

Development of Android-Based Learning Media in Wide Area Network Technology Courses

Alvian Irsyad¹, Dedy Irfan²

Program Studi Magister Pendidikan Teknologi dan Kejuruan

Fakultas Teknik Universitas Negeri Padang

alvianirsyad.piliang@gmail.com

Article History

Received : July 15th 2022

Revision : October 26th 2022

Publication : December 30th 2022

ABSTRACT; This study aims to create and develop android-based learning media in the subject of Broad-Based Network Technology at SMK N 1 Tilatang Kamang. This research uses the *Research and Development* (R&D) method. The subject of his research is android-based learning media in the subject of Broad-Based Network Technology. The validators in this study were two lecturers from Padang State University as Media Experts and two vocational teachers majoring in Network Computer Engineering at SMK N 1 Tilatang Kamang. While the object of research is class XI TKJ students using android-based learning media in the subject of Broad-Based Network Technology. The results of the media validation test obtained an average value of 0.88 which was included in the valid product category, and the material validity test results obtained an average value of 0.93 which was included in the "Valid" category. Furthermore, in the practicality aspect of learning media, the percentage of assessment by teachers was obtained with an average of 92.50 while the average assessment by students was 94.32 in the "Very Practical" category. And the application of android-based learning media through the effectiveness test stage through student learning outcomes tests, namely in the form of *pretests* and *posttests*. The results of the effectiveness test state that this android-based learning media is in the "Effective" category.

Keyword ; *Learning Media, Android, Wide Area Network Technology Courses*

INTRODUCTION

Learning is essentially a way in which students interact with their environment, leading to changes in behavior for the better. Education occurs through human interaction and is not limited by time and space. Education is the main factor for shaping a person. Education plays an important role in the process of shaping the human person. There are several factors that can influence the process in an interaction, both external factors from the environment and internal factors from within the individual. The main task of the educator is to organize the environment to support behavior change in learners (Mulyasa, 2008: 100.)

In the era of globalization as it is today, it affects many changes in various aspects of life. In this era, the process of innovation that covers all aspects of life by involving technology as the main means in education. Change always keeps up with the development of a technology. Technology is one of the things that is very attractive to today's younger generation. The important role of technology is as the main medium in all developments, including in the field of education.

Learning media is a form of vehicle in the learning process which in its use can be done in the classroom or outside the classroom. In the learning process, the use of learning media allows it to be carried out without a teacher in the classroom. Because this tool can be used as a guide for the learning process, students can work individually on the prepared topic. With the help of learning tools, students are expected to be able to interact and think critically in the learning process and not get bored, so that the learning process can run well and in accordance with the original goal.

Science and technology have progressed over time. Increasingly, the development of science and technology is getting more sophisticated which has a significant influence on several aspects of human life, be it directly or indirectly, such as education.

The learning process should be made as interesting as possible. One of them is the use of innovative learning media so that students are interested and can be motivated in learning the subject matter. Many learning media are developed today, but educators often think they are too complicated and time-consuming to create, and they cannot last long. In addition, the use of learning media in the classroom with images is considered impractical. So teachers rarely use pictorial learning media.

With the advancement of technology now, educators are required to be more creative and innovative in the process of teaching and learning activities, the purpose of education can be achieved. As is the case during the Covid-19 pandemic that we have gone through, there are adjustments in the implementation of teaching and learning as well as the use of learning media. During the Covid-19 pandemic that we have been through for some time recently, learning is no longer focused on using media such as whiteboards and projectors. All are computer-based and mobile because the learning process is carried out online. In this case, the author feels that the need for the development of computer-based or mobile-based learning services both in online and offline learning, because it will add variety to learning media so that it does not seem monotonous and that's all.

On December 28, 2021, the author had the opportunity to conduct a short interview by telephone with one of the productive teachers in the Computer and Network Engineering department of SMK Negeri 1 Tilatang Kamang, namely Mr. Donal Indra, S.Pd, M.Pd.T, from the results of the interview obtained information including:

1. Learning media used by teachers of productive subjects using whiteboards and projectors with powerpoint slides. In general, the teaching materials used can already guide, it's just not optimal, especially during a pandemic.
2. In the view of Mr. Donal Indra S.Pd, M.Pd.T, the use of learning media using smartphones will be liked by many students, considering that since the Covid-19 pandemic, many things related to the teaching and learning process are carried out using laptops and *smartphones*, be it when learning is still online as it was at the beginning of the pandemic, or offline which has begun to be carried out since November 2021.
3. Only a few students have laptops, yet almost all students have android-based *smartphones*. *Android smartphones* are considered to have more flexibility than other electronic media such as laptops to support teaching and learning activities.

Android-based media is expected to help improve the quality of learning. The development of android-based learning media is to make products in the form of learning media equipped with text, images, videos, and the product is also equipped with evaluation

questions along with the score results obtained by students after they finish answering the questions, so that students can know the extent of their ability to solve questions.

