



Effectiveness of Mobile Learning: moPhyDict to Improve High School Students' Physics Conceptual Understanding

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Abstract: In learning physics, the problem that arises is a lack of physics conceptual understanding in contextual learning. These problems are due to the absence of innovative and creative learning resources that can be used to learn by the students. One of the learning resources that can be used is a dictionary. moPhyDict (mobile physics dictionary) is a dictionary containing explanations of concepts and illustrations (images, videos, animations) in a language that is easily understood by students. This study specifically aims to test the effectiveness of Mobile Learning: moPhyDict to improve student's physics conceptual understanding. The method employed in this study was a quasi-experiment design. The experimental design used a pretest-posttest control group design. The sample of the study was 60 students from Senior High School, which divided into a control group and experiment group. The instrument test in this study used conceptual multiple choice question. Based on the t-test on the control class and the experimental class, it can be inferred that there is a significance score of 0.031. These results are supported by data: (1) the average score of the ability to understand the concept of the control class who did not use moPhyDict increased from 37.4 to 55.46, and (2) the average score of the conceptual understanding of the experimental class who used moPhyDict increased from 40.87 to 74.33. It was concluded that moPhyDict is effective to improve physics conceptual understanding of High School Students.

Keywords: mobile learning, moPhyDict, physics conceptual understanding

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INTRODUCTION

21st-century learning paradigm sit requires learning that integrates technology and information in the learning process (Misbah, Pratama, Hartini, & Dewantara, 2018). The learning process is held to encourage students in finding out knowledge from various sources of observation (*student-centered*). Students are required to be independent learners. As independent learners, students are free to manage their own experiences and sources of learning. One of the learning sources that can be used by students is a dictionary. A dictionary is a book that lists words in alphabetical order with their meaning explained or written in another language, or similar products to be used on a computer (Lew, 2011). The dictionary provides information about meaning, spelling, and speech. A facility in the form of application that allows users to process word and to process the spelling of typed documents is called electronic dictionaries (Lew, 2011). The electronic dictionary offers several features for meaning descriptions (Lew, 2011). For example, the meaning of the word is described by using pictures, audio animation, or video content, and other features that cannot be provided by the printed/paper-based dictionary. These features are interesting. They also can help users understand the meaning of words in the dictionary.

In recent years, gadgets with the Android operating system are mobile devices that show rapid development (Crompton, Burke, Gregory, & Gräbe, 2016; Fling, 2009). More people also use mobile devices in the educational world (Ally & Prieto-Blázquez, 2014). The presence of mobile learning that uses mobile electronic media is indented as a complement to the existing learning. It provides opportunities for students to learn on the material that is not understood whenever and wherever on their own (Numainumahrani, 2012). This certainly can provide different experiences in the learning process (Ally & Prieto-Blázquez, 2014).

In learning physics, conceptual understanding is an important thing. The understanding of theory and concept will lead the students to the basic structure of knowledge in a whole. Understanding the concept also requires students to transfer concept language to their language (which is easier to understand) (Rizkyanda, Jamal, & Suyidno, 2013). (Daryanto, 2010) explains that understanding concepts in Bloom's Taxonomy is divided into three aspects, namely 1) Translating. This ability is related to understanding ideas expressed in other ways from the original statement, 2) Interpreting. This ability is related to understanding and recognizing the main idea of communication or with the intention of interpreting various readings in a deep and clear manner, and 3) Extrapolating. This ability demands higher intellectual ability by drawing conclusions and declaring effectively from an explicit statement.

Observations have been conducted by distributing questionnaires in six high schools regarding physics learning applied and students' learning outcomes that have been achieved. The results of the observations showed that 59% of students stated that classroom learning was done by explaining the material, giving examples of problems, and working on the problems. 57% of students stated that physics was only related to formulas and calculation. There were 79% of students who stated that they understood physics during the classroom process only. However, when the students want to relearn the material that has been taught or try to work on the problems after class, they become unable to understand. There are also students who only understand a part of the material conveyed by the teacher during the class. These problems show that the low conceptual understanding from the materials that have been taught.

