

MATHEMATICAL UNDERSTANDING CAPABILITY OF SENIOR HIGH SCHOOL NUMBER 1 STUDENTS THROUGH LEARNING ASSISTED GRAPHER APPLICATION ON ANDROID

Yanna Sanova¹, Ely Susanti², Ayu Mentari³

¹Senior High School Number 1 Palembang

²Mathematics Education Department, Sriwijaya University

³Mahasiswa PPG FKIP Universitas Sriwijaya

Abstract

This research is a descriptive study that aims to describe the ability to understand mathematical concepts in grade 12 7 in SMA 1 Palembang through learning assisted Grapher application on android. The subjects of this study consisted of 30 students. The instrument used was observation and test. Observations were used to collect data about learning and tests were used to see the ability to understand students' mathematical concepts. The results of the study concluded that the ability of students' understanding of rational function material, limitless to algebraic functions and infinite limits on categorized trigonometric functions was quite good. In the material of rational function, students were misconstrued due to being trapped in images that appear to be congruent. Even though the pictures were not congruent. Still related to the material of rational function, the presentation of a picture that was not right in terms of scale and form of sketches caused students to misinterpret the problem and make conclusions. Specifically for infinite limit material for both algebraic and trigonometric functions, the low scores of students on the concept comprehension tests were caused by students being less careful in calculating.

Keywords: Mathematical Understanding, Grapher, Android.

1. Introduction

The ideal learning activity is the all teachers' dream. Ideal learning can be drawn from the activity and atmosphere [1]. Judging from the aspect of its activities, ideal learning activities are when all students actively involve in learning, and the teacher acts more as a motivator and facilitator. Whereas if viewed from the atmosphere in the classroom, ideal learning activities can be seen if the learning activities are fun, all students are enthusiastic and eager to participate in learning, and students feel that the learning process has meaning for them [2]. Therefore the teacher must be able to design and gather the learning well. In designing and gathering learning, teachers should always consider the material aspects, strategies, models, methods, media, and learning resources[3].

The phenomena that occur in the field so far and experienced by researchers are still many students who experience difficulties in understanding the material with graphic visualization [4]. After tracing from several previous students' tests, information was obtained as follows: most students could not change from one representation to another,

for example if the function is known, the students do not know the graph. Other problems that are illustrated both from the results of the test and learning are students cannot provide other examples in the form of functions or graphics, if it is given a function, the student suspects to the graph, detecting similarities and differences in functions and their graphs, giving several graphs, not matching the functions and graphics; making generalizations, for example if the function is "like this" then the graph is "so", being able to explain certain concepts. It is suspected that this is because when teaching these materials, the teacher tends to only make rough sketches with an inappropriate scale. This has led to the emergence of a gap between the actual concept and the concept received by students.

Based on the results of reflections and observations that have been carried out by the researchers with the team, information is obtained that even though the learning plans that have been made refer to the concept of the 2013 curriculum but the learning process undertaken by the teacher is still not in accordance to the 2013 curriculum. The teacher is still carrying out a one-way learning process and tend to only use the lecture method, and student activities tend to be passive and only focused on the blackboard. This makes the problem worse in class. The learning process carried out by the teacher only emphasizes the demand for curriculum implementation rather than developing all the potential possessed by students. Students are seen only as listeners and recorders of all things conveyed by the teacher, and students lack the opportunity to be active in teaching and learning activities, so that the activities of students in the class are not well conditioned. For example, on the sidelines of learning, students use their components for purposes that do not support learning. From the results of a cursory reflection and observation conducted by researchers and teams, information was obtained that students looked saturated and felt bored when learning.

From the description above, it can be seen that there are two things that are the root and cause of the problems above, namely the problems related to the methods and problems related to the learning media. The researcher decided to focus on improving learning from the media aspect. Learning media plays an important role in the achievement of learning goals set by the teacher. [3] states that in addition to methods, learning media also become an important element. Learning media can provide a great influence on the climate, conditions, and learning environment that is organized and created by the teacher [5]. The use of media in the learning process not only can attract students' attention to the lesson but also can generate new desires and interests, generate motivation and stimulate the learning activities, even bring other psychological influences on students such as eliminating boredom and boredom in learning.