METHOD

This research was carried out using research and development (R&D) methods. Sugiyono (2013:407) states that R&D is a research method used to produce certain products, and test the effectiveness of these products. In this study, the resulting product was an android-based learning media in the subject of Wide Area Network Technology at SMK N 1 Tilatang Kamang.

Models in research can be used as a framework for the development of theory and research. The development model used in this study is the model proposed by Thiagarajan & Semmel is a 4-D development model (Trianto, 2014). The development of the 4-D model has four stages which include the defining stage (*define*), design (*design*), development (*develop*) and the deployment stage (*desseminate*).

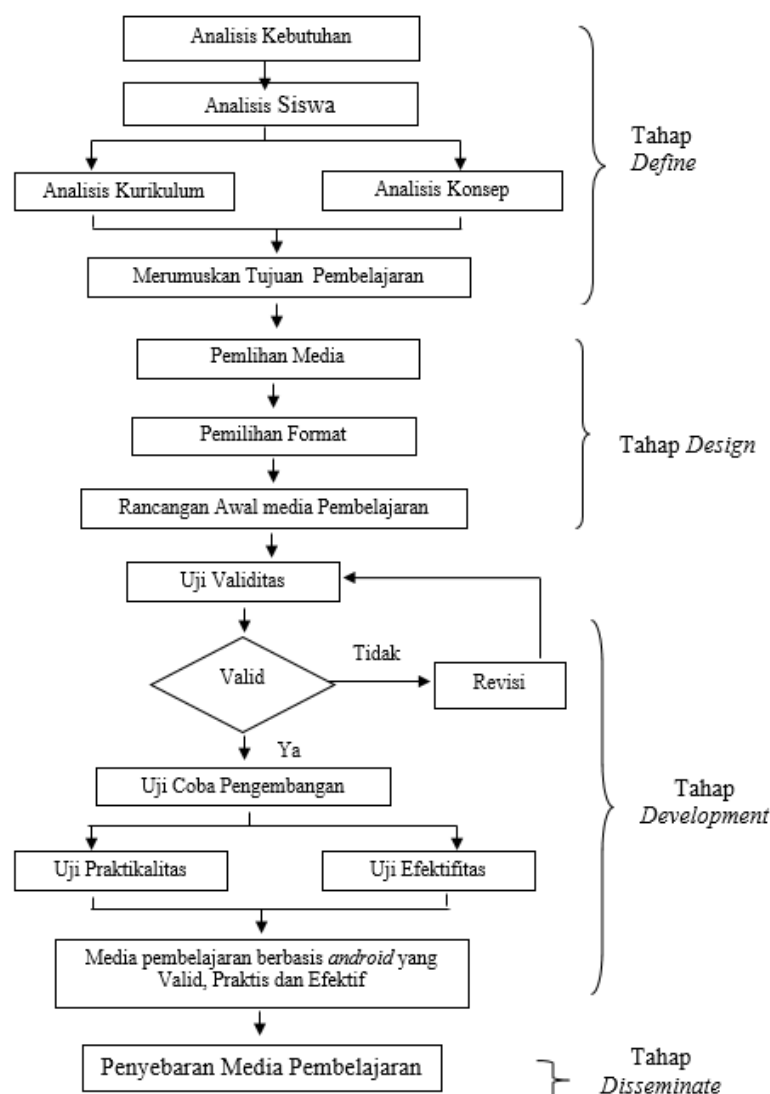


Figure 1. Research Procedures.

The subject of his research is android-based learning media in the subject of *Wide Area Network* Technology. The validators in this study were two lecturers from Padang State

University as Media Experts and two vocational teachers majoring in Network Computer Engineering at SMK N 1 Tilatang Kamang. Meanwhile, the object of the study is class XI TKJ students using android-based learning media in the subject of Wide Area Network Technology.

The data in this study are validation results obtained from validation sheets consisting of material expert validators and media experts. Furthermore, from class XI students of TKJ SMK Negeri 1 Tilatang Kamang to learning media developed based on the practicality sheets distributed. As well as assessments from class XI students to see the effectiveness of the learning media developed.

The data from the study were analyzed with descriptive statistics. Data was obtained through questionnaires from validators and questionnaires from student responses as well as questionnaires from teacher responses to *android-based* learning media developed. Data analysis techniques for each of the research data can be described as follows.

1. Validity Test Analysis

Analysis on validity tests with learning using *android-based* learning media in broad-based network technology subjects, content and media validation is based on validator assessments by experts. According to Saifuddin Azwar (2013:113). From the results of *expert judgement* conducted by experts, the effectiveness coefficient of Aiken V of the evaluated item is in the range of 0.60-1.00, and the decision-making rules are very high. Therefore, the coefficient of effectiveness of these experts has completed the requirements, namely as an effective tool and can be used in this study.

