Laboratory manual based on smartphone application in increasing students' psychomotoric learning outcome

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Abstract. This study aims to determine the differences in psychomotor learning outcomes between students who use a smartphone-based laboratory manual with students who use laboratory manual based on printed module. This type of research is quasi experimental research. The sample consisted of 40 students 11th grade high school with 20 experimental group students and 20 control group students. Data collection uses observation sheets of student lab work skills. The results showed that there were significant differences between student learning outcomes using the lab manual on smartphone with students using printed modules so that it could be said that laboratory manual based on smartphone application could improve students' psychomotor learning outcomes.

1. Introduction
The development of technology has had a lot of influence on social life in the past decade. Apart from learning, students who already know a lot of technological devices have a lot of tendency towards the use of these devices, especially in big cities. In the world of education many researchers try to create technology-based learning media to motivate students, so students as learners can learn the material anywhere and anytime [1]. This affects the learning patterns and interests of students in using the learning media they use.

The development of learning media in the form of e-learning, video, mobile learning, and various other multimedia allows students to get more information than printed modules that only contain text. Technology-based learning media are also more accessible to students in large cities with adequate electricity and internet access. One of the many technological devices owned by students is a smartphone. In accordance with APJII data that 50% of the Indonesian Population Owns Smartphones [2]. But the use of smartphones for students is actually not optimal for learning. Students are more likely to use smartphones to social media, games, listen to music, and watch videos or movies. A recent study also found that young people in this era are highly active Internet users. For example, 60% go online to download music, 72% check email on a daily basis. 73% get information for school work, and 28% go online for instant messaging with their friends [3].

In biology learning, lab work is a learning method that is often used. Even the technology-based learning has increased in all of the worlds, many students in Indonesia still learn laboratory manual using laboratory manual modules, printed books, and student worksheets given by the teacher. The use of learning media is still classified as conventional, because of limited elements that are only in the form of text or only a few images so that students imagine abstractly their lab work knowledge. Even though
in today’s technology era students have great potential to learn laboratory manual from smartphones or other multimedia devices. Therefore this study aims to see the differences of psychomotoric learning outcomes between students who use smartphone-based practicum guides with students who use the text practicum module.

2. Method

2.1. Design of study
This research using quasi-experimental method with non-equivalent control group design [4]. The sample of this research was student’s eleventh grade, which are one group using media and the other group with conventional media (Table 1).

| Group     | Pre-test | Treatment  | Post-test |
|-----------|----------|------------|-----------|
| Experiment| O₁       | X₁         | O₂        |
| Control   | O₃       | X₂         | O₄        |

Information:
O₁ and O₃: Student’s Psychomotor Learning Outcomes before using the media
X₁: Laboratory activity with a smartphone application-based lab manual
X₂: Laboratory activity with printed module lab manual
O₂ and O₄: Student’s Psychomotor Learning Outcomes after using the media

2.2. Participant
The sample used in this research are 40 eleventh grade students of SMA YMIK 2 Jakarta. The sample selection technique was by purposive sampling, 40 students which is 20 students in experiment class who are learn lab work with smartphone apps and 20 students in control class who are learn lab work with conventional media based on printed module.

2.3. Data collection technique
Data collection techniques were carried out by using instruments to assess students' psychomotor abilities in lab work with assessment scores 1-3 in each aspect [5] and the score will be test with t-test.

3. Results and discussion
Based on the calculation data shows in Table 2 the result of t-test show t count > t table and the value of sig.2 tailed was 0.000, so H₀ was rejected, which means there are significant differences in the psychomotor learning outcomes of the experiment class then control class.

| Students’ Psychomotor Learning outcomes | Levene’s Test for Equality of Variances | t-test for Equality of Means |
|----------------------------------------|----------------------------------------|-----------------------------|
|                                        | F         | Sig. | t     | df | Sig.(2-tailed) | Mean Difference | Std. Error Difference | 95% confidence interval of the difference |
| Equal Variances Assumed                | 1.599     | 0.219| 8.775 | 38 | 0.000         | 18.542          | 2.11311              | 14.26423 – 22.81977                  |
| Equal Variances not Assumed            | 8.775     | 35.7 | 0.000 | 18.542 | 2.11311 | 14.25527 | 22.82873 |

Table 2. T-test of students’ psychomotoric learning outcomes.
In the other words, students' psychomotoric learning outcomes using smartphone applications are better than students who are using conventional learning media. This is caused by the differences in inputting information by students. Students who learned lab work by using a smartphone get knowledge in the form of text, animation, simulation videos, and sounds. The video facilitates the construction of students' understanding so the video indirectly guided students to carry out the procedure correctly, while in printed module students get information abstractly. This is in accordance with the statement of Sharoff that the use of video has several learning goals, one of which is the goal into the increasing of psychomotoric domain [6].

Students also learn more about the tools and materials lab they will use through the content provided in the smartphone application. The amount of content that are more interesting and integrated in smartphone application makes it easier for students to understand the material and laboratory procedures to be carried out. According to Laila, students’ knowledge of laboratory tools and materials has a positive correlation with students' practicum skills, so that if students have understood their tools and materials that will be used in their lab work, their practicum skills are also getting better [7]. The use of smartphone devices included in the mobile learning device also makes learners more motivated so that they influence it in improving practical skills [8].

Unlike the previous guidelines that have existed, these guidelines are usually only in the form of text and images so that they experience limitations in terms of explanation of important points during the implementation of the lab. In this way, students have the possibility of greater procedural errors than when students learn through the smartphone application laboratory manual. Another reason is ability of the media to motivate students. Students who have simultaneous characters in the millennial era now also prefer learning that varies and tends not to be monotonous, which in this case their media can be overcome by the presence of learning videos. Videos integrated in Youtube can also stimulate active learning and provide additional knowledge beyond the expected capabilities.

4. Conclusion
The conclusion of this study is there is significant difference in psychomotoric learning outcomes between students who are use laboratory manual on smartphone applications than students who are use conventional laboratory manual, so that the use of smartphone-based laboratory manual can increasing students' psychomotoric learning outcome.

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