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Submission date: 10-Sep-2020 06:50PM (UTC+0700)
Submission ID: 1383573260
File name: The_Use_of_Mobile_Application_as_a_Media_in_Physics_Learning.pdf (293.14K)
Word count: 4172
Character count: 23077

Jurnal Penelitian dan Pembelajaran IPA
Vol. 5, No. 1, 2019, p. 72-83

JPPI
p-ISSN 2477-1422 e-ISSN 2477-2038

The Use of Mobile Application as a Media in Physics Learning

(Received 11 August 2018; Revised 27 May 2019; Accepted 27 May 2018)

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DOI: 10.30870/jppi.v5i1.3722

Abstract

This article aimed to investigate the use of mobile application among physics teachers in terms of its use as a tool for physics experiment and the obstacles faced by teachers. The data were collected using a questionnaire consisted of 15 questions. The participants were physics teachers in SMP/MTs and SMA/MA (junior high schools and high schools) in West Java, Indonesia. The questionnaire was delivered through social media Whatsapp in a form of Google Form. The results showed that mobile application had not been widely used by the teachers as a tool for physics experiment. This condition occured because of their limited knowledge in using mobile application as a tool for physics experiment. It is expected that the use of mobile application training will be a solution in updating ICT skills of physics teachers.

Keywords: Experiment, ICT Skills, Smartphone, Training.

INTRODUCTION

The development of information and communication in this digital era provides various facilities in schools. Including technologies such as smartphones, laptop, and personal digital assistant which are applications that can be used in a learning and teaching process (Sung *et al*., 2016).

Smartphone has a set of abilities such as a multimedia, internet-access, and lots of application. Mobile applications have a strong attractiveness for its (Ahmed *et al*., 2015). The advantage of mobile application is a fast and rapid communication and information searching, saving time and costs, and increasing productivity (Anachack and Darya, 2018). Therefore, lots of phone users move to smartphone which significantly increase the number of users of mobile applications (Ahmed *et al*., 2015).

Mobile application is used in various field such as social network, weather, news, sport, banking, map, movie, retail, and photo/video. The numbers of users increase continuously (Islam, Islam and Mazumder, 2010). In Bangladesh, mobile application is already a familiar matter among since 2013 (Ahmed *et al*,. 2015). Studies related to the use of mobile application have also been conducted in several countries (Ahmed *et al*., 2015; Okolocha and Nwadiani, 2015).

In Indonesia, studies related to the use of mobile application are not yet that famous, especially in studies related to the use of mobile application as a learning media. In fact, smartphone is not something uncommon; almots all students have smartphones (Kuhn and Vogt, 2013). However, students use the smartphones mostly to access information (Ahmed *et al*., 2015) and not as a way to maximize the learning media in teaching and learning process. Besides, smartphone has various range of features that can provide the improvement in learning and teaching process such as showing pictures, navigation, voice recorder, e-mail, social media, internet, and so on (Sarwar and Soomo, 2013).

Smartphone has many applications that can help teachers in learning and teaching process, such as force measurement, linear accelerometer, gyroscope, barometer, roller coaster, ruler, magnetometer, compass, global positioning system/GPS, stroboscope (beta), inclinometer, light meter, color detector, sound meter, tone generator, silo scope, spectrum analyzer (audio) spectrogram, multi-media, color generator.

The results of research on the use of mobile applications as a learning

media have been studied by many experts (Monteiro *et al*. 2014; Fernandes *et al*., 2017; Goncalves *et al*., 2017; Wisman *et al*., 2018).

Teachers in schools must be able to integrate smartphone technology that is currently developing in learning. Teachers can use mobile applications as experimental tools. As an experimental tool, the use of mobile applications supports STEM (*science, technology, engineering and mathematic*) learning. STEM is believed to be an important part of a country's productivity (González and González, 2016). Using mobile applications as experimental tools can overcome the problem in limited laboratory facilities and infrastructure in schools and expensive costs for purchasing experimental equipment. The use of smartphones as an experimental device increases students' interest in learning. Experiments are also very easy to do in the classroom, because all the tools and materials used in the experiment are available and low in cost (Kapucu, 2017).

