THE DEVELOPMENT OF SOLMAT(SOLUTION MATH) APPLICATION ON BASIC MATHEMATICS MATERIAL FOR IMPROVE LEARNING OUTCOMES

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ABSTRACT

Only 28% of students in Indonesia are capable of interpreting problems into mathematical models, due to their lack of understanding of basic mathematical concepts. The purpose of stimulating and guided training is to provide students with a good understanding of problem solving in mathematics. Based on this concept, the purpose of developing the Basic Mathematical Solution Application (SOLMATDAS) is to provide understanding to students with guided training using android as the medium. Media development follows the 4D methodology (Define, Design, Develop, Disseminate), with media and ICT validation by each expert and media effectiveness by learning participants. from the results of the validation test, the percentage of learning expert validation was 90% and ICT expert validation was 90.2%, so the media can be categorized as very valid and can be used as a learning media, whereas after dissemination and testing the effectiveness of the media in obtaining pretest and posttest scores it was carried out by teacher to students in one class. The results of processing the pre-test and post-test statistics obtained a significance value of 0.038, because the significance is less than 0.05 which means there are differences in learning outcomes using SOLMAT and direct learning. From these results it can be concluded that the use of the SOLMAT application can assist in advanced mathematics learning activities which requires an understanding of basic mathematical concepts.

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INTRODUCTION

Learning is a process of finding information that aims to solve the problems faced, as well as learning mathematics that aims to get solutions to existing problems, for the problems and solutions themselves students must experience them directly including by providing problems during learning called problem exercises.

In the educational environment, of course students as learners need to master mathematics well, especially the basic concepts of mathematics, because good mastery of concepts in

mathematics can support learning mathematics (Singkawang et al., 2020) or other material that uses mathematical calculations in it.

However, there is still a lack of student interest in learning mathematics (Malini et al., 2019), because mathematics is considered a material that is difficult to learn (Wasiah, 2021) . This can be seen from the results of research Markus (2019) that only 28% of students in Indonesia are able to interpret and recognize, without direct instructions, how to represent a problem mathematically. Lack of understanding of basic material as a prerequisite for further material is one of the things that causes mathematics to be difficult material. Difficult in terms of understanding and describing the problem in a mathematical form as a whole. Mastery of mathematical material lies in mastering the basic concepts that every student must have. with a deep understanding of the concept it will make it easier to study further mathematical material, as well as in fully describing a problem into a mathematical concept, so that it can solve the problem.

Seeing this, we need a media that can provide a stimulus for understanding basic material in supporting understanding of prerequisite material in learning mathematics.According to Puryati (2017), in learning students need to be given a training stimulus, to improve problem-solving skills, in line with that (Yuliana et al., 2017) guided exercises can give more meaning to student learning. so that the training stimulus can give meaning to students in learning and solving problems.

Stimulus and response are a part of Behavioritic theory where giving a good stimulus will produce a good response as well (Sudarti, 2019). In behavioristic theory, a person has learned when there is a change in his behavior (Oktariska & Toenlioe, 2018), in other words, a change from not being able to solve a problem to be able to solve a problem.

With this understanding, the guided training stimulus will provide a change in behavior from being unable to be able to solve math problems. therefore, it is necessary a proper media that can provide stimulus to students

Media consists of various kinds, from real objects to illustrations in the form of pictures and stories (Aghni, 2018), but the media is one-way, which only provides information and knowledge, this is different from media that use ICT (Internet, Computer, Technology), this media can display real objects as a result of each problem (Rahim, 2011), this is what makes users, in this case, students, teachers, and parents find it difficult to clearly understand how to solve the problem of basic mathematics.

In the 21st century, the use of computers has become commonplace, especially mini-computers known as Smart Phones, this is proven by the increasing number of smartphone users in Indonesia and even in the world. Seeing this, developing media using a smartphone is feasible. This is in line with the research of Arsita Devi & Ratna Puspananda (2021), which states that smartphones can help students learn. Especially on primary math that will be developed and studied at the next level.