2. Practicality Testing Analysis

The results of research through questionnaires on media from educators and students. The test analysis was carried out to assess the perceptions of educators and students in order to establish the practicality of learning media. This analysis consists of a questionnaire in the form of several questions as a determinant of media practicality. Not only that, this analysis also contains an assessment of the answers given which consist of very practical, practical, quite practical, less practical, impractical.

According to Purwanto (2010: 102) a user practicality test data on learning media such as android-based learning media can be used formulas as below:

$$NP = \frac{R}{SM} \times 100$$

Information:

- NP = Searched or expected percent value
- R = Raw scores earned by students
- SM = Ideal Maximum Score of a contested test
- 100 = Fixed number

It is further stated the percentage obtained in the grouping in the table below.

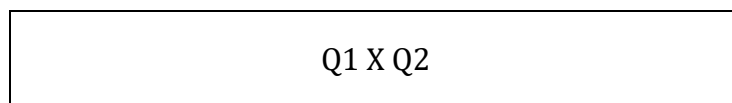
Table 1. Category Practicality

No	Value	Assessed Aspects
1	86%-100%	Very Practical
2	76%-85%	Practical
3	60%-75%	Quite Practical
4	55%-59%	Less Practical

5	≤ 54%	Impractical
---	-------	-------------

3. Effectiveness Testing Analysis

Analyze the effectiveness of learning media to determine the level of effectiveness of learning media in learning. To test its effectiveness, this study used the "single shot case study design" method, which is part of the "design before experiment" method. The research design of one stop case study design is as follows:



Information:

- X = Perlakuan
- O1 = *Pretest* value (Before treatment)
- O2 = *Posttest* value (After treatment)

The first treatment for students is to study the application of media. In addition, the analysis is carried out as follows:

- a. Give a test, which is a posttest that is used to measure the learning expectations of students.
- b. Obtained data on the completeness of student learning individually from each student. Furthermore, it determines the number of students who meet the KKM that has been set by the school, namely ≥ 75 .
- c. The next step is to determine classical completion, if at least 85% of students in one class have met KKM, then the class is said to have completed learning (classical completion) (Trianto, 2012: 241). Use the formula proposed by Mulyasa (2004:19) to determine the integrity value of student learning achievement classically.

$$\text{Classical completeness} = \frac{\text{banyak siswa yang tuntas}}{\text{jumlah siswa}} \times 100\%$$

- d. Then compare the *pretest* values with the *posttest* using the *gain score* formula in Hake (2013).

$$g = \frac{S_{\text{post}} - S_{\text{pre}}}{100 - S_{\text{pre}}} \times 100\%$$

Information:

- G = *Gain score*
- S_{post} = *Posttest Score*
- S_{pro} = *Skor Presest*

Normalized gain score is a good way to analyze *pretest* and *posttest results*. Pretesting for students is given before implementing learning media, and *posttest* is given after the implementation of learning media. *Gain score* is a good indicator that can show the level of effectiveness of learning carried out from *pretest* and *posttest* scores. Improvement of learning outcomes is divided into three categories, namely.

Table 2. Category Gain Score

No	Gain Score	Category
1	$g > 0,70$	Tall
2	$0,30 < g < 0,69$	Keep
3	$g < 0,29$	Low

RESULTS AND DISCUSSION

Media development activities are carried out using the 4D method with stages, namely:

1. Defining Stage

The implementation of research begins with a determination stage (*define*) aimed at establishing and defining problems and obstacles encountered during learning activities. After analysis, data will be obtained about the actual conditions that occur in the field and the solutions offered to solve these problems. At this stage, five activities will be carried out. The first is to know the needs of the students, the second is to examine the background of the students, the three tasks carried out, the four concepts applied, and finally the learning objectives to be achieved, which are described as follows:

a. Needs Analysis

At this stage, an analysis of common problems that occur in productive lessons is carried out, including the subject of Broad-Based Network Technology in class XI TKJ SMK N 1 Tilatang Kamang. This analysis was carried out through pre-conducted interviews with teachers of Broad-Based Network Technology subjects. The results of the interview can be seen in the following table 4.1:

Table 3. Table of interviews with teachers of subjects

1. What curriculum is applied in the school where the father teaches? Answer: Using the 2013 Curriculum
2. What problems are often encountered in the subject of Broad-Based Network Technology? Answer: Students have difficulty in understanding the lesson..
3. What teaching materials do fathers use in teaching in class? Answer: Teaching materials used are generally in the form of Modules and PowerPoint
4. Are the teaching materials used in accordance with the demands of the 2013 curriculum? Answer: It hasn't been completely and there still needs to be additions, especially during a pandemic where it's unclear when it will end. It is hoped that there will be supporting teaching materials that facilitate students to study independently
5. Can the teaching materials used guide students in understanding the lessons taught?