Relying on the facts and theories above, researchers are interested in conveying a thought that might be a solution to these problems, namely through the use of the Grapher application on Android on learning. The use of the Grapher application on Android was chosen as an alternative action that could improve students' understanding. The choice of using the Grapher application on Android on learning as an alternative action has gone through several considerations, namely: (1) the main problem related to the use of media in learning; (2) Grapher is one application for drawing graphics; (3) almost all students of class XII IPA 7 have android; and (4) Grapher is easy to operate and does not need data (off-line).

Based on the description above, the purpose of this study was to describe the ability to understand mathematical in grade 12 of SMA 1 Palembang through learning assisted Grapher application on android.

2. Literature Study

2.1. Mathematical understanding

Understanding is divided into four levels, namely mechanical understanding, inductive understanding, rational understanding, and intuitive understanding [6]. Mechanical understanding of a concept, if he can remember and apply the concept correctly. Inductive understanding of a concept, if he has tried the concept applied in a simple case and believed that the concept applied in a similar case. Rational understanding of a concept, if it can prove it. Intuitive understanding of a concept, if he has convinced of the truth of the concept without hesitation.

[7] distinguishes into two types of understanding, namely instrumental understanding and relational understanding. An instrumental understanding of a number of concepts is interpreted as an understanding of mutually independent concepts and only memorizes formulas and applies them in calculations without knowing the reasons and explanations. On the other hand, relational understanding includes a complex scheme or knowledge structure that relates to or relates to each other which can be used to solve broader and more complex problems.

Identical to Skemp's opinion which states that there are two types of understanding, namely: instrumental and relational, [8] expresses his opinion on procedural knowledge that is identical with instrumental understanding, and conceptual knowledge that is identical in understanding relational. However, between Skemp and Hiebert, there are differences regarding the relationship between these two abilities. [8] states that Skemp gives a clear boundary between these two abilities so that there is a dichotomy between instrumental understanding and relational understanding. Whereas Hiebert does not give a strict boundary between procedural knowledge and conceptual knowledge, so that between these two abilities continue.

Another opinion about understanding was stated by Bloom [9] which states that there are 3 types of understanding, namely: translation, interpretation, and extrapolation. The implementation of this understanding on mathematics can be exemplified as follows: translation, for example; being able to convert an equation into a graph, being able to change questions in the form of words into symbolic forms or vice versa. Interpretation, for example; being able to determine the right concepts to be used in solving a problem, being able to interpret a similarity. While extrapolation, for example, being able to apply concepts in mathematical calculations, being able to estimate the tendency of a diagram.

[9] in the revised Bloom Taxonomy states that there are 7 cognitive processes of understanding, namely:

Interpreting (interpreting): Changing from one representation to another representation.

Exemplifying / Illustrating: Finding specific examples or illustrations of a concept

Classifying: Determines that an example or case belongs to the category of a concept or not.

Summarizing, generalizing: Making a statement or statement that represents some of the information presented with the information from this picture students are directed to observe the comparison of the lengths of the corresponding sides between the two triangles.

Inferring: Find patterns from a collection of examples or cases.

Comparing: Detects similarities and differences between two or more objects.

Explaining: Explaining and using a causal system of a concept.

2.2. Android

The development and progress in the field of science and technology are growing very rapidly. So that humans can create tools, facilities and infrastructure as well as sophisticated equipment for various activities so that in life activities there are various facilities that allow their activities to be more effective and efficient. The development of Information and Communication Technology is currently growing very rapidly. This development causes changes in community behavior and activities in daily life. One of the technologies that is now developing very quickly is information technology and mobile communication (mobile). Mobile technology that is currently not only used as a communication tool, but also as a tool to facilitate users in everyday life. This can happen because in mobile technology there are many facilities, including: accessing the internet, e-mail, organizer, music, games, learning, etc. that can be used anywhere, anytime faster and easier.

According to [10], android is a mobile device on the operating system for Linux-based cellular phones. Hermawan (2011) added that Android is a Mobile OS (Operating System) that grows in the midst of other OSes that are developing today. Other OSes like Windows Mobile, i-Phone OS, Symbian, and many more.

Android is a very popular Operating System (OS) or operating system lately. It cannot be denied that this operating system has taken the attention of the world community and the people of Indonesia. Gadget and cell phone companies are competing to make devices using the Android operating system. Therefore, it is surprising that almost every day we see new gadgets on the market using the Google operating system.

