Mathematical Learning Resources Using Android Application for Online Learning during Pandemic Covid-19

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Abstract. Online learning is one alternative that can be used for learning activities during the covid-19 pandemic. Online learning requires tools that can be used together so that learning activities take place effectively. Utilization of advances technology is an effort that need to be done to support the current learning process. The use of the android application as one of the alternative in implementing online learning during the Covid-19 epidemic is considered very appropriate, because in general vocational students have used this platform as a communication tool. This research is the initial phase which aims to develop learning resources in mathematics using android applications in an effort to carry out the continuation of learning activities in the Covid-19 pandemic. The method of developing learning resources uses the Analysis, Design, Development, Implementation and Evaluation (ADDIE) model. This research produces mathematics learning resources using Android applications to support government programs in the application of online education in order to minimize the worldwide spread of Covid-19. Learning resources using Android applications that are developed are equipped with animated videos, example questions, practice questions and competency tests.

1. Introduction
Currently the world is horrendous with an outbreak of the spread of the Corona virus or better known as Covid-19. Many countries have become concerned about the deadly spread of Covid-19 [1]. The rapid and massive spread of the virus is forcing the world health organization World Health Organization (WHO) to establish the Covid-19 outbreak as a global pandemic. Every day the scope and impact of the spread of Covid-19 always increases [2]. The spread of this massive and relatively rapid outbreak had an extraordinary impact and change on various sectors of life such as the economic, social and including education. Nasir Mustafa [3] said that the Covid-19 pandemic had affected the education system throughout the world leading to the total closure of schools, universities, and colleges. The United Nations Educational, Scientific and Cultural Organization (UNESCO) stated that the corona virus outbreak had an impact on the education sector. Nearly 300 million students are disrupted by their school activities throughout the world and are threatened with an impact on their educational rights in the future.

Education has become the pilar of the development of each country, therefore the sustainability of education is very important for the growth and development of a country in under any conditions. Education for centuries has been confronted by various kinds of challenges, ranging from curriculum changes, to the closure of educational institutions either due to economic problems, instability of a country or epidemics such as covid-19 that threaten the safety of many people [4]. This fact is experienced by educational institutions in any part of the world, including Indonesia. This situation requires the government program to establish physical distancing which results in the closure of...
schools in various regions. The closure of the school is based on the spread of the virus that occurs so fast and to reduce social contact between students [5].

One effort that can be done to keep educational activities remain ongoing is to implement a online learning system. Roida [6] said that online learning aims to meet educational standards, make the teaching and learning process can be implemented well. In fact, the implementation of the online learning process still has some obstacles especially in mathematics subjects [7]. Mathematics learning remains a priority in any condition. Mathematics is the center of science which has a very important role in the development of Science and Technology. Mathematics plays a major role in preparing human resources to be able to face the era of globalization, especially in filtering various information during the covid-19 pandemic [8]. Teachers as the spearhead of education must be able to ensure that learning activities continue and are carried out even though students are in their respective homes.

The application of online learning requires a tools or media that can be used by teachers and students to continue learning activities. Since the implementation of learning activities from their homes, many teachers and education practitioners who use the Android application as a learning medium, for example whatsapp (WA) applications, google classroom, zoom, webex, hang out and others. The android application used is basic not involved an application that fully support learning material with a specific approach, but rather a social media and teleconference. These applications that are used as a liaison to communicate in large groups. In contrast, mathematics books that are commonly used as learning resources will no longer effective to be applied. For this reason a mathematical learning resource specifically for online learning during the Covid-19 pandemic is needed to be developed. Learning innovation is a solution that needs to be designed and developed by a mathematics teacher to maximize learning activities. Basically, various platforms can be used to support online learning [9]. Musfi [10] said that the use of media in an online education system aims at the process of transferring subject matter and can reach the students in various location. The use of instructional media is one important solution in increasing students’ interest and motivation in learning mathematics [11].