Answer:

In general, the teaching materials used can already guide, it's just not optimal, especially during a pandemic.

6. What kind of teaching materials do you need right now?

Answer:

Teaching materials that support students to be able to study independently at home, considering that all students have *android smartphones*, as much as possible teaching materials can be integrated in the *smartphone*.

In the interview, it can be concluded that the teaching materials have not been fully applied to the 2013 curriculum, which in the learning process is still centered on the teacher. Coupled with the uncertain pandemic conditions up or down, and all students have *android smartphones*, so a learning media is needed that supports independent learning that is integrated in a *smartphone*.

b. Student Analysis

At this stage, researchers conducted an analysis of class XI students of SMK Negeri 1 Tilatang Kamang. The age of students at that level is between 15 and 18 years old, of which the student is entering the developmental stage of adolescence.

Based on the analysis of these students, it is considered in the development of *android-based* learning media, the development of this media is used by broad-based network technology subjects that are tailored to the characteristics and needs of students. The use of android-based learning media in learning activities can increase students' understanding of the material presented by the teacher, because with this media it displays learning materials with a varied and interesting appearance, and can be opened anytime and anywhere by students.

c. Task Analysis

This activity is carried out so that students are able to understand the material presented in the subject of Broad-Based Network Technology which is adapted to the 2013 Curriculum. Then continued with the evaluation stage, where in the evaluation stage there are exercises, namely in answering questions to students can interpret the questions correctly.

Tasks carried out by students after participating in learning with interactive methods are carried out as a step to find out the level of student understanding. Especially after the use of *android-based* learning media is expected to be able to increase students' understanding of the material presented.

d. Concept Analysis

This activity is carried out as an effort to determine the concepts that will be used during the learning activity. The concepts that are arranged are adjusted to the indicators achieved by students during the course of participating in lessons in the subject of Broad-Based Network Technology.

e. Formulation of Learning Objectives

This activity is carried out as an effort to align between the media used during learning, especially when using *android-based* learning media in accordance with

the goals to be achieved in the broad-based network technology subject in accordance with the learning objectives.

2. Planning Stages

After going through the *define* stage, the results of the analysis are used for the *design* stage. At this design stage, the design of the developed module is carried out. The purpose of this stage is to design an android-based learning media. The format of the module preparation consists of the following components.

a. Start Page

On the start page is displayed Cover of the application with the "Start" button to start running the application. It looks like the image below.



b. Menu Page

This page contains menus in *android-based* learning media, the menu page display is as shown below.



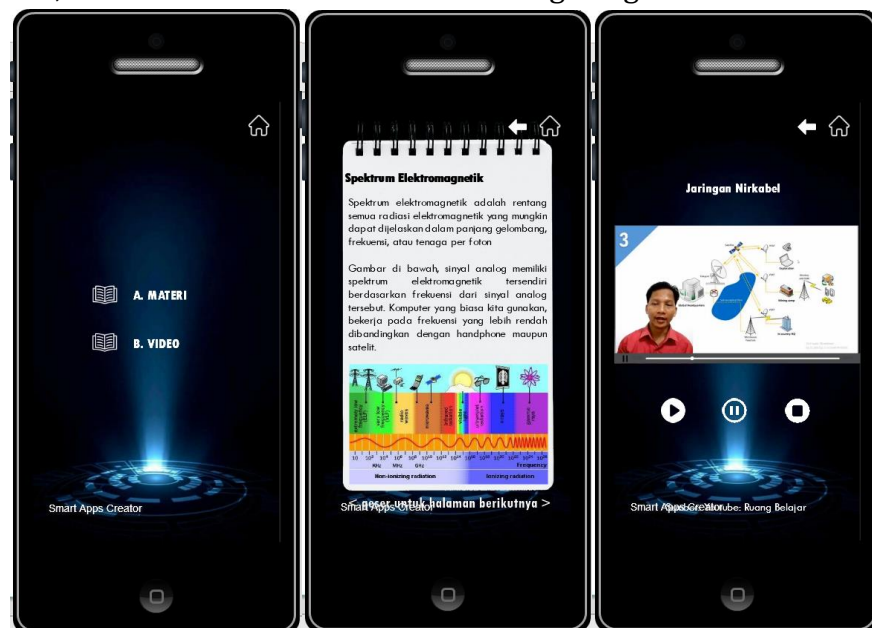
c. Syllabus Page

This page contains a syllabus of the subject of Broad-Based Network Technology. It looks like the image below.



d. Material Page

This page contains material that will be taught by teachers using *android-based* learning media, which can be shown in the following image.



