An analysis of need and design of m-learning using scientific approach on electricity material in senior high school to stimulate higher order thinking skills

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Z Zulmaidah[1], A Suyatna[1]* and U Rosidin[1]

[1] Physics Education of Graduate Program, Lampung University, Jl. Sumantri Brojonegoro No. 01, Lampung, Indonesia.

*asuyatna@yahoo.com

Abstract. The purpose of this research is to create m-learning design can be used as learning supplement using scientific approach for stimulating students higher order thinking skill. This research used R and D method of ADDIE (Analyze, Design, Develop, Implementation, Evaluation), in this article limited to the design stage. The sample of need analysis consists of 67 Senior High School student and 14 Physics teacher in Lampung. The data of m-learning need is collected using a questionnaire and analyzed using quantitative descriptive analysis. Test design is carried out by the expert of physics (teacher and lecturer of physics). The result of this experiment are (1) scientific approach is not totally applied in physics learning in class yet. (2) lack of supportable learning media straightaway with K-13. (3) Teacher and student need supportable media matched with K-13 that is m-learning. M-learning design which uses a scientific approach for Electricity lesson has some characteristics such as interactive, having educative content, interactive module, presentation material, having electricity animation and videos, experiment simulation, summary, hyperlink to another sources, task, quiz, and discussion forum. The learning steps consist of observing, asking, trying, associating, and communicating. Synchronous learning activities are carried out for discussion forums, asynchronous for the other of it.

1. Introduction

Ideal education must be in line with the effort to comply with 21st-century demands. Educational domain must prepare the graduates who are ready to adapt the modern workforce, having good communication skills, able to work productively in teams or groups, understanding the instructions, having good perceiving at business opportunity, able to evaluate themselves, being problem solvers, able to manage time, and can lead [1] . Therefore, Indonesia has made curriculum improvements with the aims are achieving the dimensions of knowledge competence, scientific work, and scientific attitudes as daily behavior in interacting with society, environment and the usage of technology [2]. This improved curriculum is known as the 2013 curriculum (K-13). In the implementation of K-13 directs the essence of the scientific approach in learning activities so that learning using a scientific approach will produce students who have 21st-century skills that are critical thinking, creative thinking, collaboration, and communication (4C) [3]. Nevertheless, the current learning process is still teacher-oriented, physics

learning is not related to daily life, it is difficult to understand because it only contains formulas, and not interesting [4]. Education in the revolutionary era 4.0 has been utilizing many digital technologies to support learning. Many people who have smartphones have the opportunity to make smartphones as a part of learning intentionally for overcoming the problem of limited learning time in class. The usage of smartphones in learning is aimed to make student easy to learn whenever and wherever they are. The usage of mobile devices in the learning process is known as mobile learning (m-learning) [5]. In achieving an ideal education and learning objectives in accordance with k-13 requires a preliminary study about teacher needs toward appropriate learning media that can help students understand the concepts of physics, teacher and student responses regarding the availability of media used, implementation analysis of physics learning in Lampung State High School and a valid design to build an m-learning.

2. Method

The method used in this study is the R&D model of ADDIE (Analyze, Design, Develop, Implementation, Evaluation), but in this article is limited to the design phase. The first phase is to analyze. In the analyze phase, analysis is conducted to know the teacher's need on appropriate learning media that can help students understand the concepts of physics, teacher and student responses regarding the availability of the media used, and implementation analysis of physics learning. The data of needs analysis were obtained from questionnaires distributed to high school students as many as 80 respondents and 14 teachers in Lampung. The next step is design. The design will be examined by experts which are carried out in the field of physics education (teachers and lecturers) in order to find out the suitability content with interactive learning activities to stimulate HOTS. The design is examined by filling an assessment questionnaire then analyzed according to the averages and converted.

Tabel 1. Score Convertion

Average Score	Decision
4,20 – 5,00	Very suitable with m-learning design
3,40 – 4,19	Suitable with m-learning design
2,60 – 3,39	Suitable enough with the m-learning design
1,80 – 2,59	Not suitable enough with the m-learning design
1,00 – 1,79	Unsuitable with m-learning design

3. Result and Discussion

The results of a preliminary study of a needs analysis that conducted in the field, based on the closed questionnaires distributed to teachers in Lampung can be seen in Table 2, indicates that implementation of K-13 in schools has commonly prevalent, as known from all the teachers who have filled in the questionnaire state that they have used k-13 in learning but the application of a scientific approach that should coincide with k-13 has not been fully implemented yet. This is caused by the many obstacles when applying this scientific approach to the learning process. The most dominant obstacles are the time and the media. [6] Other studies mention that the problem is learning resources are not suitable yet [7]. The lack of learning media that following K-13, it makes teachers need suitable media, hoping that the media can overcome obstacles when applying a scientific approach and be interesting media for students. Therefore all teachers agree to develop an m-learning for electricity learning.