Based on the above problems, ICT-based media is needed to support the ability to understand the concept of basic mathematical material, therefore a mathematical solution application (SOLMAT) is developed as a training stimulus to improve learning outcomes with the title of the research title "development of solmat applications on basic mathematical material for improve learning outcomes". The advantages of this application improve students' ability to basic math problems.

METHOD

This research is descriptive and qualitative research using 4D research methods (Define, Design, Develop, Disseminate) developed by Silvasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel,

The stages show as follows:

1. Define
   a. Front-end Analysis

      In this case, the problem examinees by looking at research studies that have achieved through journal articles accredited by Shinta 1, 2, 3 and 4, to know interests (Fatmawati & Anjarsari, 2021)and mathematical literacy abilities (Muzaki & Masjudin, 2019)   owned by students. The goal is to determine the stimulus that needs to be developed.

   b. *Learner Analysis*

      Student analysis is to find out students' initial abilities by compiling and identifying students in terms of their needs and characteristics, to determine the specifications and qualifications for behavioral change from the goals to be achieved   (Taufik, 2019). This analysis is important to determine what kind of stimulus needs to be done so that the final goal is achieved

   c. *Task Analysis*

      Analysis of the tasks that are designed in this study are all conceptions of what needs to be done to provide solutions from the results of learning analysis so that the ability of the basic mathematical subject matter can be improved.

   d. *Concept Analysis*

      After conducting the initial analysis, student analysis and task analysis, followed by doing the concept, in carrying out the concept, carried out in the right way so that the learning objectives are conveyed (Fatimah & Kartikasari, 2018)   , while the lessons that will be conceptualized are limited to elementary mathematics lessons in junior high school.

   e. *Specifying Instructional Objectives*

      In the formulation of objectives, the purpose of this research is directed to solve the problem of the conception of basic mathematics material that needs to be possessed by junior high school students, which will be the basis for supporting lessons at the next level (Nihayah, 2021).

2. Design
   a. *Constructing Criterion-Referenced Test*

      Standard tests were conducted in this study in the form of questionnaires and test devices related to learning basic mathematics that has been in the concept at the previous stage. To scale the questionnaire using the Likert scale and test device in the form of a description of the problem and will be submitted to the subject teacher to adjust to the needs of teachers in assessing the ability.

   b. *Media Selection*

      The selection of media is done by examining what media are widely used by students. To see the amount of media consumption is taken from the primary data of BPS (Central Statistics Agency Indonesia).

   c. *Format Selection*

      The choice of format does by looking at the format that has been doing by previous researchers, through various scientific articles in accredited journals. As the achievement of national learning goals (Kurniati, 2013), after conducting a study of the format, the format will be determined.

d. *Initial Design*

The initial design will be directed to ordinary classical learning only ICT media acts as a tool, which can facilitate the knowledge of the subject matter that is being followed by students, with the addition of simulation solutions that can interact with students. The application design is as follows:
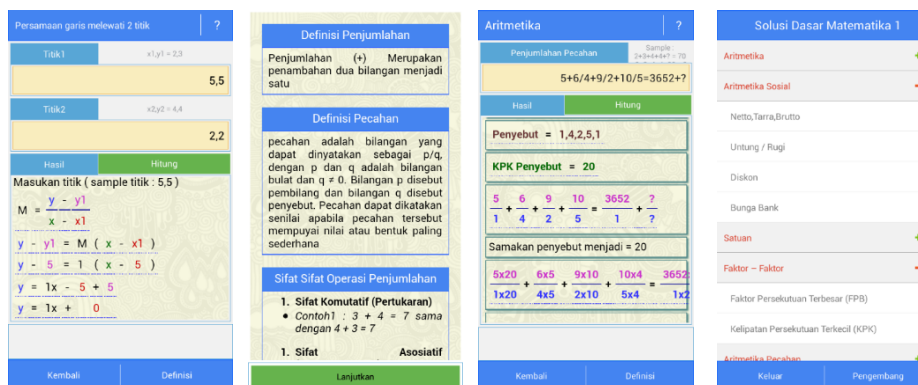

