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The Effect of Mobile Phone Application on Mathematics Learning: Students Critical Thinking Skills

Supandi Supandi[1]
Department of Mathematics Education, Faculty of Mathematics, Natural Science and Information Technology Education
Universitas PGRI Semarang
Sidodadi Timur 24, Semarang 50125, Indonesia
The corresponding author:
supandi@upgris.ac.id

Agung Handayanto[2]
Department of Mathematics Education, Faculty of Mathematics, Natural Science and Information Technology Education
Universitas PGRI Semarang
Sidodadi Timur 24, Semarang 50125, Indonesia

Aurora Nur Aini[3]
Department of Mathematics Education, Faculty of Mathematics, Natural Science and Information Technology Education
Universitas PGRI Semarang
Sidodadi Timur 24, Semarang 50125, Indonesia

Lilik Ariyanto[4]
Department of Mathematics Education, Faculty of Mathematics, Natural Science and Information Technology Education
Universitas PGRI Semarang
Sidodadi Timur 24, Semarang 50125, Indonesia

Widya Kusumaningsih[5]
Department of Mathematics Education, Faculty of Mathematics, Natural Science and Information Technology Education
Universitas PGRI Semarang
Sidodadi Timur 24, Semarang 50125, Indonesia

***Abstract*— The development of information technology today has been widely used in school learning. One of them is the use of mobile phones as a supporter of learning activities. This research explores the information disposition of critical mathematical thinking through the development of APP Inventor Mobile Phone Application (MPA) -based learning. This research implemented the design and device of Technology Mobile Phone Application in five cities in Central Java with total schools as many as ten schools. Each school was sampled by three students with high, medium, low math skills. Students were treated with mathematics learning with MPA, then given the problem to be solved. Results of student work are scored and analyzed for each level of students critical thinking skills in all schools.**

Keywords-Mobile Phone Application, disposition, critical mathematical thinking

I. INTRODUCTION

Technological developments are increasingly growing. In addition to business competition between producers, this development occurs because of the increasing consumer needs. One form of technological development that continues to experience growth is mobile phones. Pawluk's research [1] states that mobile phones are communication tools that allow features such as those that can be obtained using a computer such as storing information, e-mail, and various software that is applied. In other words, mobile phones can be defined as a mobile phone that has advanced innovations with uses such as computers that can integrate daily human activities without borders.

Most mobile phone use today is only for communication devices. Among students, the use of mobile phones is widely used in social media. Mobile phone ownership among students grows with the times. The form of mobile phones that are relatively small and have a lot of data storage memory allows students to store applications that simplify their activities. The increase in mobile phone use provides renewal efforts to the world of education as alternative learning in class and outside the classroom.

Mobile phone-based learning supports students to obtain the widest knowledge. When students learn with a mobile phone aids, it will add knowledge outside the classroom [2]. Thus, the knowledge gained by students is not limited to class time. Students can adjust material content according to their learning style and learning speed. The use of mobile phones has a positive influence on students and is not limited by differences in gender, age and role of parents. These factors are not a significant factor in influencing the performance of mobile phone use in the learning process [3], [4], [5]. Mobile phones are not only considered as a medium of communication but also as a learning medium that can be utilized in the activities of the teaching and learning process, in this case, students have a dependency on mobile phones because they can obtain and store knowledge needed practically.

Mobile phones can be used as an alternative to student learning both in class and outside the classroom. Clayton and Murphy [6] said that mobile learning or m-learning is one of the breakthroughs in the world of education.

Learning by using a mobile phone is one of the learning media that allows educators to deliver teaching materials to students using mobile phone-based media. The existence of m-learning will enable students to learn indefinitely because it can be accessed anywhere and anytime.

The use of the internet as a learning medium conditions students to study independently. Thus when students learn individually, students become actors and thinkers. M-learning based learning can be done interactively so that it attracts students' learning interests. Through guidance from teachers, proper use of cell phones will improve student achievement and prepare them to enter higher education institutions [7]. Using mobile phones in learning will have a lot of positive impacts, especially in the field of education. Eventually, learning becomes effective to improve the quality of education in the future. So mobile phone-assisted learning can be used effectively to develop critical thinking, creative approaches to sort information and hypothesize to solve mathematical problems.