Table 2. Result of teacher needs analysis toward media proper with K-13.

No	Statement Analysis
1	100 % teachers have implemented the K-13 in their school
2	33% teacher used a scientific approach
3	93 % teachers found the obstacles in applying the scientific approach
4	100 % teachers needed learning media when studying electricity
5	100% teachers had a shortage of media on electricity material
6	93 % teachers needed new media with the scientific approach
7	60% teachers could use m-learning in the class
8	93% teachers agreed that m-learning will be improved as electricity material

Table 3. Result of student needs analysis toward media that proper with K-13

No	Statement Analysis
1	72 % students stated that Physics is difficult to be understood
2	36% students stated that Physics learning is pleasant
3	63%students stated that teacher using another media instead of book
4	82% students stated that Physics learning is related to real life
5	95%students stated that they need learning media that can ilustrate the Physics in real life
6	90%students agreed that observing activity is available in Physisc learning
7	61%students agreed that in learning Physic needs to add formulating hypotesis and question activity
8	70% students agreed with collecting data activity in Physic learning.
9	63 % student agreed with data analyzing and concluding activity in Physics learning and also presenting
10	97% students had android/ smartphone
11	88% students stated that android smartphone had been ever used in learning.

Based on the results of the analysis in table 3 it can be identified that physics is a subject that is difficult to understand and unpleasant. One of the studies states that physics is a difficult subject because physics concepts are abstract and in understanding physics, studentshave to master the mathematics [8,9] in addition students assume they cannot complete physics assignments [10]. Other studies say physics is difficult to understand because physics is not connected with daily life [11]. The number of students who agree with that learning physics is also needed activities to observe, formulate the hypotheses, collect data, process and draw conclusions, indicates that students want physics learning delivered with a scientific approach. The scientific approach is able to improve intellectual abilities, create awareness of student learning, and achieve high learning outcomes [12]. The high number of students have smartphones in their hand, it makes m-learning opportunities will be usably applied at school. ITU report explained, cell phones and human populations are almost as large as the number, and it will exceed seven billion by early 2014 [13]. In developing countries, people have morecellphones than computers. [14]. Cellphones and tablets are ready to be presented in all educational institutions, especially in developing countrieswhich can exceed personal computer technology and adopt cheaper and more flexible mobile devices [15]. For this reason, it is necessary to design a valid, interesting and effective m-learning so that learning physics will be better, easily accessible, can improve students' ability to analyze problems and increasing students' learning attractiveness [16,17,18,19,20,21]

Table 4. The result of m-learning design examining

M-learning Design	Score Average	Suggestion
Content		
Learning Objectives	4.25	learning process using m-learning should insert the main points of the material
Interactive module	4.325	
Summary	3.75	
Videos	4.25	
Experiment Simulation	4.5	
Display Material	4.25	
Hyperlink	4.1	
Interactive quiz	4.375	
Thescientific approach in the learning activity		
Instructional material study	4.1	The presenting of the interactive quiz should truly stimulate HOTS
Virtual experiment	4	
Assignment	4.25	
Quiz	4	
Discussion	4.25	
The design gives the stimulus HOTS and curiosity	3.875	More concern on how to stimulate HOTS in each activity
Interactive design	4.25	

Following the experts, the validation result obtained that m-learning design using scientific approach is interactive. M-learning design had contents; namely learning objectives, interactive modulee, display materials, experiment simulation, videos, animation of electricity phenomenon, and suitable interactive quizzes. Summary and proper hyperlink to other learning resources. The interactive learning makes students more confident and independent, more enjoying the learning and it is also the alternative ways in presenting the physic phenomenon [22,23]. Experiment simulation can help students in facilitating the understanding of an object better, improving the pleasantness and easiness of receiving material theoretically of practically [24,25]. The suggestion from the experts that the learning process using m-learning should insert only the main points of material can be clues for students to achieve the learning objectives.According to the expert validation result of m-learning design consist of learning activities; namely instructional material study, experiment simulation, assignment, quiz, and discussion forum. The phase of m-learning design activities include to observe, to ask, to try, to associate, and to communicate make the learning being meaningful, longlasting remembred, more focus, and can stimulate HOTS [12,26]. The synchronous learning activity is conducted for a discussion forum, while asynchronous for others.Therefore, based on the result of expert examining, the flowchart of m-learning design is made.