Figure 1. Apps Desain

3. Develop
    a. *Expert Appraisal*
        The expert judgment will be done by:
        -   *2 learning experts*
        -   *1 ICT expert*
    b. *Development Testing*

        In the trial phase, it will be carried out by conducting a media test for 4 students, and then they will be asked to respond to the application in the form of responses and *suggestions*. For responses, the assessment refers to the *Likert* scale assessment with the addition of scores and interpretations (Azizah et al., 2018), with the assessment as show in Table 1.

Table 1. Validation Criteria

Validation Criteria	Validation Level	Interpretation
$\geq 4.50 - 5.00$	Very Valid	The product can be used without repair
$\geq 3.75 - < 4.50$	Valid	Product can be used with minor improvements
$\geq 2.99 - < 3.75$	Sufficiently Valid	The product can be used with many improvements
$\geq 1.90 - < 2.90$	Less Valid	Product cannot be used
$0.00 - <1.90$	Invalid	Product is not suitable for use

4. Disseminate

    At the dissemination stage, distribution will be carried out through the Google Play store, with the aim that the media can be distributed properly, after which a survey of responses from teachers and students who use the media is conducted. The application experiment activity was carried out by the subject teacher directly in the class being taught, with the aim of not changing the learning situation and conditions (Simanullang, 2020). The students were tested before and after getting taught with the

help of the media, students who use the media come from SMAN in Pangalengan. then the initial and final values obtained will be tested on the normality of the data and paired tests to determine the effect of media use.

RESULTS AND DISCUSSION

Results

In carrying out this research, following the 4D development stage, in the Define stage, a literature study was carried out on the problems of student learning outcomes , student learning outcomes are low because an understanding of the basic subject matter is not strong, so a stimulus is needed in the form of repetition of practice questions and guidance on how to solve it. Given that now many students have smartphones, the development of smartphone-based learning media can further support learning. With different student characteristics, the speed of learning will also be different, while the subject that will be conveyed in this application is the basic subject matter of mathematics, starting with simple arithmetic, social arithmetic, KPK, FPB, wake up space, and wake up flat and linear equations of two variables. This basic math study is the base capital for students to continue studying for the next step, while the main goal is to provide information and concepts along with the stages of solving basic math problems, which will be useful if students forget or do not understand about the basic math.

At the Design stage (design) begins with preparing the concept of subject matter, after the concept of subject matter is compiled, design development is carried out by making a mockup of the application, this mockup is used as a reference for media development to the design implementation stage while making mockup using Inkscape software as shown in show in figure 1.
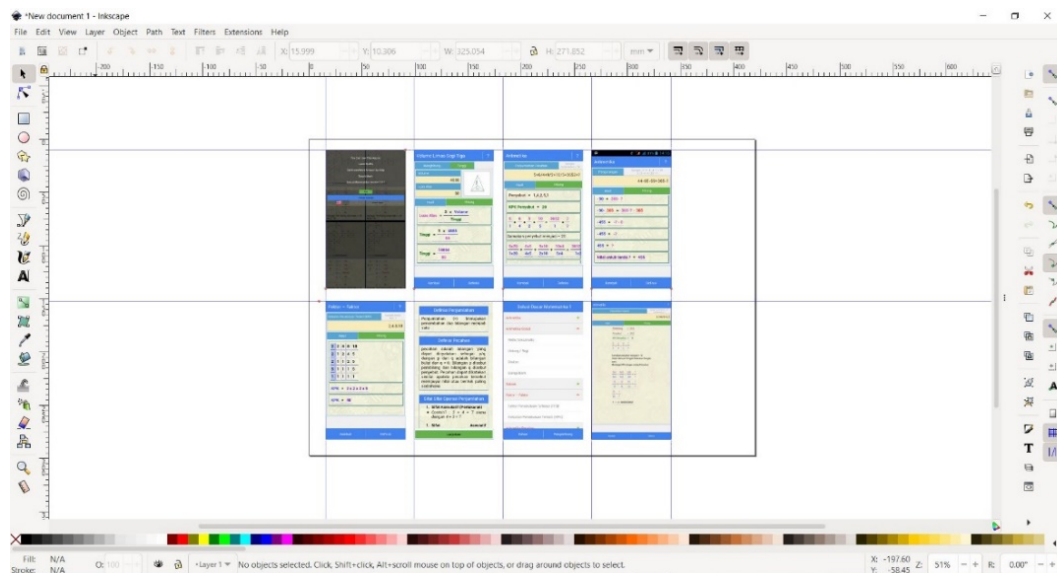