Therefore, learning resources for students are needed. Learning resources can be used by students effectively to understand the whole concept of physics. Moreover, it can also be used

by the development of information and communication technology. There are some studies using animations and videos to provide visualizations of physics concept. The current study aims not only to visualize the physics concept but also contains an explanation of the concept and can be operated through a gadget. Thus, it can be accessed and used by students to study at any time. Electronic dictionaries can contain various kinds of contents to provide a complete picture of knowledge for students. moPhyDict (mobile Physics Dictionary) is an electronic physics dictionary that can be used as a source of the learning process. Based on the problem above, it is necessary to develop mobile learning moPhyDict (mobile Physics Dictionary) to improve students' physics conceptual understanding. The objective of this study was to test the effectiveness of moPhyDict (mobile Physics Dictionary) for senior high school students on heat and static fluid topic.

METHOD

This study aims to test the effectiveness of the product on students' ability to understand physics concepts by taking samples that can represent the population. The sample was taken using a purposive sampling technique. Therefore, the sampling was done based on certain considerations. The method used to test the effectiveness of moPhyDict was a quasi-experiment, Pretest-Posttest Design model. The research subjects involved in this study were 60 high school students. The data were collected using a test instrument. After that, the data were analyzed using descriptive analysis and inference analysis. Description analysis was used to describe the minimum, maximum, average, and standard deviations of students' initial abilities and final abilities. The first inference test used is the normality test and homogeneity test. After the data were normally and homogeneously distributed, t-test

(independent samples t-test) was used to test the effectiveness of moPhyDict.

RESULT AND DISCUSSION

moPhyDict can be used as an alternative source of students self-learning. moPhyDict included static and static fluid materials. The main page of moPhyDict contains components including, word search dialog box, view of search words, titles, and access keys to explain material concepts. The main moPhyDict page can be seen in Figure 1.

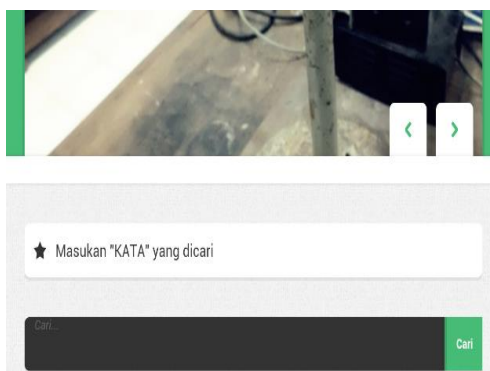


Figure 1 moPhyDict Main Page

Material presentation related to static and static fluid chapters starts from a simple concept to more complicated concepts. In explaining the concept of material, moPhyDict is provided with images by linking physics and environment, the development of technology and science, as well as its application in daily life. This can be seen in Figure 2, Figure 3, Figure 4, and Figure 5.



Figure 2 moPhyDict Material Concept Page



Figure 3 Video in moPhyDict



Figure 4 Practicum Video in moPhyDict

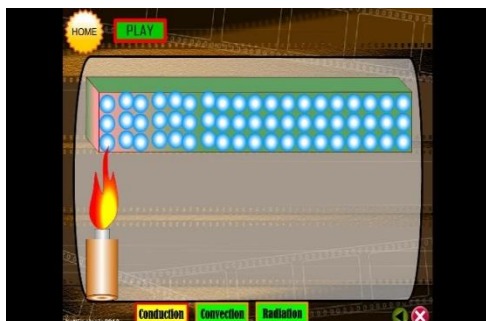


Figure 5 Conduction Animations in moPhyDict

The moPhyDict effectiveness testing phased used the pretest-posttest control group design. At the beginning of the study, the pretest was conducted in the control class and the experimental class. The pretest was carried out in the classroom with students writing the answers on a piece of paper. After that, the experimental class was given treatment by continuously in order to see the effect of moPhyDict on students' conceptual comprehension abilities. At the end of the study, posttest was conducted in the control class and the experimental class.

The results of pretest and posttest of the control class and experimental

class were processed using the SPSS 25 for Windows application. The results were presented based on Table 1.