As a reference in conducting experiments using mobile applications, the teachers can access the results of research by experts. Among them is Pierratos (2018) who used accelerometer on smartphones to study the mechanical energy conversion of pendulums. Amaroso and Rinaudo (2018) combined the use of tracker software with smartphone applications to study oscillations. Kapucu (2017) used a light sensor on a smartphone to find the average speed of a toy car. Pili (2018) used a light sensor on a smartphone to measure the value of gravitational constant through a simple pendulum motion. Pili (2018b) determined the average of angular speed value using a magnetic sensor on a smartphone. Kuhn (2015) determined the speed of sound using a frequency analyzer on a smartphone. Septianto, Suhendra and Iskandar, (2017) used a magnetometer to analyze magnetic fields in straight wires and flowing circular wires. Ozer *et al*. (2017) used a camera and accelerometer to analyze the motion of objects. Monteiro *et al*. (2014) utilized pressure sensors to measure vertical speeds of elevators, stairs and drones. Yoshino, (2017) used a smartphone camera for microscopes. There are also more results of research on the use of applications on smartphones that can be accessed by teachers.

Unfortunately, the results of research on the use of smartphone applications have not been widely used by teachers. Moreover smartphone technology has not been used optimally by the teacher in the learning process. Furthermore, this study aims to obtain data about the use of smartphone applications as a learning

media in school by physics teachers and the obstacles faced by the teachers. It is expected that the research data can encourage stakeholders to maximize the use of ICT technology, especially applications on smartphones in schools in facing the challenges in the digital era.

METHOD

This study uses descriptive survey method. Researchers sought to gather information about the use of smartphone applications by physics teachers without manipulating the research variables (Okolocha and Nwadiani, 2015). The subjects in this study were physics teachers in SMP/MTs and SMA/MA (junior and high schools) in West Java. The research data were collected using a questionnaire modified from (Ahmed *et al.,* 2015). Ahmed *et al.,* (2015) divided the questionnaire into two parts. The first part was to gather demographic information about respondents (gender, income per year, age, and level of education). The second part of the questionnaire was to gather information related to optimal opportunism that was possible for a developer to be able to use the application (quantitative and qualitative questions that describe cellphone usage and cellular applications, types of applications used, internet usage, design relationships and application performance, monetary potential of an application between consumers and latent demand for paid applications and additional content).

In this study, the questionnaire consisted of two parts. The first part of the questionnaire consists of two questions to find information on participant research characteristics, namely gender and education levels. Second part of questionnaire consists of 15 questions (7 closed questions and 8 open questions) to search for smartphone ownership information, the use of smart phones and mobile applications and obstacles faced by teachers. Closed questions use the Guttman scale with yes-no answers. The questionnaire used in the study is shown in Figure 1.

Questionnaires were distributed to physics teachers in junior and high schools in the cities of West Java, Indonesia through Whatsapp social media in a form of Google Form. Questionnaires were distributed for two days on June 4-5 2018. The numbers of participants who filled out the questionnaire were 66 people. The collected data were then arranged and grouped. The next grouped answers were calculated as the percentage.

Questionnaire of The Use of Smartphone on Physics Learning

To the honorable Sir/Madam. My name is Ade Yeti Nuryantini from UIN Sunan Gunung Djati Bandung. Thank you very much for spending your time in completing this questionnaire. This questionnaire is intended to require information related to the use of smartphone as a media for physics teaching and learning session in a school. Please fill the questionnire as honest as possible. Your identity will be confidential. The collected data will be used to design a training for the use of smartphone in physics learning.

1. Do you have smartphone?
   a. Yes
   b. No
2. How many smartphones do you have?
   a. One
   b. Two
   c. More than two
3. What kind of handphone do you have right now
   a. Android
   b. Apple
   c. Other.....
4. Since when have you had smartphones?
   a. Less than 1 years
   b. Less than 2 years
   c. More than 2 years
5. How long do you use your smartphones in a day?
   a. 1 hour
   b. 2 hours
   c. More than 2 hours, that is.....hours/day.
6. Which application do you often use on your smartphones?
   a. Chatting application: Whatsapp, Line, BBM, etc
   b. Games
   c. Social Media, Instagrem, Twitter, etc.
   d. Others.....
7. Are you familiar with smartphone applications that are used as a learning media?
   a. Yes
   b. No
8. If you are familiar to the applications as a mean of learning, which application would you use to help the learning process?
   .....
   .....
9. Which topic of physics would be discussed with the help of media in smartphone?
   .....
   .....
10. Is there any obstacle in using smartphone as learning media?
    a. Yes
    b. No
11. What kind of obstacle do you face in using smartphone as learning media
    .....
    .....
12. What application do you prefer on a smartphone to be used as a learning media?
    .....
    .....
13. Is there any laboratorium facility in the school where you teach right now?
    a. Yes
    b. No
14. Are you interested in using smartphone as a physics learning media?
    a. Yes
    b. No
15. Are you willing to participate in a training session of the use of smartphone as a learning media in physics
    a. Yes
    b. No

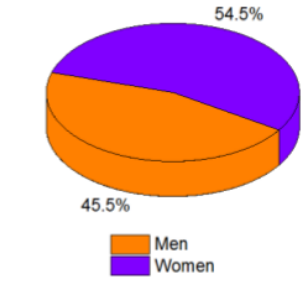
Figure 1. The questionnaire used in the study.

