	3.2.2 Determine the result of the subtraction of integers;
	3.2.3 Determine the result of the multiplication of integers;
	3.2.4 Determine the result of the division of integers;
	3.2.5 Determine the result of the mixed operation of integers;
	3.2.6 Explain the properties of integer operations.

Meanwhile, technological analysis from the interview with a math teacher in SMPN 5 Jombang shows that online learning makes it quite difficult for students to learn due to signal problems. As a result, the material cannot be delivered optimally. Therefore, it is necessary to have interactive learning media that can be run without turning on internet data. In line with this, research (Rambu *et al.*, 2022:11) states that with learning applications that can be accessed offline, students can use them to study at any time and avoid network problems.

After conducting the analysis, the next stage is designing learning media. At this stage, the researcher collects Operations of Integers material which will be presented in the learning media. The presentation of the material is created from the storyboard of learning media in Table 6 below.

Table 6. Media Storyboard


Storyboard Display	Information
	The first page contains a profile button, a media help button, a music button, and a start button.
	This page contains three main media menus: competency, material, and evaluation.





Storyboard Display	Information
	This page contains the presentation of material according to various types of integer operations.
	This page contains practice questions on the operations of addition, subtraction, and multiplication of integers.
	This page contains practice questions on mixed arithmetic operations with integers.
	This page is an evaluation menu page that contains quiz questions.


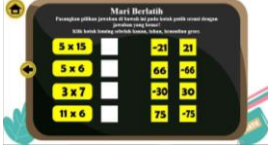


After the storyboard is complete, proceed with making background designs, animations, etc., that are needed to present the material. For the image assets, they were created using Corel Draw X7 application.

The next stage is developing learning media. Learning media is programmed using the Construct2 application, with the final result in the form of Android-based media with a capacity of 15 MB (Mega Bytes). The media was named *Math Moist* (Math Media on Operations of Integers). Table 7 below presents the display of the media that has been developed.

Table 7. Media Display

Media Display	Information
	This page is the initial view of the application. In the upper left corner, there are three buttons in order from the far left: the profile button to find out the developer's identity, the hint button to find out media usage instructions, and the music button to activate or deactivate music.

Media Display	Information
	On main menu page, there are three options: 1) the competency menu, which contains KD information and learning indicators; 2) the material menu contains each type of operations of integers; and 3) the evaluation menu contains quiz to check student understanding.
	On the material page, the material is presented with additional Scout animations that can run according to randomized numbers. Students click "ACAP", numbers appear in the green box, then click "CEK", and the animation will run. After the animation stops, the results will appear in the box above the "CEK" button. Below the number line, there is an explanation of the animation movement.
	Specifically, students are asked to complete the Table according to the number pattern found in the material for multiplication of negative and positive integers and multiplication of negative and negative integers.
	Students are asked to conclude the operating rules on this page by filling in the white circle with the yellow ring below according to the correct answer.

Media Display	Information
	<p>On the division material page, the material is presented by utilizing the concept of division which is the inverse of multiplication. First, click “ACAK”, the number will appear in the green box, then students type the answer in the white box, then click “CEK”. The conclusions will be drawn, after three randomizations.</p>
	<p>This page contains practice questions according to each operation. Students are asked to shift the answer box on the right to the white box according to the correct answer.</p>
	<p>Especially for mixed arithmetic operations, practice questions are presented as shown in the image below. Click “ACAK”, the number will appear in the green box, students type the answer in the white box, then click “CEK”. The discussion will appear after students click the check button.</p>
	<p>This evaluation page contains questions to check student understanding. Click “ACAK”, type the answer in the white box, then click “CEK”. The score will increase by 10 and the time will increase by 3 when the answer is correct. The score will reduce by 5 when the answer is wrong without any reduction in time.</p>

After the media has been programmed, it is then validated. The following Table 8 presents the validity of learning media.

Table 8. The Result of Media and Material Validation

Media Validator	
Software engineering aspects	80%
Visual communication aspect	79.16667%
Average media validation results	79.583%
Material Validator	
Learning design aspects	87.5%
Final average	83.541%

Based on the percentage of validation results of 83.541%, it can be concluded that the Math Moist media is "very valid" according to the media validity categories referenced in Table 3.

From the validation process, several inputs were obtained from the media validator. The outline of the comments from the validator is related to variations in randomizing numbers and answer options in practice questions. Here is Figure 4 for material validator comments and Figure 5 for media validator comments.

12. Terdapat umpan balik terhadap hasil evaluasi	✓
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Komentar/saran :
Media Pembelajaran menarik dan Sesuai dengan Cakupan Materi operasi hitung bilangan bulat.