Table 1 Results of Pretest description analysis

Group	N	Mean	Std. Dev.
Control	30	37.40	6.841
Experimental	30	40.87	7.825

After the end of the learning process, the final test was also carried out on the control class and experimental class to determine students' ability to understand the concept. The results were presented based on Table 2.

Table 2 Results of Posttest description analysis

Group	N	Mean	Std. Dev.
Control	30	55.47	12.14
Experimental	30	74.33	10.22

The results of the final test of the students' ability to understand the concept from Table 2 were presented in the form of distribution with the criteria for learning outcomes. The learning outcomes of the control class and experimental class are presented in Table 3 and Table 4 as follows.

Table 3 Results of Control Class Posttest distribution

Range	Frequency	Criteria
$91 \leq x \leq 100$	-	Very Good
$71 \leq x \leq 90.9$	-	Good
$51 \leq x \leq 70.9$	20	Medium
$31 \leq x \leq 50.9$	8	Bad
$10 \leq x \leq 30.9$	2	Very Bad

Table 4 Results of Experimental Class Posttest distribution

Range	Frequency	Criteria
$91 \leq x \leq 100$	2	Very Good
$71 \leq x \leq 90.9$	22	Good
$51 \leq x \leq 70.9$	6	Medium
$31 \leq x \leq 50.9$	-	Bad
$10 \leq x \leq 30.9$	-	Very Bad

Based on the distribution Table 3 and Table 4, the posttest results showed

that the experimental class using moPhyDict had the final test value of the conceptual understanding ability higher than the control class. It is because the experimental class used moPhyDict in their learning process. Different, results show the influence of moPhyDict, which helps students in their learning process. moPhyDict is equipped with images, videos, animations, narratives, and examples of the application of physics in daily life.

Before the t-test was carried out, a normality test and a homogeneity test were performed on the scores of the students in the control class and the experimental class. The results of the normality test using the *Kolmogorov-Smirnov* with Liliyors correction. The results of the normality test at the students pretest seen from the asymp significance value of sig. 2-tailed was 0.06 in the control class and 0.08 in the experimental class with 95% correctness. This sig. 2-tailed value is greater than the significance level of α , which is 0.05. Data on pretest values in the control class and experimental class were stated to be normally distributed. The results of the normality test at students' posttest score seen from the asymp significance score of sig. 2-tailed was 0.06 in the control class and 0.07 in the experimental class with 95% correctness. The value of this sig. 2-tailed is greater than the significance level α , which is 0.05 in the control class and experimental class. Thus, it can be concluded that the posttest score data in both control and experiment class are stated to be normally distributed.

The homogeneity test results using the *Levene's* test were used to determine the homogeneity of the two groups. Based on *Levene's* test on pretest and posttest, the data showed a significance value of 0.913 and 0.361. This significant value is greater than α , which is 0.05. This indicates that they have the same variant. The scores of pretest and posttest have a greater value than 0.05. Therefore, the scores of pretest and

posttest have the same homogeneity/variance.

After the data were normally distributed and homogeneous, parametric analysis was done using the t-test (independent sample t-test) to determine the difference between the control class and the experimental class after getting treatment in each class. The results of the t-test of the posttest scores, where the significance value is 0.031. The significance value is smaller than α , which is 0.05. It can be concluded that there is a significant difference between the posttest score of the control and experimental classes. The experimental class used moPhyDict in the learning process, which proved to be able to improve students' understanding of physics concepts. The results of this different test are supported by data on the distribution of posttest scores of students in the experimental class, which used moPhyDict. The score range of $91 \leq x \leq 100$ was obtained by two students with very good criteria. The range of $71 \leq x \leq 90.9$ was obtained by 22 students with good criteria. The range of score of $51 \leq x \leq 70.9$ was obtained by six students with medium criteria.

The results of t-test indicate that there were some differences between the control class and the experimental class. In the control class, the learning process was done by teacher delivered materials as well as exemplified the application of the concept of physics in daily life to the students, and the students practiced solving some questions. Learning process which correlates the concepts of physics in daily life is believed to be able to improve students' ability to understand the concepts (Aikenhead, 2009; Anderhag, Hamza, & Wickman, 2015).

