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To cite this article: H Hardiansyah et al 2019 J. Phys.: Conf. Ser. 1402 077075

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Teaching material development of natural environment based on mobile learning on elementary school

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Abstract. Education and technology must go together in this millennium. This study aims to develop mobile learning-based teaching materials for thematic learning in elementary schools. This study uses research and development methods with the Dick and Carey model. The instruments used in this study were interviews, questionnaires, and tests. The results of this study are teaching materials based on mobile learning. Based on the results of the pre-test and post-test analysis, it shows that there are differences in learning outcomes between the pre-test and post-test stages. The results of the t-test show that \( t \) count \( = 12.10 \) and \( t \) table \( = 1.99 \) at the significance level \( \alpha = 0.05 / 95\% \). Thus it can be concluded that there is an increase in learning outcomes experienced by students, after participating in thematic learning with teaching materials based on mobile learning.

1. Introduction

The development of science and technology has now influenced the world of special education in the process of learning and teaching. In modern education, teachers are required to provide quality learning material for their students. Teaching materials are prepared with the aim of providing materials for learning in accordance with the demands of the applicable curriculum taking into account the needs of students that cover the characteristics and environment of students. Teaching materials can help students find alternative teaching materials besides textbooks that are sometimes difficult to understand [1]. However, learning materials used in some schools are still very conventional today such as LKS books and textbooks. Class learning feels very stiff, even difficult to understand. Good teaching materials must always follow the development of technology, art and the reality of life in a society that is always global [2]. While teachers today are able to use digital technology, such as smartphones that can now also used as a learning media. In essence, mobile learning is learning with handheld electronic devices, anytime, anywhere [3]. So the researcher decides, this study aims to develop mobile learning-based teaching materials for thematic learning in elementary schools.

2. Literature review

Mobile-learning is defined as an activity (learning) that gives each student to be more productive when consuming, interacting or giving information [4]. In his research Susan Nash revealed, Mobile learning denotes instructional content or activities that are delivered on (or mobile) devices, that accommodate
limited multimedia delivery, primarily in the form of audio, images, animation (video), and text [5]. Unlike what Comas-Quinn expressed in Levene’s research publication, the main thing about mobile technology is being able to access information anytime / anywhere, which is able to provide opportunities for students to study formally or informally [6]. M-learning refers to the delivery of learning to students anytime and anywhere through the use of wireless Internet and mobile devices, including mobile phones, personal digital assistants (PDAs), smart phones and digital audio players. Namely, m-learning users can interact with educational resources while away from their normal place of learning the classroom or desktop computer [7]. On the other hand Burden and Kearney revealed that mobile learning has made an unlimited relationship between virtual and physical environments. The contemporary m-learning literature in various studies covers case studies of innovative mobile applications that are authentic, connected, participative inquiry-based approaches. Research has explored possibilities for science learning across formal and informal contexts, making seamless links between virtual and physical environments, and particularly using participatory simulations and augmented reality technologies [8]. Mobile technologies are one of the fastest growing areas of technology. For educators, they offer an appealing opportunity for learners to transcend teacher-defined knowledge or approaches by accessing multiple, alternative sources of information. Hardware advances that allow pocket sized minicomputers to be carried around easily have combined with improved wireless networks to increase the pace and scale of attempts to innovate in learning and teaching, as well as encouraging investigations into mobile devices as classroom tools [9]. The future view presented by Aladwan that Mobile learning (m-learning) is seen as the key to the era of electronic learning (e-learning) that will come. Meanwhile, the use of mobile devices for learning has made a significant contribution to providing education among higher education students throughout the world [10]. A distance difference is not to be a barrier in mobile learning, because Mobile learning technologies are ideal in the ODL context because they are flexible, accessible, available, and cater for a myriad of interaction activities [11]. In study conducted by Christensen dan Knezek, involving 1414 teachers from a large public school district in the southwestern USA, major findings are that elementary school teachers are more open to using smartphones, tablets and other hand-held information technology devices for mobile learning in their classrooms, when compared to middle school or high school teachers [12]. Learning based on mobile learning has now been found in various forms of application and also learning activities, some of which have the theme of interactive stories, learning interactive reading, recognizing letters or numbers. Everything is packaged in an applicative menu and an attractive display that can be used by teachers or students.

State of the art in this study is the development of research products in the form of smartphone applications in which there are several learning materials in the form of animated films. Then this application is also equipped with several additional features, such as interactive quizzes that can provide test results automatically, and summaries and learning assignments that are written in writing. Research conducted by researchers has differences in terms of content, researchers focus on developing animated films that can be properly and interestingly consumed by elementary school students in grade II, animated characters who play roles also often invite audiences to ask questions in a virtual way. There is a difference from the research conducted by Susan Nash, which in the learning video only shows animated videos, but there is no communication between the animated character and the audience. Then in terms of product use. The researcher designed that the research products developed could be used by teachers in class, and students at home. For this reason, researchers designed this learning application based on mobile learning in a simple way so that it can be used by all groups. In contrast to research conducted by Comas-Quinn whose research products were only intended for students. The researcher also designed the product with bright colors so students were interested in learning to use this learning material based on learning with a happy feeling. In this perspective there is a difference with the research conducted by Shohel and Power which puts forward mobile learning products only at the efficiency of information retrieval.
3. Method

This study uses research and development methods (Research and Development) with a model developed by Dick & Carey. Data taken using assessment instruments in the form of interviews, questionnaires and tests. The sample used in the development of mobile learning based learning material products amounted to 40 elementary school students. Here is a flowchart of mobile learning based learning material products for elementary schools:

![Flowchart of mobile learning based learning material products](image)

**Figure 1.** Dick and Carey’s design model.

This mobile learning based learning material product has passed several stages of validity testing conducted by experts who are experts in their respective fields. Testing the validity in question, namely: Test the experts of basic education material, test media experts and test language experts. The following is a description of product validity test data by experts. More than 80% of the value obtained by the product development learning materials based on mobile learning in the validity test provided by
experts. This will be a benchmark for the success of mobile learning based learning products in the field test stage. Here is a percentage and display of mobile learning based learning materials after passing the validity test by experts.