Figure 4. Material Validator Comments

Komentar/saran :





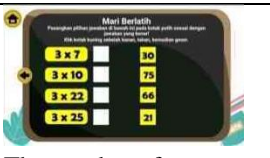
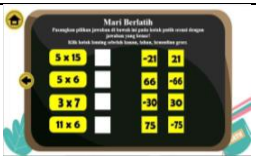


1. Pada materi operasi penjumlahan, di "mainkan animasi" mungkin sebaiknya didahului menggunakan bilangan pastinya, tidak langsung menggunakan a dan b. Misalnya, siswa pramuka hadap kanan maju 4 langkah, menunjukkan bilangan 4, dan sebaliknya, kemudian baru dibawa ke yang lebih umum.
2. Pada sifat-sifat operasi penjumlahan bilangan bulat, mungkin pilihan bisa diperbanyak, misalnya 1, 2, 3, 4 dan peletakkannya diacak agar setidaknya siswa menghitung dan tidak menyamakan jawaban di kolom sebelumnya (pada baris yang sama).
3. Untuk perkalian bilangan bulat, umumnya menggunakan bilangan pertama yang sama (3 dan -3), saat pengacakan, mari berlatih, dan dalam tabelnya. Selain itu kecenderungan dari hasil yang kecil kemudian membesar di bawahnya. Misalnya hasil kali baris pertama 30, kemudian berlanjut 39, 81, 120. Jika memungkinkan, bisa dibuat lebih bervariasi dan acak untuk penataan mari berlatihnya.
4. Frasa "dengan pola yang sama" memiliki makna ganda. Bisa berarti memiliki selisih yang sama atau bisa langsung ditafsirkan jika polanya adalah bertambah 3. Sebaiknya diperbaiki. Hal ini juga mirip dengan yang berlaku di perkalian bilangan bulat negatif dan negatif.
5. Pada perkalian, untuk mari berlatih, saya melihat papan tulis kosongnya masih cukup luas. Apa memungkinkan jika ditambah pilihan jawabannya? Misalnya untuk perkalian bilangan bulat negatif dengan negatif, pilihannya tidak hanya bilangan yang positif (negatif juga, seperti -30). Hal ini dapat dikaitkan dengan kesimpulan yang diperoleh setelah mengisi tabel.
6. Pada mari berlatih operasi hitung campuran, bilangan sudah diacak. Namun, saya menemukan bahwa yang memungkinkan bilangan negatif hanya bilangan kedua ya? Apakah benar seperti itu ya? Mengapa dirancang demikian?

Figure 5. Media Validator Comments

In multiplication randomization, the prime number is always made three because it wants to show the concept of repeated addition. If the main number is two, repetition is less visible. If it is made four, the possibility of the second number appearing is less varied, considering the number line is limited to 12. In the multiplication table, the main numbers are deliberately made the same to direct students'

understanding of the multiplication rules from the patterns formed. There are 3 "Mari Berlatih" slides in mixed operations with different difficulty levels. The first slide is only the second number that appears as random negative numbers, the second is more random negative numbers than the first, and the third is more complex operations than the second. The results of the modified learning media are presented in Table 9 below.

Table 9. The Revision of Learning Media

Before Revision	After Revision
 <p>The animation's movement uses a and b to show the number of steps.</p>	 <p>The description of the animation movement is changed using exact numbers.</p>
 <p>The number of answer choices equals the number of questions, and their placement is in order from the largest to the smallest.</p>	 <p>The number of answer choices is multiplied, and the placement is randomized.</p>
 <p>The number of answer choices is the same as the number of questions; there are no confounders of wrong answers and less varied numbers.</p>	 <p>The number of answer choices was reproduced, including the option of positive and negative answers as a distraction to check students' understanding.</p>
 <p>The number of answer choices is the same as the number of questions, and there are no misleading answers.</p>	 <p>The number of answer choices is multiplied, including the option of positive and negative answers as a distraction, to check the student understanding.</p>

After the revision is complete, the next stage is the implementation stage. The implementation stage is done by testing the media. The limited trial to students done in two meetings. In the first meeting, students learn the operations of addition and subtraction of integers, then they do the test of learning outcomes for the addition and subtraction section only. After that, the learning outcomes test sheets were collected for the researchers to be continued at the next meeting. In the second meeting, students continued to study multiplication, division, and mixed arithmetic operations of integers. Then complete the learning outcomes test in the appropriate section of the second meeting material. When the learning outcomes test is completed, students are directed to fill out a response questionnaire to find out the practicality of the media.

The last stage is the evaluation of the media based on the results of the media trials. The results of the student response questionnaire after the media use trial is presented in Table 10 below.

Table 10. Results of Student Response Questionnaires

Subject	Percentage
RP	92.8571%
J	94.2857%
DA	87.1428%
MF	82.8571%
OA	84.2857%
AM	82.8571%
SA	87.1428%
DH	95.7142%
ED	91.4285%
Average percentage	88.7301%

Based on the percentage of scores obtained in the student response questionnaire, it can be concluded that the Math Moist media is "very practical" according to the media practicality categories referenced in Table 4. Furthermore, the acquisition of student learning outcomes tests after the media trial is presented in Table 11 below.

