Mobile learning to improve mathematics teachers mathematical competencies

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Abstract. The role of teachers is crucial to the success of mathematics learning. One of the learning indicator is characterized by the students' improved mathematical proficiency. In order to increase that, it is necessary to improve the teacher's mathematical skills first. For that, it needs an innovative way to get teachers close to easily accessible learning resources through technology. The technology can facilitate teachers to access learning resources anytime and anywhere. The appropriate information technology is mobile learning. Innovations that can make teachers easy to access learning resources are mobile applications that can be accessed anytime and anywhere either online or offline. The research method was research development method. In preliminary analysis, subjects consist of teachers and lecturers in professional teacher education program. The results that the teachers ready to adopt mobile-learning for the improvement of their skills.

1. Introduction

The Indonesian governments’ policy about teachers and lecturers is an acknowledgment that teachers are a profession and need to gain fair and solid respect and protection [1]. Therefore, the professional education of teachers should be oriented towards the establishment of academic competence that should be displayed in rhythm with disciplinary content and pedagogical content [2]. In addition, the professional education of teachers also pay attention to the dimensions of improving the professionalism of teachers, namely: support for management competence, empowerment strategies, supervision of the development and research of class action [3]. The hope is that teachers are able to cultivate a high level of motivation to teach and educate teachers [4], because the interest in the teaching profession and achievement motivation has a positive relationship to teaching skills [5].

In mathematics learning, the role of teachers is crucial to the success of learning. The success is characterized by improvement of students’ mathematical proficiency [6]. The mathematical proficiency consists of: (1) conceptual understanding; (2) procedural fluency; (3) strategic competence; (4) adaptive reasoning; and (5) productive disposition [6]. Of course, in order to increase students' mathematical proficiency, it is necessary to improve the teacher's mathematical skills first. This is in line with Evans [7] and Samuelsson [8] that teachers 'skills in teaching mathematics can improve students' mathematical skills.

The results of the observations that have been done in the "Education and Training Profession Teachers" program from 2009 to 2016 and "Professional Teacher Education" program from 2013 to 2014, there are many mathematics teachers who do not understand some concepts and its application...
well. Likewise, there are many teachers who difficult to solve mathematics problems. For example, when teachers are asked about concept of area. Most of them only answer a formula of area, area is length × width. Furthermore, when teachers are asked a follow-up question, “Why is your argumentation about the formula of area?”, so most of the teachers didn’t know the reason. In addition, when teachers are given a problem to look for an area of triangle. Almost no teacher can explain how formula of triangle area is found. Whereas, if the teacher have good understanding of the concept and also have a good strategy, then they didn’t get a difficult to solve it, as shown in Figure 1.

![FIGURE 1. An example for finding area of triangle](image)

One way to improve teachers' skills is exploiting technology. The technology can facilitate teachers to access learning resources anytime and anywhere. The technology information that appropriate with that situation is mobile learning. Other studies confirm that this technology can be applied in learning in Indonesia [9, 10]. The mobile learning technology can integrate learning resources, teachers, and experts. One content of mobile learning are video recorded of learning activities. This videos are stored on e-learning that integrated manner with other learning resources, such as documents or tasks. In addition, mathematics experts who are given space will make it easier for teachers to get solutions of the problems they faced.

Based on a study conducted by Wilson [11] shows that applications designed with in-depth thought can present many things, for example, can display dynamically linked recurring presentations, which may not be displayed by silent media such as books or whiteboards. Some applications of computer technology are its ability to display educational processes in an energetic, dynamic visual appearance, especially for mathematics. Mathematics learning with smart phone utilization will make it easier for teachers to deliver course material especially related to graphics, pictures, videos, and interactivity.

The development of mobile learning certainly requires a teacher preparedness study. It can not be arbitrarily created because it will cause a bad effect if the control from the developer can not be done. For that reason, a sensible solution is to pilot the mobile learning that is developed because the researcher has good control over the teacher.

2. Methods

This research is a development study that followed opinion of Borg & Gall [12]. There are four major stages of research, namely: preliminary analysis, product draft development, trial-testing, and effectiveness test. Analysis of preliminary study which examines the phenomenon of research subjects to receive innovation. Subjects consist of teachers and lecturers. Teachers who entangled are students from professional teacher education program. The lecturer is a lecturer who teaches the profession education program.

Development of product draft, namely development of mobile application learning in accordance with the condition of research subjects. Trial is a test activity of product draft on the subject, and conducted to the teacher or lecturer. Effectiveness test is the real test of learning when the product is ready to use. The subjects of the study were lecturers and teachers where teachers' professional education program in the western region of Java. Comparison of mathematical abilities is analyzed both quantitatively and qualitatively. Form of analysis by observing the mathematical ability of teachers before treatment, when treated, and after treatment. Duration of research is three years.
3. Result
We will describe about preparedness of teacher as student and lecturers for applying mobile learning. And also we will give an information about teachers’ competency test. There are interesting findings of how the learning interactions use mobile learning.