**Figure 3.** Percentage of product validity test by experts.

After the mobile learning-based teaching material products have finished passing the validity test phase, the next step is to test the product in the one-to-one test phase conducted by two students. After learning the responses of students in the one to one test phase, the researchers continued on the small group test stage which was attended by six students. Then the last step is to test the product at the stage of the field trial which is followed by 40 students, with the following results.

4. **Results**

   4.1. **Field test**

Based on the results of a field test of 40 respondents after carrying out mobile learning based thematic learning, a list of posttest scores was obtained. It can be seen that there are differences in student learning outcomes in the pre-test and post-test. The lowest value at the pre-test evaluation stage is 20, while the posttest evaluation stage is 30. The highest value at the pre-test evaluation stage is 86, while the highest value at the posttest evaluation stage is 100. The average value of the total pre-test and the post-test also experienced many changes, at the pre-test stage the average total value was 62.58 while the post-test was 73.10. The recapitulation above also shows an increase and decrease after students take part in thematic learning using teaching materials based on mobile learning. There were 25% or 10 respondents who experienced a decline, and 75% or 30 people experienced an increase after participating in the
thematic sub-theme learning using the learning material based on mobile learning. Following is a description of field trial data.

**Table 1. Description of field trial data.**

<table>
<thead>
<tr>
<th>Field Trial Data</th>
<th>Information</th>
<th>Pre-test $x_1$</th>
<th>Post-test $x_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2503</td>
<td>2924</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>62.58</td>
<td>73.10</td>
<td></td>
</tr>
<tr>
<td>The Highest Score</td>
<td>86.00</td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td>The Lowest Score</td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>17,243,1889</td>
<td>19,473,585</td>
<td></td>
</tr>
<tr>
<td>Number of Respondent</td>
<td>40</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\sum_{i=1}^{n} X_i^2 &= 168221 \\
\sum_{i=1}^{n} Y_i^2 &= 228534 \\
\sum_{i=1}^{n} X_i Y_i &= 194226
\end{align*}
\]

The price of t count -12.10 (rounding result) means absolute price, so the value (-) is not used. The results of the t-test show that t count = 12.10 and t table = 1.99 at the significance level $\alpha = 0.05 / 95\%$. The price of t count is greater than the price of t table (12.10 > 1.99). So that the test decision taken is $H_0$ rejected.

4.2. **Student’s response**

The researcher used a questionnaire with a Likert scale in collecting student response data, to find out the extent to which students were interested in teaching learning materials based on mobile learning. If viewed from student response indicators, it can be seen in the graph as follows:

![Figure 5. Percentage of student response to each indicator.](image-url)
5. Discussion
The general objective in this research and development is to create a model of teaching materials based on mobile learning. This product has gone through the validity of sharing experts who are experts in their respective fields, such as elementary school material experts, media experts and linguists. After going through the validity of the experts, this mobile learning-based teaching material was tested to students in the one-to-one test, small group test, the last was the trial test field. So the new product was born in the form of mobile learning-based teaching materials that have been tested and validated by experts. Then based on the results of the t test, the price of t count -12.10 (rounding results) means absolute prices, so the value (−) is not used. The results of the t-test show that t count = 12.10 and t table = 1.99 at the significance level α = 0.05 / 95%. Price t count is greater than the price of t table (12.10> 1.99). So that the test decision taken is H₀ rejected. Then it can be concluded that the learning material based on mobile learning can be applied to learning in elementary schools very well. Mobile learning offers learning opportunities to learners without the limitations of time and space. Mobile learning has introduced a number of flexible options to the learners across disciplines and at different educational levels [13]. Mobile learning motivated learner engagement in the learning process and at the same time it offered them opportunity to learn anytime and anywhere. Furthermore, mobile learning helped learners stay focused on their studies and also assisted them in better managing their studies and facilitated their learning. In sum, it is evident that mobile learning can be an effective learning enhancement tool if properly designed [14]. The results of this study showed Korean teachers’ mobile learning attitudes was low in general. But, The group with more than 15 years of teaching experience showed higher attitudes toward mobile learning than those groups that were less experienced [15]. As a result of the research, it was determined that the readiness level of the prospective teachers does not change depending on the gender and the students use the mobile technologies most in communication, studying, acquiring information and making plans. In addition, in the study, the results have been reached, such as both theoretical and practical training should be given in universities in order to increase the availability of prospective teachers on mobile learning [16]. The findings of the study showed that students had highly positive attitudes toward mobile learning, and they had the necessary technical knowledge to implement mobile learning [17]. The findings suggest that mobile learning may promote students’ academic achievement. Both groups had significantly high attitude scores toward mobile learning. Furthermore, the students appreciated mobile learning as an approach that may significantly increase their motivation [18]. Findings show that mobile learning within higher education institutions in Africa increased student and lecturer collaboration and, provide distant communication, increased student participation and engagement, facilitating authentic learning and reflective practice, as well as fostering learning communities [19]. Educational research must recognize the challenges of advancing technological progress and improving availability of systems and mobile devices. A wise response to these challenges is interrelated technological progress and availability are growing, the belief that learning is no longer bound to class but takes place anywhere and anytime, and encourages various learning experiences through mobile learning approach [20].

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