The use of technology has become a necessity for all types of lessons, including mathematics [12]. Technology that is currently developed gives the widest scope for mathematics teachers to be able to utilize various technology products as learning media, especially during the outbreak. Pariienen [13] said that teachers who do not understand technology must be empowered to be able to change learning content, so that students can have a better access to knowledge. A study conducted by Zelkowski [14] concluded that students can learn well and effectively if they use the right technology. Minister of Education and Culture Regulation No. 65 of 2013 also stated the same thing, namely the use of information technology can improve the efficiency and effectiveness of learning [15].

Cambridge International's research through the Global Education Census in 2018 explains that students in Indonesia are very familiar with technological developments, not only as users of social media but also for needs in the field of learning. The results of this study indicate that 40% of Indonesian students become computer users or IT rooms. This fact has led Indonesian students as IT/computer room users to the highest rank globally with more than 67% using smartphones in learning activities, and 81% for doing homework. Based-on the number of students who have used smartphones to support learning activities, it is very reasonable if a teacher chooses an android application as a support medium for learning activities during the Covid-19 pandemic. The use of android applications can improve the content of the program presented then understanding of the material can be further enhanced [16]. The use of the android application as a learning media has several advantages, it is easy to carry, practical, provides interesting visualizations, and is easy to use. Learning using the android application also opens learning boundaries to support learners in learning anytime at any places [17].

Based on the above finding, researchers see the need to design up-to-date learning media that can be used as an online learning media during the Pancovid Co-19 progress. This is done as an effort to support government programs in suppressing and minimizing the spread of Covid-19 that are massive and fast and the continuity of teaching and learning activities for teachers and students. This learning media is a learning resource for mathematics using an android application with a scientific approach
in an effort to improve students' mathematical critical thinking skills on the subject of enumeration rules, permutations and combinations.

2. Methodology
This research is a research development that aims to produce a source of learning mathematics using android applications in an effort to meet the demands of online learning in the pandemic Covid-19 era. The development model used in this study is the ADDIE model, the ADDIE model is considered more dynamic and flexible [18]. This model includes several stages, namely Analysis, Design, Development, Implementation and Evaluation. The ADDIE model is widely used to design and develop various learning products and tools [19]. The phases of the stages of developing mathematics learning resources using an android application using the ADDIE model can be seen in the figure below.

![Figure 1. Development Phased](image)

Based on Figure 1, it can be seen that the ADDIE development model consists of five stages, namely analysis, design, development, implementation and evaluation, but in this study research is limited to the development stage only, and will continue with the implementation and evaluation stages in subsequent studies. The initial stage of development begins with the analysis activities, the results of this analysis will be an evaluation for the continuation of the next stage [20]. The analysis phase consists of analyzing the problems experienced by students in the continuity of teaching and learning activities, analyzing the needs to provide solutions to the problems found, curriculum analysis on basic competencies, character analysis of learners and analyzing the needs of media that will be used to develop mathematical learning resources using the android application. The learning resource development stage is continued at the design stage. At this stage the researcher designs the appearance and content of learning resource content. The learning resource display contains the application logo, background color, type and font size used and plans for the content to be assigned in the learning resource. The learning source content present in the menus such as introduction, Competencies, video animation, sample questions, exercises, summary and competency test.

Following completing the analysis and design stages, the development of learning resources is continued at the development stage. At this stage the learning resources that have been designed developed into an android application through the coding process in the android studio. The coding process produces learning resources in the form of applications that are ready to be used by teachers and students for online learning activities during the Covid-19 pandemic. The ready-to-use learning resource component are the title page, main menu, preface, Main and basic competencies,
instructions for user, summary and competency test. Learning activities carried out by applying a scientific approach in an effort to improve students' mathematical critical thinking skills.