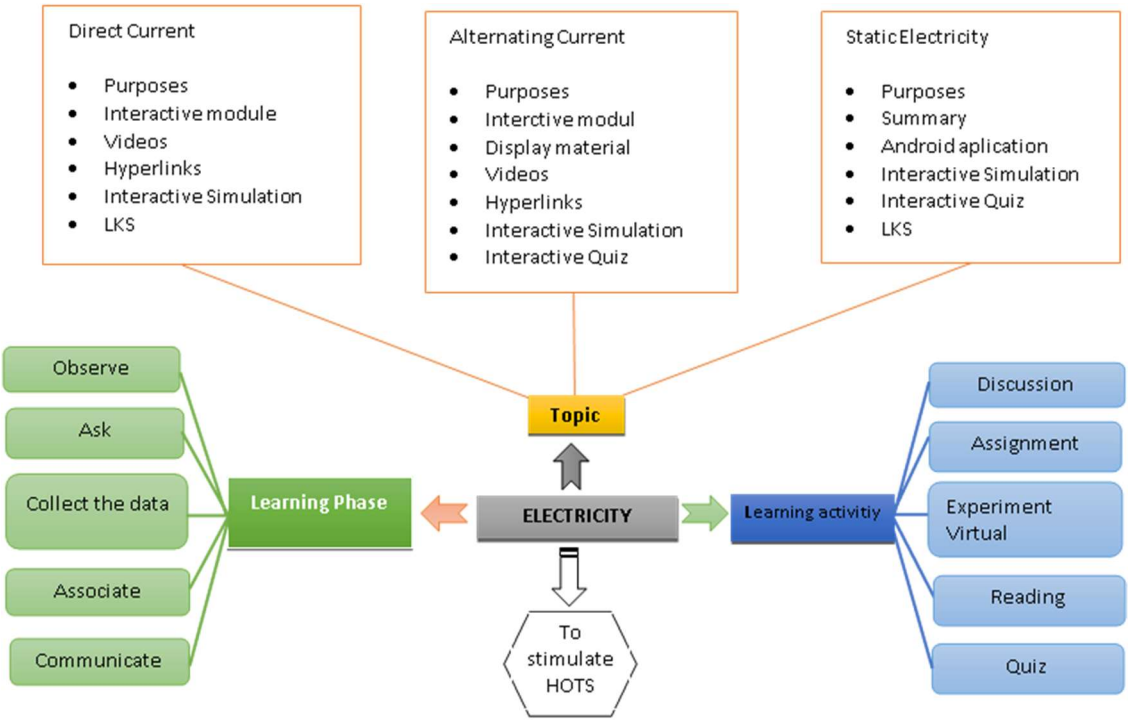

Figure 1. The chart of m-learning design

4. Conclusion

The implementation of K-13 in schools has thoroughly applied, although the implementation of scientific approach has not applied fully yet, it is caused by many obstacles when applying this approach in the class. The lack of learning media which match with K-13 being the reason why teachers agreed to improve the m-learning design as electricity supplement in learning. The students stated that physic is a lesson that difficult to be understood, abstract and uninteresting subject. The student also wanted that Physics will be taught with scientific approach. In addition, each student now has a smartphone in their hand, and it will be easy for applying m-learning in schools and indirectly has been ever applied in schools. M-learning design with the scientific approach for electricity material is interactive, had contents; namely learning objectives, interactive modulee, display materials, experiment simulation, videos, animation of electricity phenomenon, summary and proper hyperlink to other learning resources and suitable interactive quizzes. The learning activities consist of instructional material study, experiment simulation, assignment, quiz, and discussion forum. The phase of m-learning design activities includes to observe, to ask, to try, to associate, and to communicate. The synchronous learning activity is conducted for a discussion forum, while asynchronous for others.

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