Figure 2. Mockup Apps SOLMATDAS

The next stage is development stage, for this stage we build the mockup to the real apps using Android studio software as shown in Figure 2.
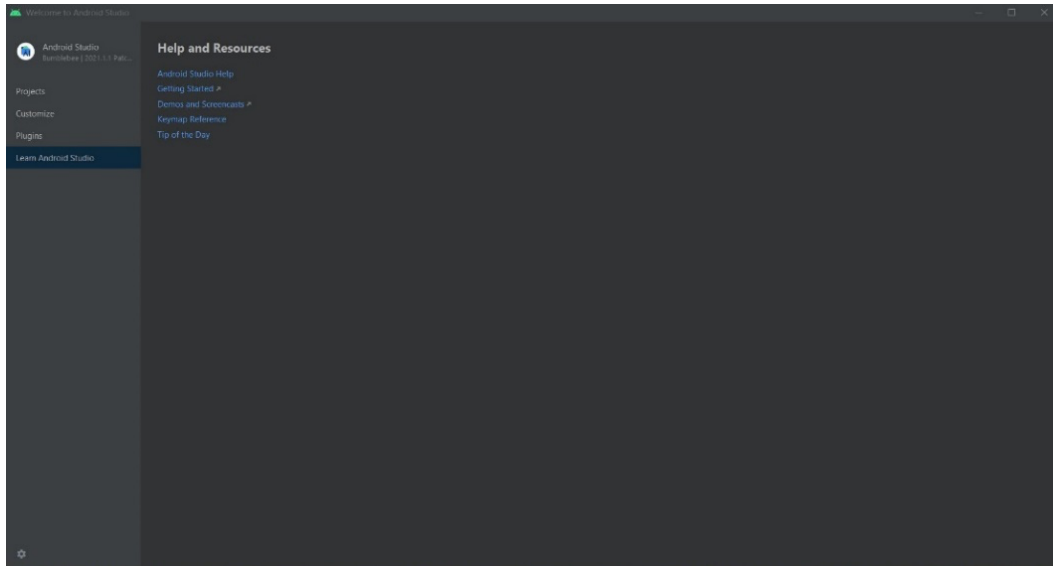
Figure 3. Android Studio Software