3. Results and Discussion

3.1 Analysis Stage

The analysis phase is the first step that underlies the process of developing learning resources. The Analysis Phase includes problem analysis about learning conditions that cannot be done directly in the classroom because the massive Covid-19 spread, then the media for online learning is needed for the continuity of learning activities in an effort to improve students' mathematical critical thinking skills. In this case the learning media that can be used to fulfill the learning activities of mathematics is the source of learning mathematics using the Android application. The analysis phase continues on the curriculum and competency analysis of the material that will be presented in the learning resources in order to improve students' mathematical critical thinking skills. The material covered was the enumeration, permutation and combination. This topics are part of Basic Competencies 3.25 and 4.25 according to the 2013 curriculum for the vocational schools. Curriculum and competency analysis is also related to the approach used in learning activities, while the approach used is a scientific approach that includes five stages of activities namely observing, asking questions, gathering information, processing information and communicating. The analysis phase ends with an analysis of students' character and tools needed to develop learning resources. Character analysis of students aims to understand the characters of students, this finding will shape the development of learning resources. Analysis of media requirements is an analysis of the minimum standard of a computer device that can be used to develop learning resource applications.

3.2 Design Stage

At this stage the researcher design learning resources that are tailored to the results of the conceptual analysis stage. Activities in designing learning resources using Android applications are (1) designing application logos, (2) compiling a map of learning resource needs that contain an overall picture of content based on the competency of the curriculum used, (3) determining the design of the background color display, determining the type of writing, writing size, slide size and naming of learning resource applications, (4) determination of learning resource content consisting of video animations, sample questions, exercises, summaries and competency tests, (5) collecting various types of references and (6) compiling instruments to be used in developing learning resources. The design of product is shown on the following figure:

![Figure 2. Design of Product](image-url)
3.3 Development Stage

The development phase is the process of coding learning resources that have been designed in the previous stages. At this stage, the learning resources become an application that is ready to be used as a medium of online learning during the Covid-19 pandemic. The coding process is done using a computer device that loads the android studio application. The coding process requires a computer device with a minimum of 4 GB ram and core i7 specifications. The following is an application display that has gone through the coding and installation process on Android smartphone.

3.3.1 Introduction Menu

![Introduction Menu](image1)

**Figure 3.** Opening Page

The opening menu was developed in the form of a splash screen. Figure 3 shows the splash screen that appears for three seconds after the application is opened. The function of the intro menu is to provide information to application users regarding the title of the material presented in the learning resource.

3.3.2 Main Menu

![Main Menu](image2)

**Figure 4.** Main Menu
The main menu is useful for students to use the learning resource application according to the pages they need. The main menu appears when the application is opened and can be swiped left to see the homepage list in a smaller view. The main menu contains an overview of the parts contained in the source. The menu developed in learning resources includes introduction, usage guidelines, basic competencies, concept maps, learning materials, summaries, competency tests and about the author. Each button on the main menu is designed hyperlinked to a particular slide page. This design making it easier for students to access learning resources without having to do a lot of scrolling.

3.3.3 Introduction

Figure 5. Introduction

Figure 5 is a preliminary page display on the learning resources developed. This introduction page is intended as an opening greeting to introduce learning resources that will be used. The introduction contains the purpose of developing learning resources in mathematics using the android application and an explanation of the things contained in the learning resources.

3.3.4 Usage Instruction

Figure 6. User Instruction
Instructions for use are developed in simple language so that it is easily understood by students. Usage instructions are useful to provide an idea of how to run the learning resource application. Directions for use can make it easier for students to use the navigation buttons, video, play and stop buttons, scroll, touch, drag back and others.

3.3.5 Basic Competencies

![Basic Competencies](image)

Figure 7. Basic Competencies

The Menu for Basic Competencies inform the user the topics will be presented in this application.