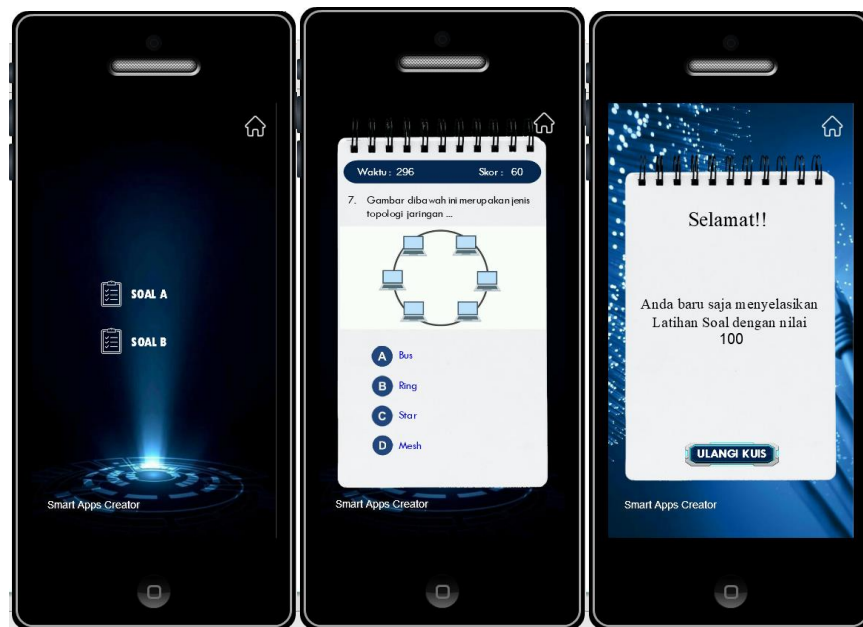
e. Instructions Page

This page contains basic instructions for using android-based learning media. The appearance of the instructions page can be seen in the image below.



f. Evaluation Page

This page contains evaluation questions from the material available in *android-based* learning media. The appearance of the evaluation page can be seen in the image below.



g. Profile Page

In terms of profiles, it contains profiles from *android-based* learning media makers. It looks like the image below.



3. Development Phase

After the stages in the design have been completed, the next stage that will be carried out is the stage in developing. This stage aims to produce valid, practical and effective learning media using android-based learning media.

a. Validity of Learning Media

In learning activities, it is better to prepare media for android-based learning that has been tested for validation so that it has a valid status. This stage in testing the validity of media is carried out so that the media used in learning has been known to be eligible for use according to the assessment by media experts and material experts. Validation in this research is used to obtain valid status results from experts. If this learning media is declared invalid, validation will continue to be carried out until the results obtained can be declared valid.

Test data in validity is obtained through instrument data that has been filled in by validators who are experts in the subject matter and experts in the media. The following is the result of questionnaire data through expert validation testing.

1) Validity of Media Experts

Media validity is validation of the product design that has been produced. This media validation is carried out by 2 parties from media expert validators and there are 3 conditions in the assessment, namely construction requirements, didactic requirements and technical requirements. The researcher attached a media validation questionnaire format.

The results of the assessment of each aspect given by the validator are then analyzed using the statistical formula Aiken's V. Results obtained are validation values summarized in the assessable learning media section shown in Table 4 as follows.

Table 4. Validation Results on Learning Media Using Android-Based Learning Media

No	Validator	Valuation	Category
1.	Validator 1	0,88	Valid
2.	Validator 2	0,87	Valid
Average		0,88	Valid

From Table 4 which states the validation results from media experts on android-based learning media developed has a valid category with an average value of 0.88.

2) Validity of Material Experts

In checking the validation of material carried out with the number of 2 validators of learning materials for Broad-Based Network Technology. The purpose of validating this material is for the accuracy and suitability of the learning material contained in the media whether or not it is in accordance with learning needs.

Experts in validating by reviewing from several aspects such as the quality of the material, interaction aspects, display aspects and learning aspects. In carrying out validity, experts review material on android-based learning media. Next, the validator assesses the material contained in the media.

The results of the study are seen from the results of each aspect that has been given by the validator then analyzed using the formula Aiken's V. Results that have been obtained are validation values in the product design that has been produced. The results of the validation recapitulation are summarized from several aspects of the material on the learning media that have been described in Table 5.

Table 5 Material Validation Results on Learning Media Using Android-Based Learning Media

No	Validator	Valuation	Category
1.	Validator 1	0,89	Valid
2.	Validator 2	0,96	Valid
Average		0,93	Valid

From the results of Table 5 which states the validation results from material experts on android-based learning media developed has a valid category with an average value of 0.93.

b. Practicality of Learning Media

1) Teacher response to the practicality of android-based learning media.

This developed learning media can provide practicality, ease in conveying learning. This practicality data was obtained from a questionnaire that had been filled out by two teachers of SMK Negeri 1 Tilatang Kamang with the subject of Broad-Based Network Technology. The results of the assessment on the practicality are summarized in Table 6 as follows.

Table 6. Teacher Practicality Response.