Android Studio is designed for application development on the Android platform and uses the Java programming language, for the development of this application as shown in Figures 3 and 4.
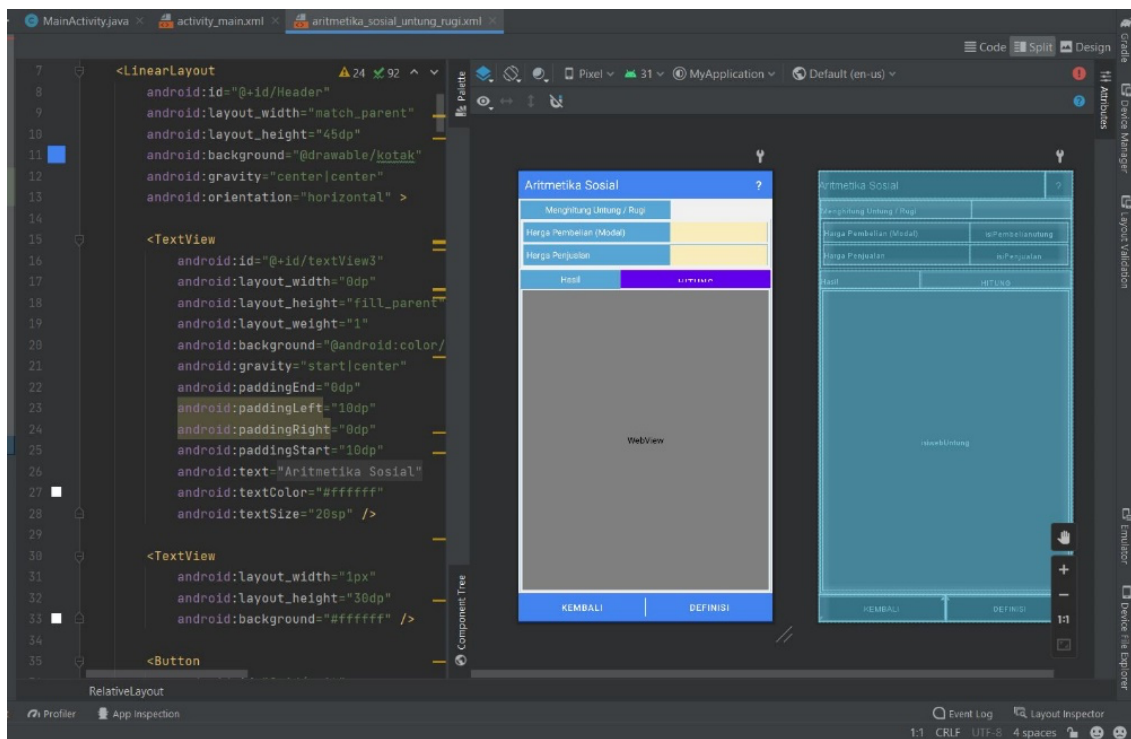

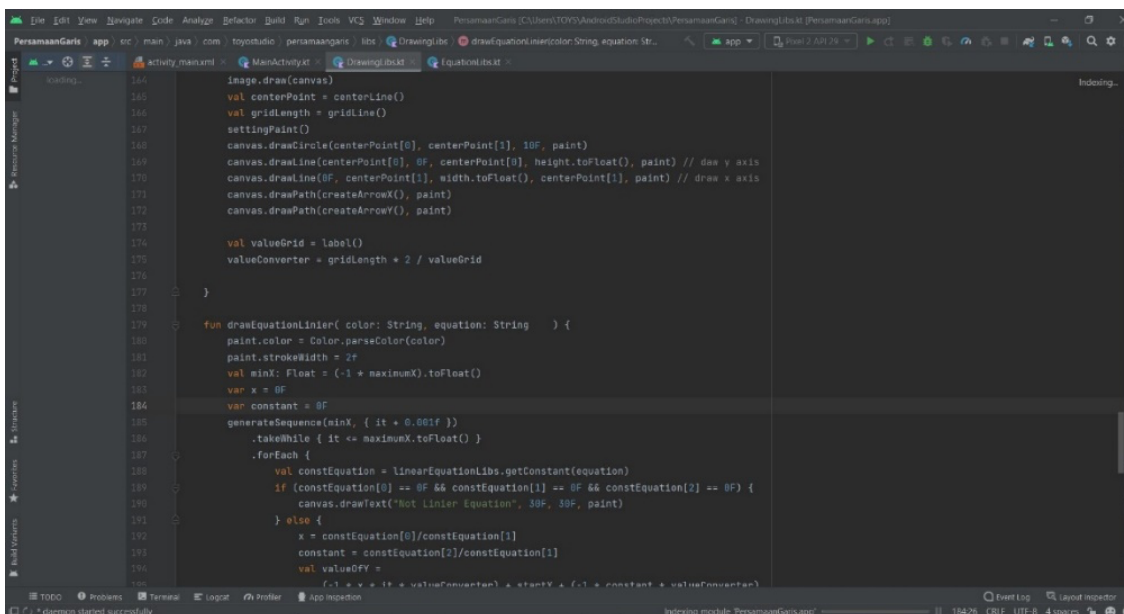**Figure 4. Design Apps Layout Android Studio**