The Android symbol / logo is a robot with two antennas on its head, this symbolizes that Android is a symbol of a high-end operating system for gadgets and smartphones [11]. From the beginning of its launch in 2007, Android has updated its version several times. The version on Android has a unique name (mostly food names).

In the learning process, a teacher has an important role in achieving learning activities in school. The teacher becomes the tip of the learning process. Even though the teacher has intelligence without being supported by good learning media, the learning process will saturate and attract students.

Mobile (Hp) / mobile phone / cellular phone / smartphone as one of the latest and updated telecommunication products in the midst of the globalization era, communication and information technology have their own phenomenon for the world of education, especially for teachers and students. Its presence, which provides convenience and sophistication to be able to access and get all information across the world very quickly, easily and cheaply, is often used as a decline in the morality of the nation. This may be true, but certainly not entirely true if there is an assumption / perception that the presence of a cellular telephone for students is more negative than positive.

Android was originally given to a brand that was not too well known in the past, a Korean manufacturer who was the first pioneer of the Android operating system. One of the first Android users until finally Android is growing so fast that the latest operating system comes out called Kit Kat. Android operating systems always take their names from foods, such as Donut, Eclair, Yogurt, Ice Cream Sandwich, Ginger Bread, and now Kit Kat. Indeed, we really need our own smartphone because our needs will definitely increase and it is certain that the surrounding conditions will surely develop. So it is very necessary for us to own and use a smartphone.

In learning, smartphones can function as media. Media is the plural form of medium, the Latin term which literally means intermediary or introduction can also be defined as a tool, means, or vehicle. In the world of education, it is usually called educational media or learning media.[12] states that educational media or learning media are tools, methods, and techniques used in order to more effectively communicate and interact between teachers and students in the process of education and teaching in schools.

According to the Association for Education and Communication Technology (AECT), the media is all forms used to distribute information. Media is defined as objects that can be manipulated, seen, heard, read, or discussed along with the instruments used for these activities. Clearly the media is everything that can channel messages, stimulate students' thoughts, feelings and will so that the learning process in them is encouraged. Thus according to the definition conveyed by the National Education Association (NEA). While Software is a design, instrument and other printed material needed for computer operations or automatic media.

Thus, Android-based learning media is intended as learning material that is compiled and used in such a way and delivered using a computer as a hardware device that is used to convey learning material so students can learn in a more interesting and enjoyable atmosphere.

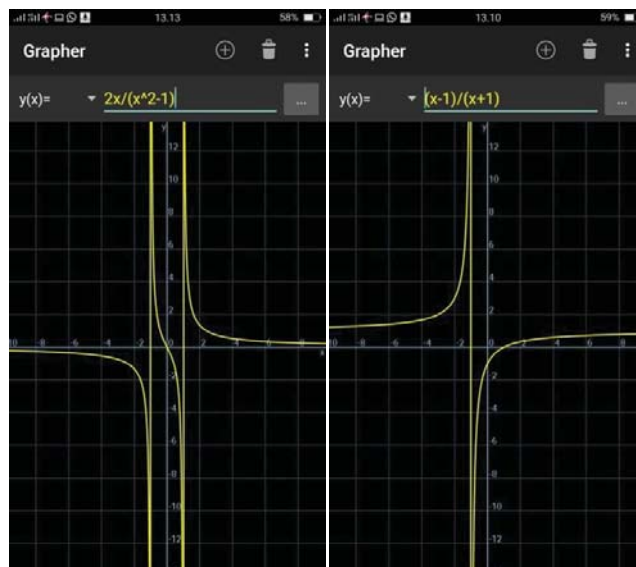


Figure 1. Grapher in Android

3. Research Methodology

The research used was qualitative research. This research was carried out in class XII IPA 7 Palembang 1 State Senior High School totaling 30 students. This research was applied to Mathematics subjects on rational function material, infinite limits for algebraic functions and infinite limits for trigonometric functions

Data collection techniques used in this study were tests and observations. Objective Test is an instrument of data collection to measure the ability of concepts understanding, while observation is used to collect data by observing each ongoing event and recording it with an observation tool about what happened during learning. All data obtained were analyzed descriptively.