3.1. Readiness of Learners
Survey results from 2012 to 2017 found that there is an increase in the readiness of teachers in adopting mobile learning technology. The readiness, among others: (1) learners have a strong desire to accept innovation (2) learners have minimal tools, (3) learners have enough prerequisite skills. However, until 2017 there are still obstacles in the teachers, namely (1) no mobile learning application for increasing mathematical competence, (2) learning culture through mobile learning has not been owned, (3) mobile device owned not yet have full readiness for mobile learning, (4) internet networks are sometimes unstable, especially if using economic package (5) quota limitations, (6) interactions can not be made because the network is not smooth yet, (7) learners are often not focused when there is product launching on the application.

3.2. Lecturers Readiness
Lecturers have a better readiness in each year, only the rate of lecturers in accepting the adoption of mobile learning technology is not as high as learners. The findings obtained are, there are two characteristics of lecturers. First, lecturers who are responsive to the development of mobile learning technology. Second, lecturers are not responsive in responding to the development of mobile technology, the age range of lecturers over 50 years. To test the mental readiness of lecturers to adopt mobile learning, 20 lecturers are given the task to conduct online-based learning, the result is good enough that evidenced by the fulfilment of the learner's assignment above 80%.

3.3. Culture of Learning
Prior to the creation of mobile application, researchers created a group in one of the existing mobile application. This is done so that we got a description of how the interaction of lecturers and learners. The first step is recording the teaching activity. Recorded results uploaded to the cloud, in this case YouTube. Links from YouTube are shared on the Learning Management System (LMS) on Google+.

In the LMS is made community "teacher professional education". In the community lecturers interact with learners through video sharing uploaded in the cloud. Another form of interaction is to answer and ask questions. The result, from 18 students who tested, there is only 5 teachers who active interaction using mobile application, 7 teachers who sometimes, and 6 teachers who never appeared in comment in application.

3.4. Competency Test
Learners are given a subject's ability test before being given a learning source based on mobile learning. Once given the test given the source of learning. Furthermore, after completion of learning resources learners are given a test of ability. The results can be seen in Figure 2.

In the interest of answering whether there is an increase in mathematical ability of learners, there are pre-test and post-test learning. Figure 2 shows each learner getting improved mathematical skills after using an application that has few characteristics with mobile learning.

Testing statistics is needed whether the increase in each learner is significant. The test taken is paired t-test, the consideration being that both groups of data are paired and both are normally distributed. The result of t-test yields a significance value of 0.000. This means the two groups of data differ significantly. The average difference of the two groups was 14,444. In other words, on average each prospective teacher increases his ability to about 15.
FIGURE 2. Comparison of Scores Before and After Learning

4. Discussion

Considering the findings that learners have the interest, tools, and sufficient skills to adopt mobile learning, it is indication that mobile learning application development will make the ability of teachers to be good. There have been many studies suggesting that interest contributes positively to learning outcomes [13]. Likewise, aids will be a support in learning success [14]. Likewise, the prerequisite skills may be contributed to the success of learners [15]. The absence of an application for learning purposes is just a matter of time, it does not happen if learners want to download paid apps in the play store or App Store as long as they accept to buy the application. One culture of Internet users in Indonesia is looking for free. Not yet formed the culture of learning using mobile learning is to stay conditioned so that learners have no choice other than the mobile learning media then it will be resolved. For example, the option of choosing an online motorcycle taxi has become the choice of many large urban communities in Indonesia because of such a condition. In countries that facilitate e-learning well, it's still a problem [16]. Meanwhile, the readiness of the device in the learner is usually the readiness of battery durability. This can be solved with new technology of battery charging. Simply by educating learners, so this is not a problem. With regard to internet quota, this should have a strong desire from individuals, institutions, and governments. Meaningful learners should calculate the risk of coming to class or college training that requires transportation and accommodation costs. Institutions should provide free hotspot facilities for the academic purpose in certain region to help students who are difficult to pay for internet connection. For the government, the activity of providing free hotspot services can be a policy to educate the citizens. The speed of internet connection in Indonesia at any time there is an increase. However, the increase is not significant enough for the interest of interactive learning. There is the fact that operators are launching a 4G facility that promises internet connectivity to be faster. At the time this study was conducted, 4G facilities have been tested and the results are quite satisfactory. However, until now the range of 4G areas is still limited. As a result, the use of 4G for research purposes can not be utilized properly.

Lecturers are creatures who are accustomed to receive knowledge, for it is not difficult to condition the lecturers to accept new things. Lecturers have three field of jobs, namely: teaching, research, and servicing for community. These three jobs make the lecturer as a creature that is demanded to keep changing in accordance with the condition of society.

The problem of learning culture is strongly related to technological developments and growing problems. When technology makes it easier for learners and becomes a problem for those who do not follow it, then automatically learning culture will change.

Increased competence in learners is good news, this means that mobile apps with not specifically designed have helped learning to improve competence. Especially if there is an application designed specifically for professional education teachers.

5. Conclusion

There are five conclusions generated in this study, namely: (1) In general, learners are ready to implement mobile-based learning, (2) learning habituation will change itself due to advances in technology and community culture (3) Internet connection should be a concern for policy holders so
that the benefits of internet can be quickly absorbed, (4) the mathematics competence of learners has improved quite well, although there are many constraints of internet connection, and (5) mobile applications should be developed in accordance with the findings that have been obtained.

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