Figure 5. Java Langguage at Android Studio

The stages of development are by making the layout first and then the functions related to the layout. After the application product has been developed, it is continued by validating it to media experts and ICT experts. Media experts get a score of 4.5 and percentage score 90 % with details in   Table 2.

Table 2. Learning expert validation result

	Validator 1	Validator 2	Summary
Media Content	5	4	4.5
convenience and benefits	4.83	4.17	4.50
Final Result			4.5

From the data obtained the media is in the very valid category so that it can be used in learning activities, while for ICT experts a score of 4.51 and percentage score 90.2 % is obtained with details in Table 3.

Table 3. ICT Expert Validation Result

	Validator 1	summary
Media Content	4.8	4.8
Appearance and ease of use	4.22	4.22
Final Result		4.51

From the value obtained, the media is in a very valid category and can be used by students in learning activities, where experts validated and stated that it could be used, then the media was tested on a limited basis to 4 students with an average score of 3.97 and percentage score 79.4 % , with details shown in Table 4.

Table 4. Limited Test Result

	Student 1	Student 2	Student 3	Student 4	Final Reult
Result	4.05	4.00	3.89	3.95	3.97

From the test results with a value percentage of 79.4 %, the media is included in the valid category and can be used by students in learning activities without significant obstacles, which means the data is continued to the product test stage in learning activities.

Before starting the product test, the media is distributed by uploading the basic math solution application media on google play with the link https://play.google.com/store/apps/details?id=matematika.solution&hl=in&gl=US.   After uploading, educators and participants first download the application on the google play platform which is available on every smartphone. Once downloaded, every lesson that requires basic mathematical subjects, uses the application as a tool. Before and after learning activities, a test is carried out to measure the level of effectiveness of the media in supporting learning, at this stage the effectiveness of using the product is tested at the SMAN 1 PANGALENGAN school, the test is carried out by educating teachers and students to use this application, with the aim that learning activities directly carried out by teachers and students as usual, with the hope that the learning situation and conditions will not be different from previous learning. After and before learning activities by using media as a tool, a test is carried out. From the results of the initial test and the final test, statistical calculations were carried out with SPSS to test the normality of the pretest and post-test data and the results were not normally distributed as shown in Table 5 below:

Table 5. Normality Test for Pretest and Post Test

	Kolmogorov-Smimov			Shapiro-Wilk		
	Statistc	df	Sig.	Statictic	df	Sig
Sebelum ada Perlakuan	0.123	36	0.185	941	36	0.053
Seteleh ada Perlakuan	0.175	36	0.007	0.903	36	0.004

a Lilliefors Significance Correction

From the calculation results, it was found that the data was not normally distributed so the calculation was continued with the Wilcoxon relation test and obtained a significant value of 0.038, for the calculation results are shown in Table 6 below:

Table 6. Wilcoxon Related Test

	Sebelum ada Perlakuan - Seteleh ada Perlakuan
Z	2.073b
Asymp. Sig. (2-tailed)	0.038

a Wilcoxon Signed Ranks Test
b. Based on negative ranks.

In the calculation results obtained a significant value of less than 0.05, it can be concluded that there is a positive influence of media application of basic mathematics solutions on student learning outcomes.