4. Results and Discussion

4.1. Android Assisted Learning

Android-assisted learning was carried out in four meetings. The material taught at the first to the fourth meeting was rational function, infinite limits for algebraic functions and infinite limits.

Learning in the first to four meetings was focused on using the Grapher application on android. Intentional learning activities were directed more in the form of small group discussions (4 people) and large group discussions (class discussions). The goal was that high capable students are able to help students with low capable in solving problems, and it is expected that all low-ability students also are able to follow the learning well.

At the first meeting there were four types of problems discussed by students. These four things related to four forms of rational function. The four rational functions

are the rational function of the linear form divided by the liner, linear divided by square, the square divided by linear and the square divided by the square. During learning activities took place, the role of the teacher was more as a navigator and facilitator.

Each group was given a different problem. Each group was given one type of rational function, and each group had to complete 3 questions about rational functions. Next, students were asked to draw a graph of the three rational functions, to determine the intersection of the x-axis and y-axis, to determine the origin and the result area, then to look for the similarities and differences of the three images. The following were some of the solutions given by students at the first meeting.

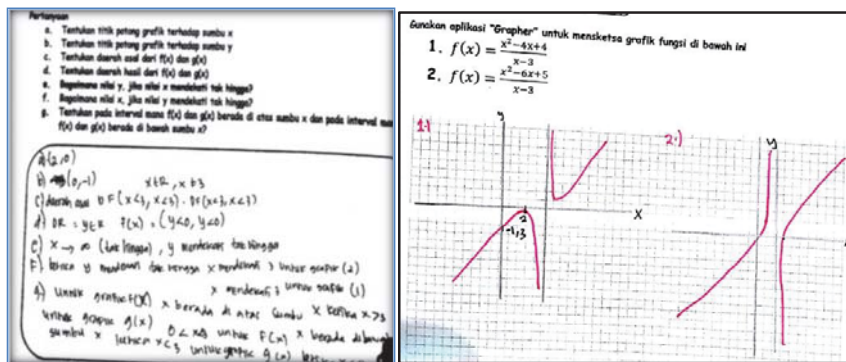


Figure 2. First and Second Meeting

The use of the Grapher application on this Android has never been categorized before, therefore, the teacher could not rush to complete the subject matter. In addition to introduce and familiarize students with this application, learning was also directed so that student students became active learners who were able to construct their own concepts and solved problems using their own knowledge. As a result of this situation, the teacher had difficulty in managing the learning time, because the time planned in the learning plan was not enough, it was forced to complete the learning about the rational function then proceed to the second meeting.

The third meeting continued from the first and second meetings. At the beginning of the third meeting, students were asked to describe the rational function and then investigate the value of $f(x)$ of the function when the value of x approaches infinity. The function $f(x)$ given in the second problem is in the form of a linear rational function divided by a liner, linear divided by square, the square divided by linear and the square divided by square. The following were some of the solutions given by students at the second meeting.

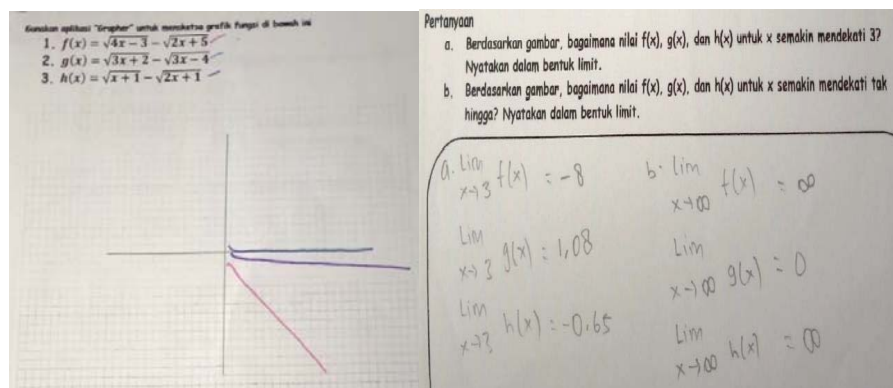


Figure 3. Third Meeting

When learning activities were in progress, the teacher sometimes had to provide scaffolding to groups that still had difficulties in solving problems related to graphics, for example how to draw graphics by using applications and how to read graphs which have applications. Scaffolding was also given because students were not used to use applications and read charts.