Meanwhile, in the experimental class, students learned independently using moPhyDict before the learning process was done. After that, it was continued with the delivery of materials/concepts by the teachers along with a discussion regarding videos and animations presented in moPhyDict.

Discussion of videos and animation was accompanied by a question and answer session about their relevance to the concept of physics. The presentation of animations and videos that support the concept of physics enable the materials to be more interesting and well accepted by the students (Zainuddin, Hasanah, Salam, Misbah, & Mahtari, 2019). Students' interaction with animation and motion pictures both individually and in groups can influence their learning activities (Maimunah, An'nur, & Misbah, 2016; Widodo, An'nur, & Mahardika, 2017). Animations and videos provide different visualizations and representations of a static (immovable) image and can represent abstractions of small particles (Hartini, Misbah, Dewantara, Oktovian, & Aisyah, 2017; Levy, 2012). Furthermore, animations and videos can also strengthen students' understanding of physics concepts because there are illustrations accompanied by examples that are familiar with the students' daily life (Aikenhead, 2009).

In the experimental class, teacher and students together carried out a simple demonstration/practice exemplified in moPhyDict. Through direct practice (demonstrations and simple experiments), students got a complete visualization of the concepts of physics that were being studied. This proves that by presenting concepts along with the video, animation, and images can strengthen students' understanding of concepts. The concept will be understood without any doubts in their minds (Wahyudin, Sutikno, & Isa, 2010).

moPhyDict contains the concept of material presented in accordance with the truth of the theory which does not cause many interpretations. The language used in the explanation of the concept is also easy for students to understand. Learning using media is a fun and interesting activity (Al-Balushi, Al-Musawi, Ambusaidi, & Al-Hajri, 2016; Ally & Prieto-Blázquez, 2014). moPhyDict is considered to be a

learning media which can improve students' motivation and learning interests in physics subject. In its implications, students' learning outcomes will also increase. moPhyDict is considered as mobile learning that is easy and practical for students to use in their own mobile devices or cellphones. This is a result of the rapid development of technology which improves the affordability of mobile devices since mobile devices are cheap, easy, powerful, and popular in all circles (Falloon, 2017; Hsia, 2016).

Mobile learning using mobile devices (mobile phones) as operating devices is more practical and easier to carry compared to computer devices that seem big and heavy (Keengwe & Bhargava, 2014). Also, mobile learning is more popular with teenagers who are students involved in the learning process because the mobile phone is small, easy to carry, and has a variety of features or facilities (Grant, 2019). The mobile device has a variety of features and facilities such as social media, music, camera, video, and internet. Furthermore, files in the pdf, word, and excel format can also be accessed in a mobile device. Thus, mobile learning can be accessed by students anytime and anywhere since they always carry their mobile device. In short, this is what makes mobile learning accessible.

moPhyDict is a form of mobile learning packaged in the form of an android application which enables students to use it anytime like a pocketbook (Khumaidi & Sucahyo, 2018; Sari, Riswanto, & Partono, 2019; Supeno, Bektiarso, & Munawaroh, 2018). moPhyDict is equipped with a video presentation, which contains simple practicum activities that students can try at home as well as labs that require laboratory equipment. The presentation of this video is complemented by animation, narration, musical accompaniment, and examples of the application of physics in daily life. moPhyDict can be used as mobile learning in a science subject. Mobile

learning is expected to bridge science learning with various advanced features offered. Therefore, intact knowledge in the students' learning process can be formed (Falloon, 2017; Mardiana, 2017; Ngurahrai, Farmaryanti, & Nurhidayati, 2019; Surahman & Surjono, 2017).

CONCLUSION

moPhyDict as mobile learning proves to be effective in improving students' conceptual understanding of physics. moPhyDict can be used as an alternative source of students in learning physics. moPhyDict also has the advantage of being accessible and easy to operate through the mobile device possessed by each student. moPhyDict not only contains physics material and calculating formulas but also presents with animation and simple practicum videos that students can try independently.

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