Table 11. Learning Outcome Tests

Subject	Mathematics Ability Category	Score	Information (KKM ≥ 70)
RP	Low	66	Not Complete
J	Low	77	Completed
DA	Low	85	Completed
MF	Medium	76	Completed
OA	Medium	87	Completed
AM	Medium	78	Completed
SA	High	92	Completed
DH	High	87	Completed
ED	High	95	Completed

Based on the result of the learning outcomes tests, 8 of 9 research subjects has exceeded the KKM score in mathematics at SMPN 5 Jombang. So, the Android-based learning media is capable to help students in achieve their learning mastery. The contribution of categorizing research subject is media can be used by those type of students, especially they've never been given that kind of math learning media before. It is evidence by the result that two out of three students with low math ability can pass the KKM score. This result is relevant to the study of (Putri Basya, Faqih Rifa'i and Arfinanti, 2019:8) that using android-based smartphone as a mathematics learning media could support students understanding of concepts. The analysis of media quality is available in the following Table 12 below.

Table 12. Analysis of media quality

No	Criteria	Achievements
1.	Media does not take up too much memory space	The resulting media is 15 MB in size
2.	Media can be run without system hang problems (reliable)	During the media trial, there was no interference with the Android system when the media was run on each student's smartphone
3.	There are not many bugs/errors when the media is run (maintainable)	When testing the media, the next slide button did not appear on several student's smartphones, but this can be resolved by reloading to the start page first
4.	Menus in the media can function properly (usability)	During media trials, students can open all material menus and work on the available exercises
5.	The selection of development software has been able to meet the material feature requirements.	Based on the result of learning outcome test, the randomization feature can direct student understanding to conclusions related to the rules of integer operations.
6.	Media can be run on various existing versions of Android (compatible)	Based on the trial results, the media can be run on each student's smartphones, even with different specifications and Android versions.
7.	The installation process can be done quickly.	During the media trial, some student smartphones displayed an unsafe warning. However, this can be resolved by clicking the OK button, and the installation can continue.

No	Criteria	Achievements
8	Instructions for using the media are presented clearly	When testing the media, students can operate the media independently.
9.	Media has a clear flow of its features.	During the media trial, some students asked about student activities in the number table in the multiplication operations material menu, and the rest students could understand independently.
10.	Media can be further developed for other learning.	Media can be further developed for appropriate materials related to arithmetic operations.
11.	The language used is communicative and doesn't contain of SARA	Based on the results of the student response questionnaire, no complaints were found regarding the use of language.
12.	Attractive design appearance and appropriate selection of music.	Based on the student response questionnaire results, 8 out of 9 students stated that the chosen music design was attractive. At the same time, one other student advised selecting colours on several slides, so they were light enough.
13	The animation is running fine.	Based on the student response questionnaire results, the animation can run well and interest students.
14.	The navigation icon works fine.	When testing the media, the next slide button did not appear on several student's smartphone, but this can be resolved by reloading to the start page first.

According to the analysis of Table 12 and the result of implementation, the media is deserve to use in learning. It is relevant with the previous study from (Karseno, Sariyasa and I.G. Astawan, 2021:24) that development of android-based learning media on operations of integers were practical in learning and could help the learning process become more interactive. From the response questionnaire, 8 out of 9 respondents comment that the design and music were interesting, so they didn't get bored quickly. It is also relevant to the study of (Ahmad, Ilato and Payu, 2020:72) that the use of technology in the learning process can increase student interest in learning.

However, this media still has a drawback. The answer options in the matching questions can't appear randomly. When students try to type the answer in the evaluation's menu, then the screen were zoom out. This media has also not been implemented throughly in one class, so researcher can't measure it's effectiveness validly.

CLOSING

Conclusion

This research and development resulted is Math Moist (Math Media on Operations of Integers) as an Android-based learning media. The media was developed using the ADDIE model, which consisted of analysis, design, development, implementation, and evaluation. The analysis phase includes three types, the first type is a needs analysis which produces students' problem when studying Operations of Integers, so Android-based learning media is needed. Then in the curriculum analysis, it is known that the 2013 curriculum is a reference for implementing learning. Meanwhile, from technological analysis, it can be seen that network constraints are obstacles to implementing online learning. Therefore, the analysis results become a reference for developing the learning media. Next, the design stage includes collecting materials, making storyboards, designing image assets with Corel Draw X7, and compiling instruments. Next, the development stage includes media programming with Construct2, then assessed by the media and material validators. The learning media were implemented by limited trial to 9 research subject and then evaluated based on the result of it. From those stage, it is known that Math Moist were valid and practical in learning. By using the media, 8 out of 9 students get a score ≥ 70 (KKM) that completed the mathematics learning.

Suggestion

Based on the results of this research and development, the researcher gives some suggestions as follows: 1) It is hoped that the Android-based learning media on operations of integers can applied up to the classical implementation stage in a class; 2) This media can add a feature of randomizing the answer options to the matching activity (drag and drop); 3) This media can be developed with complete material including fractional numbers according to the essential basics of operations of integers and fractions for class VII.

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