No	Aspects	(%) Category	
1.	Facilities	95	Very Practical
2.	Time	90	Very Practical
3.	Use	92,5	Very Practical
Average Teacher Response		92,5	
Categories Aspects		Very Practical	

Based on the table taken with an average practicality assessment of 92.5, it can be concluded that the learning media is included in the "SP or Very Practical" group.

- 2) Students' response to the practicality of android-based learning media
Practical media also requires input in the form of responses from 26 students of SMK Negeri 1 Tilatang Kamang. This data is obtained after the students use the media, the next stage students are asked to fill out the questionnaire given by the researcher (attached to the attachment). The results in this assessment are summarized in Table 7.

Table 7. Table of Student Practicality Responses

No	Aspects	(%) Category	
1.	Facilities	94,04	Very Practical
2.	Time	94,15	Very Practical
3.	Use	94,77	Very Practical
Average Student Response		94,32	
Categories Aspects		Very Practical	

The value obtained according to the average practicality is 94.32, so it can be concluded that the media is included in the category of SP or Very Practical.

c. . Effectiveness of Learning Media

The effectiveness in using these learning media can be viewed in two ways, namely by looking at the delivery of KKM or Minimum Completeness classically compared to the data on the *pretest* and *posttest* which apply *the gain score analysis*.

1) Classical Completeness

Classically, completeness can be seen from the percentage of the number of students who enter the completion after using the learning media. The basis for determining learning media is that the results obtained from the presentation of classical completeness of students are greater or equal to as much as 85%, so the media can be used effectively. On the other hand, the percentage result obtained is smaller than 85%, then the media is not effective for use. The following are the results of students' average scores on simulation and digital communication subjects presented in Table 8.

Table 8 Classical Completion Table

No.	KKM	Number of Learners	%
1.	< 75	3	12%
2.	≥ 75	23	88%
Sum		26	100

From the results of the analysis displayed in the Table, it is stated that the number of students who entered the completion was 23 students or equivalent to 88%. With this classical completeness has been achieved, the learning media can be used effectively when reviewed through classical completeness.

2) Uji Gain Score

Student learning outcomes show improved results after pretesting and *posttesting* which are carried out by calculating the *gain score*. Learning media can be declared effective if the value of the *gain score* obtained ≥ 0.3 or the results are still minimal in the moderate category. The *gain score* is 0.70 which is included in the high category.

Table 9. *Gain Score* Value Recapitulation Table

N	Minimum Value	Maximum Value	Gain Score
27	0.33	0.92	0.70
Category			Keep

Source: Appendix.

Based on classical completeness reaching 89% and a *gain score* of 0.70 with a high category , it can be concluded that android-based learning media is declared effective. For more details, the reader can be shown in the 17th appendix.

4. Deployment Stage

In this stage, the learning media developed is ready to be used by teachers and students in learning broad-based network technology lessons and can be widely disseminated.

Discussion

Android-based learning media is developed, this is a series of processes or activities that are carried out as an effort to provide the results of the learning media in accordance with the development theory. The purpose of this development is to obtain practical, valid and efficient learning media. Learning media is developed with a 4-D development model (*define, develope, desseminate, design*). The development model applied was developed by Thiagarajan listed in the book Trianto (2010:94).

The implementation of research begins with the stage of defining the problems faced in learning which includes the analysis of needs, students, concepts and formulations about goals. The problem found in the field is the lack of variety of learning media used. In learning activities that take place in class, students have difficulty understanding the lesson, this is also related to the material presented which should be delivered with the help of the media so that there are actions and reactions in learning based on basic abilities and indicators that have been selected in learning in achieving the objectives of learning.

In the early stages of research, it is carried out with a definement analysis or *define* and the next step is the stage in designing or *designing*. Entering the stage of designing there are activities, namely by compiling tests, choosing media, choosing a format that is in accordance with the initial design or prototype with the learning media being developed. In line with the opinion of Trianto (2012) states that the design stage is the stage that prepares or the initial design of the media developed.

In compiling the test, an evaluation tool is needed to find out the abilities of each student. There are two tests arranged in this stage, namely pretest and also posttest so that researchers can see with their abilities in their knowledge. Basic competencies are used as the basis for compiling tests.

If the test preparation stage is complete, the next step is the selection of media to be used in learning, namely *android-based* learning media. The last stage that is carried out is the selection of formats, which consist of the arrangement in writing teaching materials, explanations of teaching materials and practice materials, as well as the presentation of learning objectives to be achieved.

Media development is carried out to obtain easy-to-use media. This activity can achieve success, if two stages are carried out, namely validation of learning media and development trials. Where in the development media validation activity there are activities to test the level of validity of android-based media, which are tested by validators, while in the development trial activities there are practicality test activities on android-based learning media given assessments by teachers and students, which are followed by tests of the effectiveness of android-based learning media.

1. *Android-Based* Learning Media Validation.