Mobile phone-based learning in the field of mathematics is still being developed at this time. Inukollu [8] said that mobile phone technology as a medium of learning mathematics is one of the perspective techniques for the future. One of the innovative forms of mobile phone-based learning media is through educational game applications [9]. With the educational game, students are expected to be motivated to be more active in learning mathematics because educational games can attract students' attention in the current era. Jones's statement [10] which stated that the mobile phone functions as an addition if students use it, it will get additional knowledge. This study discusses the influence of mobile phone use in mathematics learning on trigonometry topics.

II. METHODOLOGY

This research is a type of descriptive qualitative research. In the first phase, researchers selected five cities in the Central Java Province of Indonesia. The five towns were Semarang City, Pekalongan Regency, Boyolali Regency, Kudus Regency, and Jepara Regency. Of the five towns, two senior high schools were chosen for each of the 11th grades. In this study using research subjects from nine schools.

Furthermore, from each school, three students with high, medium and low academic abilities were selected. Researchers selected five cities, schools and students as the subject of this study using purposive sampling technique ([11],[12]). The next step students were given several examples of topics and trigonometric problems using a mobile phone application. Questioning is given to students, and an interview is then conducted. Interviews were conducted to determine students' understanding of the subject matter. In addition to asking about the trigonometry material, the interviewer also asked the students' views on the use of mobile phone in learning mathematics. The next step students fill out a questionnaire on critical thinking dispositions towards learning mathematics [13]. Test and interview results were analyzed to find out how students' perspectives on mobile phone use are in learning.

III. RESULT AND DISCUSSION

A. *Result*

The results of the students 'critical thinking disposition questionnaire on the use of the phone in mathematics learning were presented in Figure 1. Based on Figure 1, the results of the students' critical thinking mathematical dispositions in several schools in Central Java have an average of the overall number of all good schools. Classification of 1 to 17 has decidedly fewer criteria, 18 to 34 were categorized as fewer scores. Furthermore, for scores of 35 to 51 classified as having enough scores, scores of 52 to 68 were categorized as having good ratings. Whereas for scores 69 to 85 classified as having a perfect score.

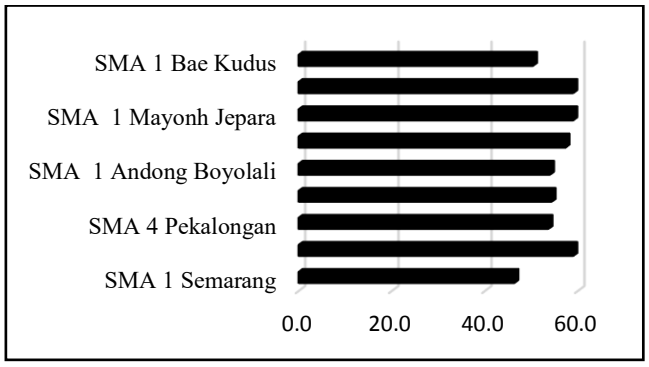

Figure 1. Mathematical Thinking Ability each School

Based on Figure 1, students' mathematical critical thinking scores from nine schools obtained results, namely SMA 1 Semarang and SMA 1 BAE Kudus, respectively, achieving an average rating of 46.3 and 50.3. Both schools were classified as sufficient criteria. Whereas SMA Sultan Agung 1 Semarang, SMA 4 Pekalongan, SMA Hasyim Asyari Pekalongan, SMA 1 Andong Boyolali were included in good categories, with scores of 59.0, 53.7, 54.3 and 54.0 respectively. SMA 1 Mayong Jepara, SMA Sultan Agung 2 Jepara were included in the good category, with questionnaire scores of 57.3, 59.0, and 59.0. Thus, based on the results of questionnaire scoring, it was found that SMA Sultan Agung 1 Semarang, SMA 1Mayong Jepara and SMA Sultan Agung 2 Jepara had the highest score than other schools.