RESULTS AND DISCUSSION

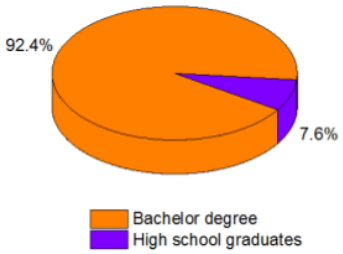
The results of the study were presented based on the questions posed in the questionnaire as follows.

1. Research participants

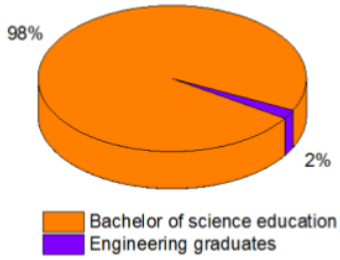
Questionnaires were distributed online to respondents regardless of their gender. Out of 66 respondents who filled out the questionnaire, 45.5% were women and 54.5% were men. Their educational background comprised of 92.4% of having bachelor degree, and 7.6% were high school graduates. 98% of respondents were bachelor of physics education and 2% were engineering graduates who had teaching certificate. All respondents taught physics in junior and senior high school. The participant research characteristics shown at Figure 2.



(a)



(b)



(c)

Figure 2. (a) Respondent gender; (b) Respondent educational background; (c) Respondent majoring for undergraduate.

2. Smartphone Use and Ownership

In this section, respondents were asked about their smartphone. All respondents had smartphone as present at Figure 3. With respect to number of mobil phone, there were 75.8% respondents who had one smartphone; 21.2% respondents had two smartphones and the remaining respondent, 3% had more than two smartphones. It can be concluded that the majority of respondents owned one smartphone. There is a trend that respondent has started using more than one smartphone. This condition is supported by the availability of smartphones at low prices encouraging people to have more than one smartphone (Ahmed *et al*., 2015).

In relation with smartphone ownership, respondents varied in their answers. The longest time they used mobile phones was for 11 years (1.5%),

while the shortest time was less than one year roughly 7.6%. respondents.

With respect to operating system use, the majority of respondents used an Android operating system and it is approximately 97% and 3% respondents used Apple IOS (Figure 4). Android has strong domination worldwide with 52% market share (Deidu, 2013). This has also affected smartphone users in Indonesia.

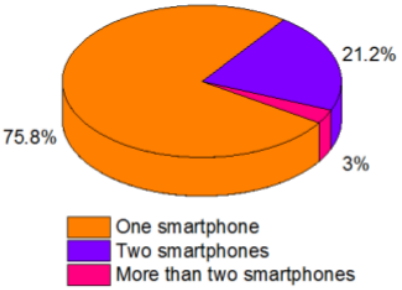


Figure 3. Smartphone ownership.

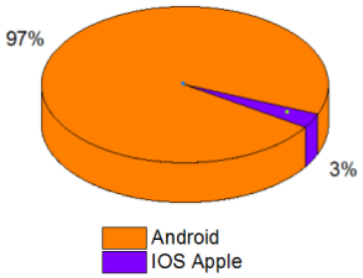


Figure 4. Respondents' smartphone operating system

3. Smartphone Use

Regarding the use of smartphones, 95.5% of respondents answered that they used their gadget for social media, chat, games, and SMS (short message service). They used various platforms for social media namely WhatsApp, Line, Instagram, Twitter and Facebook. On the other hand, 4.5% respondents used smartphones for information searching activity.

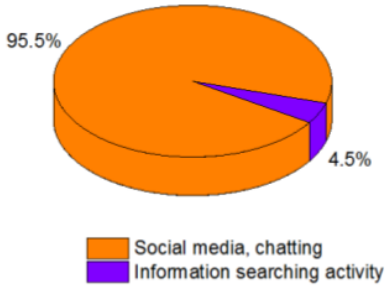


Figure 5. Smartphone use.

Physics teacher respondent were asked related to applications on smartphones that they used as learning media. There were 71.2% respondents who answered that they knew about applications that support physics learning. They listed as follows: question bank, brinly, edmodo, calculator, telegram bot, drop box, e-book, summary, practice questions, e-module, guru.com, google and youtube, hit science, stopwatch, khan academy, courser, photomath, physic toolbox, scribd, safari, youtube, phet, electronic toolkit, google scholar, converter unit, MIT app inventor, neolms, ARelectric, Phypox. On the other hand, 28.8% did not know the application that could be used as learning media for physics.