This activity is carried out as an effort to get the means and input submitted by validators on *android-based* learning media. The validator that gives the assessment consists of two groups, each of which consists of two validators. The first group is media validators and the second is material validators. Data was obtained from the results of filling out questionnaires by validators and discussions by showing the android-based learning media. The media validator gives a validation value of 0.88 which is declared valid. Meanwhile, the material validator gave an assessment of 0.93 by being declared valid.

Based on the assessment of validators obtained from media experts and material experts on the use of *android-based* learning media, it can be concluded that this media is feasible and suitable for use in learning activities in broad-based network technology subjects.

2. Practicality of *Android-Based* Learning Media.

To find out the level of practicality of *android-based* learning media, data was obtained from the results of trials conducted at SMK Negeri 1 Tilatang Kamang. The practicality assessment was also carried out with a questionnaire filled by teachers / practitioners, namely 92.50 and by 94.32 students with a very high practicality category.

Refers to the response given by students and teachers about *android-based* learning media. The overall response given explained that the use of this method is very practical.

At the dissemination stage, socialization activities can be carried out for the first time by applying them to broad-based network technology lessons. Dissemination is done by promoting media in other classes that share the same subject and shared through Google Drive. This activity is carried out as an effort to introduce android-based learning methods to all teachers and students

CONCLUSION

Based on the results of the learning media development research that has been carried out, the following conclusions were obtained:

1. This development research produces *android-based* learning media in the subject of *Wide Area Network* Technology that suits the needs of students. Learning media using

android-based learning media is presented with a material format according to the competencies that must be achieved by students. Learning media using android-based learning media helps students in receiving learning in class according to the existing learning time. Learning media using android-based learning media can be used by students anytime and anywhere when students want to repeat the lesson (learning independently).

2. Test the validation, practicality and effectiveness of android-based learning media as a learning support tool, stating that learning media is valid, practical and effective. Where the average value of all media expert validators with a value of 0.88 is included in the valid product category and the average value of all material expert validators with a value of 0.93 is included in the valid category. Furthermore, in the practicality aspect of android-based learning media, the percentage of assessment by teachers with an average of 92.50 while the average assessment by students is 94.32 so that android-based learning media is stated to have met the practicality aspect of an educational product. And the application of android-based learning media through the effectiveness test stage through student learning outcomes tests, namely in the form of *pretests* and *posttests*. The effectiveness test results state that this android-based learning media is in the effective category

REFERENCE

- Andrian, Joni. (2021). Pengembangan Media Pembelajaran Berbasis Android pada Mata Pelajaran Perencanaan dan Instalasi Sistem Audio Video di SMK. Tesis tidak diterbitkan. Padang: Program Pascasarjana UNP.
- Arikuto, Suharsimi. (2010). Manajemen Penelitian. Jakarta: Rineka Cipta.
- _____. (2015). Prosedur Penelitian Suatu Pendekatan Praktik. Jakarta : PT. Rineka Cipta
- Azmi, Rahmi Anita. (2020). Pengembangan Media Pembelajaran Berbasis WEB Menggunakan Moodle pada Mata Pelajaran Administrasi Infrastruktur Jaringan di SMKN 1 Sintuk Toboh Gadang. Tesis tidak diterbitkan. Universitas Negeri Padang
- Azwar, Saifuddin. (2013). Metode Penelitian. Yogyakarta: Pustaka Pelajar
- Batubara, Hamdan Husein. (2017). MUALLIMUNA: Jurnal Madrasah Ibtidaiyah: Pengembangan Media Pembelajaran Matematika berbasis Android untuk Siswa SD/MI. 3(1). 12-27.
- Dahar, Ratna Wilis. (2011). Teori-Teori Belajar dan Pembelajaran. Jakarta: Erlangga.
- Dickers, S., Martin, J., & Coulter, B. (2011). Mobile media learning: amazing uses of mobile devices for learning. Halifax: ETC Press
- Djamarah, Syaiful Bahri. (2008). Psikologi Belajar. Jakarta: Roneka Cipta
- Fatmawati, Siswa. (2021). Pengembangan Media Pembelajaran Berbasis Aplikasi Android Untuk Meningkatkan Hasil Belajar IPS. 11(2). 134-143.
- Hamalik, Oemar. (2004). Proses Belajar Mengajar. Jakarta : Bumi Aksara.
- Ibrahim, Nurwahyuningsih., Ishartiwi. 2017. Pengembangan Media Pembelajaran Mobile Learning Berbasis Android Mata Pelajaran IPA untuk Siswa SMP. 8(1). 80-81
- Junita, Wulan. (2019). Prosiding Seminar Nasional Teknologi Pendidikan Pascasarjana UNIMED: Penggunaan Mobile Learning sebagai Media dalam Pembelajaran. 602-609
- Khairani, Nikmatul. (2021). Pengembangan Media Pembelajaran Berbasis Android Pada Mata Pelajaran Simulasi Komunikasi Digital. Tesis tidak diterbitkan. Padang: Program Pascasarjana UNP