Schools used in research were classified into two types of schools, namely public schools and private schools. Schools included in public schools were SMA 1 Semarang, SMA 1 Bae Kudus, SMA 1 Mayong Jepara, SMA 1 Andong Boyolali, and SMA 4 Pekalongan. While private schools were SMA Sultan Agung 1 Semarang, SMA Muhammadiyah 4 Andong Boyolali, SMA Sultan Agung 2 Jepara, and SMA Hasyim Asyari Pekalongan. Based on the status of public and private schools, the results showed that, for public schools, the average score was 52.7 with good criteria and for private schools, an average score of 57.4 was obtained with good criteria. From the figures obtained, it could be concluded that between public and private schools have good criteria in

the disposition of critical mathematical thinking. However, private schools had higher grades than public schools (Figure 2).

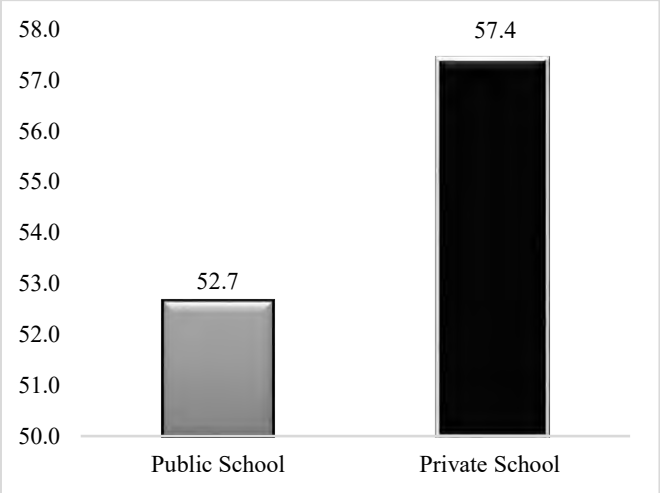

Figure 2. Mathematical Thinking Ability Based on School Status

Based on the mathematical critical thinking disposition questionnaire from five cities classified as in Figure 3. SMA in Kudus city was classified as sufficient criteria with an average score of 50.33. SMA in Jepara city received 59.00 results and was included in good criteria. SMA in Boyolali city had score 55.67, and it was in good criteria. SMA in Pekalongan city got a score of 54.00 with good criteria and the SMA in Semarang city received an average score of 52.67 with good criteria. Thus based on Figure 3, it was concluded that the high school in the town of Jepara had the highest score and the high school in the city of Kudus had the lowest score. The average score of the five cities were 54.33 (included in the good classification).

Figure 3. Mathematical Thinking Ability Based on City

B. Discussion

The results of questionnaires and interviews with students found that the mathematical critical thinking dispositions in five cities in Central Java were different. However, the results showed that the five cities were all in the good category. It turns out that these results do not depend on students' first mathematical abilities (low, medium and high). These results are seen from the average results in each school, and from the overall average of all students. Use of Mobile Phone Applications on trigonometric materials that have been tested on students with different mathematical abilities at different schools students are very interested in the application because all this time students are still dependent on the teacher.

The results of the interviews that have been conducted, students are still dependent on teacher teaching in class, so students still feel some difficulties. Forms of the problem include teachers teaching material quickly, teachers lacking guidance to students who do not understand. According to them this application helps in learning and catching up with the material presented in class. Also, students are also happy with the existence of a mobile phone application in education, because it can learn quickly. Students got examples of questions and games that made them not bored with learning.

IV. CONCLUSION

The use of Mobile Phone Applications in learning has provided alternatives for students. The results of the study showed that the score was good. Students learn more actively both in class and outside class. Learning can be done independently by students at any time. An interesting result of this study is that students in private schools prefer the use of mobile phone applications than public schools. Another result also is that schools in big cities do not depend on learning to use portable phone aids. This result certainly needs to be studied further for the next research

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