There were 95% respondents who used applications on smartphones for their learning media in terms of information search, practice questions, and electronic books for students.

Meanwhile, only 5% of respondents used smartphones as tool for physics experiment. They use frequency generator applications for sound experiments, electronic toolkit applications for electric experiments, and pHet applications for simulation of motion, wave, fluid and other material.

Nowadays smartphones is increasingly used as experimental tools serving as techniques in building active learning. There are many advantages of using smartphones for experiment purpose. It makes learning process easier. It allows school teachers and students to easily navigate smartphones for experiment purposes. It can also overcome the difficulties regarding infrastructure because it does not require expensive fees. These advantages are possible to achieve with smartphones that all the teachers use in their school (Arribas *et al*., 2015).

There are many benefits of using a smartphone in physics learning. It allows students to observe natural phenomena related to the concepts being studied and it boosts students' learning motivation and learning outcomes (Geladze, 2015; González and González, 2016). Technology-enriched learning environments have a significant influence on students' high order thinking skills within the framework of Bloom's taxonomic evaluation level (Hopson *et al*., 2001), In addition it makes the learning process more interesting and diverse to increase cognitive activity (Geladze, 2015).

The use of technology supports teachers and students in investigation process and allows students to develop their questions on the basis of their own observations. Investigation phase encourages them to collaborate in group of inquiry by facilitating information sharing (Woolsey and Bellamy, 1997).

ICT development is important to be taught to students. It helps students to understand how to solve problems and become active in learning process. They also have the opportunity to think critically and independently in finding their own ways to solve problems through research and experimentation (Geladze, 2015).

4. Constraints in Using Smartphone as Tool for Physics Experiment

The internet has been a basic need to fulfill information searching activity. As many as 69.4% of respondents answered that they had problems in accessing the internet because of inadequate signals. To overcome this problem, they have to choose good provider offerring strong signal service. Another problem is expensive price set by the operators for their service. Things got worse when there was not internet

facilities in their schools to access information.

In addition to the problems mentioned previously, respondent also had problems regarding their inadequate understanding to use the application on smartphone as an experimental tool. They did not have sufficient knowledge on mobile application use. They had never received training on how to use mobile application as a tool for physics experiment. They had no efforts to find information through the internet concerning the use of mobile application as an experimental tool. These constraints are commonly found in many countries. Most countries failed to provide enough facilities to keep teachers up-to-date related to new technologies (Pelgrum, 2001). They have to deal with the rapid development of ICT. This condition requires teachers to spend extra time and effort to learn new tools and manage existing ICT tools (Wee and Bakar, 2006).

In fact, as many as 27.7% of respondents stated that their schools where they worked did not have laboratory facilities. They prefered not to conduct experiment, because their schools lacked of facilities. This common problem requires solution. One of the possible solution is tools and materials with low-cost and supported by the use of mobile application. This effort can actually overcome the constraints of minimal school laboratory facilities (Arribas, *et al., 2015*).

Several studies have been conducted regarding the use of mobile application as a tool for physics experiments. The results of these studies have not been widely known and used by the community. This happens because the society lack of research results information. As part of the community, teachers in this case rarely access scholarly journal to read state of the art of research conducted by experts. They prefer to read blogs and other writings sources that are easily understood compared to scientific papers or scholarly journal. Another contributing factor is that researchers do not have group of specific communities for knowledge dissemination. These circumstance contribute to the teachers' lackof knowledge to explore research result (Kaino *et al.,* 2014).

In the same vein, their lack of knowledege and skill to utilize mobile application as an IT product has been common in many countries. There are at least 38 obstacles that Pelgrum (2001) found in his study. Three major obstacles faced by many countries are inadequate ICT facilities, teachers' low capacity, difficulty in integrating ICT in the learning process.

CONCLUSION

Mobile application has currently not been maximally used as a tool for physics experiment in school. It is more widely used by the users including teachers for social media needs. It can be deployed for educational purpose to create positive impact on the learning process. On the part of students, they can take active learning to develop their potential through the use of mobile application in learning. This condition is hard to achieve since there are many obstacles faced by the teacher in their school to use mobile application as a tool for physics experiment. There is a need for an increase in facilities and infrastructure that support the use of ICT and an effort is needed to increase teacher competence in the use of ICTs, especially mobile application.

ACKNOWLEDGEMENT

This research was funded by UIN Sunan Gunung Djati Bandung and has been presented at Annual International Conference on Islamic Studies (AICIS) 2018 the Ministry of Religious Affairs, Republic of Indonesia as selescted paper, 17-20 September 2018 at Palu.

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