- Kuswanto, Joko. (2019). Pengembangan Media Pembelajaran Berbasis Android Pada Mata Pelajaran Biologi Kelas XI. 2019. 2(2). 65-70.
- Lubis, Isma Ramadhani. Ikhsan, Jaslin. (2015). Pengembangan Media Pembelajaran Kimia Berbasis Android untuk Meningkatkan Motivasi Belajar dan Prestasi Kognitif Peserta Didik SMA. 1(2) 191-201
- M, Ngilim. Purwanto. (2010). Prinsip-Prinsip dan Teknik Evaluasi Pengajaran. Bandung: Remaja Rosdakarya
- Murya, Yosef. (2014). Android Black Box. Jakarta :Jasakom.
- Mulyasa, E. (2004). Menjadi Guru Profesional. Bandung: PT Remaja Rosdakarya Offset
- _____. (2008). Kurikulum berbasis kompetensi. Bandung: PT Remaja Rosdakarya Offset.
- Muyaroah, Siti,. Fajartia, Mega. (2017). Innovative Journal of Curriculum and Educational Technology: Pengembangan Media Pembelajaran Berbasis Android dengan menggunakan Aplikasi Adobe Flash CS 6. 6(2). 79-83.
- Nurhalimah, Septina Restu., Suhartono., Cahyana, Ucu. (2017). Pengembangan Media Pembelajaran Mobile Learning Berbasis Android pada Materi Sifat Koligatif Larutan. 7(2). 160-167.
- Rizky, Ema. (2016). Pengembangan Media Pembelajaran Berbasis Game Pada Mata Pelajaran Matematika di SMK. Tesis tidak diterbitkan. Padang: Program Pascasarjana UNP
- Safaat H, Nazruddin (2011). Pemrograman Aplikasi Mobile Smartphone dan Tablet PC Berbasis Android. Bandung: Informatika.
- Slameto. (2003). Belajar dan Faktor-faktor yang Mempengaruhi. Jakarta: Rineka Cipta
- Sugiyono. (2012). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta.
- _____. (2013). Metode Penelitian Pendidikan Pendekatan Kuantitatif.
- Perbawa, I Gede Bayu., Adiarta Agus., Ratnaya, I Gede. (2020). Jurnal Pendidikan Teknik Elektro Undiksha: Pengembangan Media Pembelajaran Menggunakan Smarthphone Berbasis Android untuk Pembelajaran Teknologi Jaringan Berbasis Luas (WAN). 9(3). 232-242
- Riduwan. (2012). Dasar-dasar Statistika. Bandung: CV Alfabeta.
- Rustandi, Andi., Asyiril., & Hikma, Nurul (2020). Media Bina Ilmiah: Pengembangan Media Pembelajaran Berbasis Android pada Mata Pelajaran Simulasi dan Komunikasi Digital Kelas X Sekolah Menengah Kejuruan Teknologi Informasi Airlangga Tahun Ajaran 2020/2021. 8(2). 4085-4092. <https://doi.org/10.33758/mbi.v15i2.880>
- Saputra, Yuda Galih., Harjanto, Arif., Andrian Ningsih, Yunita. (2020). Journal of Advances in Information and Industrial Technology (JAIIT): Pengembangan Media Pembelajaran Berbasis Android untuk Mata Pelajaran Fisika Materi Pokok Energi di Kelas X IPA 1 SMA Negeri 2 Muara Badak Tahun Ajaran 2019/2020. 2(2). 10-24
- Shabiri, H. (2005). Strategi Belajar Mengajar Micro Teaching. Jakarta: Quantum Teaching
- Slameto. (2010). Belajar dan faktor-faktor yang Mempengaruhinya. Jakarta: PT. Rineka Cipta.
- Supardi, Yuniar. (2014). Semua Bisa Menjadi Programer Android – Case Study Jakarta : PT Elex Media Komputindo.
- Supriyanto. (2019). Teknologi Jaringan Berbasis Luas (WAN) C3 Kelas XI. Malang: PT Kuantum Buku Sejahtera
- Sutopo, Ariesto Hadi. (2012). Teknologi Informasi dan Komunikasi Dalam Pendidikan. Yogyakarta: Graha Ilmu.

- Trianto. (2014). Mendesain Model Pembelajaran Inovatif, Progresif, dan Kontekstual: Konsep, Landasan, dan Implementasinya pada Kurikulum 2013. Jakarta: Kencana
- Yektyastuti Resti., Ikhsan, Jaslin. (2016). Jurnal Inovasi Pendidikan IPA: Pengembangan Media Pembelajaran Berbasis Android pada Materi Kelarutan untuk Meningkatkan Performa Akademik Peserta Didik SMA. 2(1). 88-99