3.3.6 Concept Map

![Concept Map](image)

Figure 8. Concept Map

In this part, Moncept Map is presented to show the structure of topics discussed in this learning resources. This Map show this application having for main topics.
3.3.7 Learning Activities

Learning Activities are divided into certain part as follows:

3.3.7.1 Learning Objectives

Figure 9. Learning Objective 1

Figure 9 is a display of learning objectives of learning activities on learning resources in mathematics using the android application. The purpose of learning is designed to provide students with an understanding of the importance of mastering the material addition rules and multiplication rules.

3.3.7.2 Learning Activities with Scientific Approach

Figure 10. Topics display on Rule of Addition

Display learning activities material addition rules on learning resources using the android application starts by scrolling down the screen after the learning goal. The appearance of the learning
source is made with certain color variations so that the learning source becomes more interesting. Animated videos on learning activities can be played by touching the play button on the Android cellphone screen.

Figure 11. The display on Topics The Multiplication Rules.

The figure above shows the display of learning resources on topics of Multiplication rules. The display not only used text but also picture and chart with a different nice color. The main idea is presented with box to catch students’ attention.

3.3.8 Summary

The summary contains a summary or essence of the learning material. Summary serves to facilitate students in remembering formulas/formulas used in the rules of enumeration, permutation and combination. Students can look at summaries to find a collection of formulas and important things that exist in each learning activity.
3.3.9 Competencies Test

One of the menu choices in learning mathematics resources using the android application is the competency test menu. This menu is placed at the end of the arrangement after all learning activities have been completed. The competency test contains essay questions that have been designed based on the development of the competencies indicators which aims to improve students' mathematical critical thinking skills. These questions contain the whole material about the rules of enumeration, permutation and combination.

3.3.10 About Author

About the author contains photos and biodata of researchers as developers of learning mathematics resources using the Android application. This page briefly describes the identity and educational history pursued by researchers.
Android application development as a support for the needs in the field of education has been done by other researcher but the development focused on the needs of teachers. One example is the development carried out by Roza on an Android-based e-tutorial in implementing the 2013 curriculum for mathematics teachers. In that study, it was concluded that through the use of e-tutorials based on Android applications can further improve teacher understanding in implementing the 2013 curriculum when compared with traditional methods [21]. Ansari Ahmar [22] in his research also explained that the use of android applications in educational activities can make it easier for someone to understand the material and exercises presented. The main different in this research, the learning resources is developed for students used. This learning resources will also help teacher in delivery the lesson online as needed on the situation of Covid-19 pandemic.

4. Conclusion
Mathematics learning resource applications using android applications are named WIN MATH. This learning resource application can be installed on any Android device so that it can be used as a learning resource in distance learning activities. Development of learning resources is based on the analysis of problems in learning mathematics during the Covid-19 pandemic period. Many teachers have difficulty in implementing online learning on the material enumeration rules, permutations and combinations. So far, teachers only use various applications such as whatsapp (WA), google classroom, zoom, webex, hang out as learning media. The applications used are not applications that can specifically describe learning material, but only as a forum in the form of social media and teleconferences. Therefore, this learning resources consider improve online learning outcomes during the covid-19 pandemic.

The development of learning resources in mathematics using the android application is considered appropriate because many students at the Vocational School level already have an android device as a means of communication. This fact provides an opportunity for teachers to develop mathematics learning resources using the android application as a learning resource. The use of the android application as a learning medium is considered to have many conveniences namely practical, effective, able to provide interesting visualizations and can be used at various places. Learning resource material that has been compiled and designed has pass the coding stage in Android Studio so that it can be used on Android devices. Learning resources developed have several menu choices, namely introduction, usage instructions, basic competencies, concept maps, learning objectives, learning materials, summaries and about the author. In the learning activities menu there is an animated video which aims to motivate students in online learning activities. Through a series of materials presented in learning activities, it is expected can help teachers and students in carrying out learning activities during the Covid-19 pandemic period. This research is the fisrt part of two series research that will be continued by doing practicality and effectivility aspect.

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