Discussions

In educational activities mathematical material is still a problem (Wulandari et al., 2020) . It can be seen from the mastery of understanding for the basic material (Rafiah et al., 2020)   has not given optimal results

The problem that often arises is when advanced material is taught, but basic math skills are not enough. For this reason, it is necessary to strengthen the basic material of mathematics (Friantini et al., 2020). The best reinforcement is the repetition of basic math problem solving exercises. However, if the basic material needed by students is different, it will be difficult for teachers to provide reinforcement simultaneously.

In overcoming this, we developed an application that contains the basics of mathematics lessons, which can be accessed when students need basic material reinforcement, which suits their needs. The application developed has passed the validation assessment both by media experts and ICT experts, and deserves to be used in learning.

Limited testing is done on this application to give an idea when it will be tested on actual learning. In the learning trials, the correlation between pre-test and post-test results can be a positive relationship between pre-test and post-test. On learning with the help of SOLMAT DAS app.

For deployment, it is done using the Playstore web Platform owned by google. With the application translate into several languages. For the percentage of users is quite varied as shown in Figure 6.
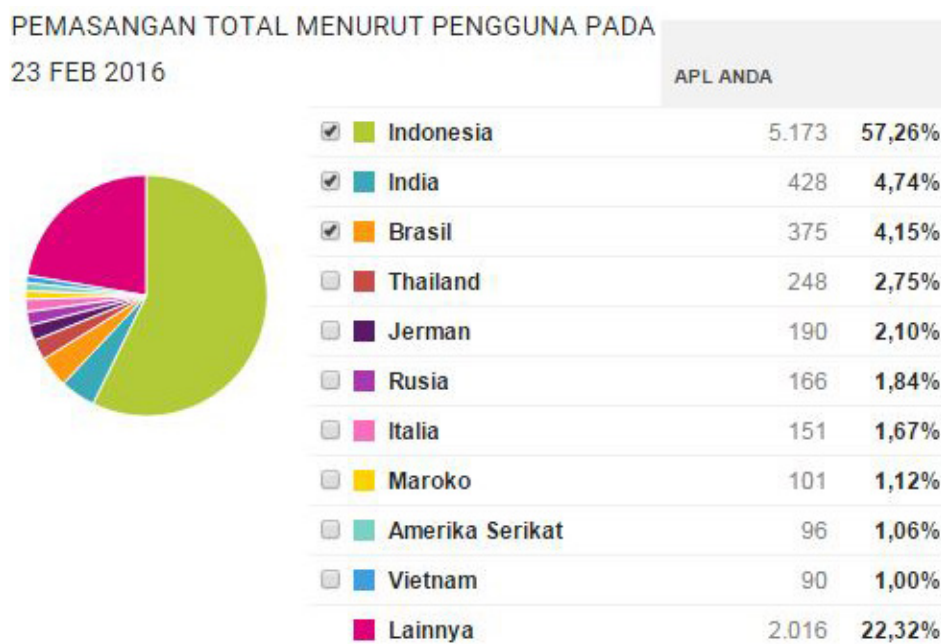

Figure 6. SOLMAT app installs by Country (source Google Play Statistics)

By looking at these results, the application developed has usefulness in supporting mathematics learning.

CONCLUSION

From the media development activities for Basic Mathematical Solutions (SOLMAT DAS) above, it can be concluded that the subjects taught repeatedly can improve students' understanding, so it is necessary to develop more specific media and subjects to construct a deeper understanding of students toward a subject. subject. The simulation concept can be developed because simulation can provide a clear and accurate picture to students. The simulation itself can be done by developing ICT-based learning media. But because this application covers the basic subject matter of mathematics globally, the focus of teaching becomes wider, so that students are quite confused when using it, in the future, it is hoped that there will be application development by including simulations for each subject. So that the focus of students can be more directed and confusion of use can be avoided, as well as provide a good understanding and produce a good increase in grades.

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