The fourth meeting also continued from the third meeting which was still related to infinite limits. The difference was in this fourth meeting, the function used was trigonometric function. The following were some of the solutions given by students at the fourth meeting.

Since the meeting until the fourth meeting, it has been seen that more students actively involved in discussions or presentations, and there were also additional arguments or explanatory arguments from other groups. Although there were still found some students who presented the results of the discussion were not able to convey these arguments systematically.



Figure 4. Learning Activities

4.2. Mathematical Understanding

There were 15 questions used to see students' understanding. The fifteen questions consisted of 10 multiple choice questions and 3 essay questions. The following are the results of the students' understanding ability test.

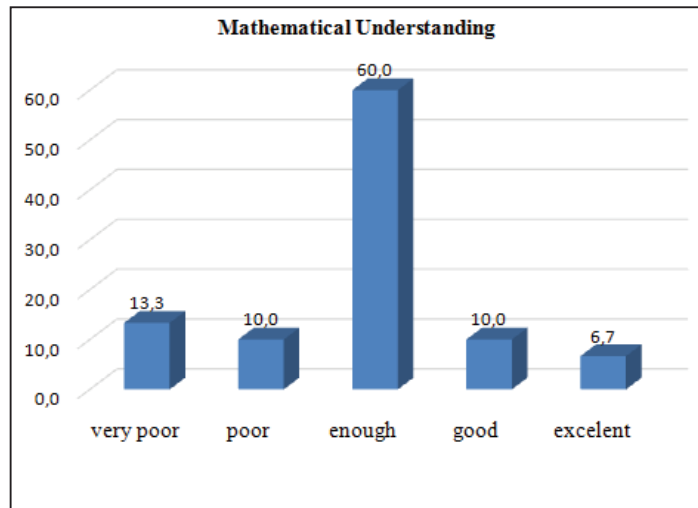


Figure 5. Mathematical Understanding

From the diagram above, it can be seen that the majority of categorized students are quite good. From the results of observations during the study it was concluded that the low understanding of the students' concepts was not only influenced by the ability to use Grapher applications in learning but also because of the students' weak ability to illustrate graphs, classify graphs, compare various forms of graphs obtained by students, and make related guesses. form of graphs that have been obtained, interpreting the results of the graphs obtained to make conclusions, as well as providing an explanation related to what has been done. For example in the following questions.

In the material of rational function, students were misconstrued due to being trapped in images that appear to be congruent and students cannot provide other examples in the form of functions or graphics [12]. Even though the pictures were not congruent. Still related to the material of rational function, the presentation of a picture that is inappropriate in terms of both the scale and the form of the sketches caused students to misinterpret the problem and draw conclusions. Specifically for infinite limit material for both algebraic and trigonometric functions, the low scores of students on the concept comprehension tests were caused by students being less careful in calculating.

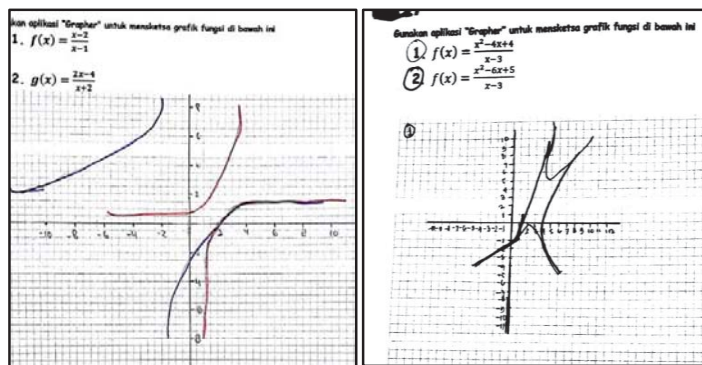


Figure 6. Mathematical Understanding

5. Conclusion

The results of the study concluded that the students' understanding of rational function material, limitless to algebraic functions and infinite limits on categorized trigonometric functions was quite good. In the material of rational function, students were misconstrued due to being trapped in images that appear to be congruent. Even though the pictures were not congruent. Still related to the material of rational function, the presentation of a picture that was inappropriate in terms of both the scale and the form of the sketches causes students to misinterpret the problem and draw conclusions. Specifically for infinite limit material for both algebraic and trigonometric functions, the low scores of students on the concept comprehension tests were caused by students being less careful in calculating.

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