The effectiveness of using smartphone-based e-book in increasing students’ learning outcomes in science learning

Hasbiyati H^1*, Sudiarti D^1, Hikamah S R^1

^1^Biology Education, Islamic University of Jember

* Email: haninghasbiyati@gmail.com

Abstract. In science learning, new innovative breakthroughs need to be sought as renewal effort to comply with the advancement of science and technology. One of the innovative applications is selection of smartphone-based e-book equipped with videos and images since it can be taken and used anywhere. The purpose of this research was to investigate the effectiveness of using smartphone-based e-book in improving students' learning outcomes in science learning. This research used classroom action research method in science learning in three schools. Data of this research were collected using tests, observations, and questionnaires. The results of this research showed that the use of smartphone-based e-book can improve students' learning outcomes. In schools 1, 2, and 3, the students' learning outcomes increased by 27%, 15%, and 18%, respectively. The use of smartphone-based e-book also increased the students' learning motivation by 12.8%, the students' learning activities by 8% and the originality of the students' creative thinking ability by 14.26%.

1. Introduction

In conventional learning process, the role of teacher is very dominant, in which teacher is fully responsible for the implementation of the teaching and learning process, so teacher is the only source of learning. While in modern learning, teacher acts as a facilitator which reduces teacher dominance. Based on the characteristics of natural science learning, the scope of science learned in school is not only a collection of facts, but also a process of fact acquisition based on the ability to use basic knowledge of science to predict or explain different phenomena.

Science material is considered as difficult material for students, so science teachers need to find new breakthroughs that are innovative as renewal effort to conform to the progress of science and technology. This is in line with [1] opinion, which denotes that one of alternative solutions to educational problems through aspects of Educational Technology application is by utilizing learning resources designed, developed, and utilized in the form of learning media that can stimulate the learning process within students. One of teacher acts proposed by [2] also use educational game to help the teaching and learning process become more effective, fun, and interactive. One of its applications in the activities of teaching and learning is the learning materials in the form of electronic modules as the application of science and technology i.e. e-book.
The selection of smartphone-based e-book is considered appropriate since smartphones can be taken and used anywhere. This conforms to the purpose of time-unlimited learning. Nowadays the intensity of smartphone use is included in the high category based on the average percentage of respondents' total responses to the intensity of smartphone use. Based on the results of the research by [3], the responses of the respondents toward the intensity of smartphone use reached 69%. Thus, the use of smartphone as a learning medium will attract students' attention easily. Furthermore, reading e-book on a smartphone is also an alternative to using smartphone in a positive way for students and applying technological devices in the educational world. The presence of this smartphone-based e-book is intended as a complement to learning and provides opportunities for students to relearn less-mastered material wherever and whenever. Accordingly, students will get different experiences in the learning process.

Learning with the use of smartphone-based e-book equipped with videos and images will attract students’ attention and eventually increase students’ motivation to learn science. This medium also features a simple investigation procedure to improve students’ learning activities, so it eases and reinforces students’ understanding on the concepts that will be instilled by teacher. In addition, the concept that is directly obtained from the results of students’ critical thinking in natural science learning with the surrounding environment can increase students’ learning outcomes. Based on the results of previous study on the development of learning media in the form of e-book with .epub extension on the growth and development material in science learning, students’ responses toward the e-book with .epub extension achieved 88.61% at excellent criteria [4]. With the gain of students’ positive responses, it is expected that there is an increase in students’ learning outcomes.

Thus, based on the background which has been described above, the purpose of this research was to investigate the effectiveness of using smartphone-based e-book on the increase of students’ learning outcome in science learning, as well as on students’ learning motivation, learning activities and creative thinking ability.

2. Methodology
This research was conducted using classroom action research with two cycles. Each cycle consisted of four stages of activities i.e. planning, action, observation, and reflection. This research was conducted in science learning in three schools, namely 1) Mts. Hidayatul Mubtadi’in as school 1 by involving 28 students of class VII-A, 2) SMP 01 Islam Jember as school 2 by involving 23 students of class VII-D, and 3) SMK Hidayatul Mubtadi’in as school 3 with 35 students of class IX.

The data of this research were collected by using tests, observations, and questionnaire. In collecting the data, the researchers performed cognitive test to determine the students’ learning outcomes during the process of science learning. The questionnaire was used to reinforce the data of the students’ learning motivation. The questionnaire on the students’ learning motivation used four (4) indicators, namely: attention, relevance, confidence, and satisfaction. The observation was used to assess the activity of the students and to investigate the students’ creative thinking. In addition, students’ learning activities were particularly measured at each cycle based on visual activity, oral activity, listening activity, and writing activity.

3. Results and Discussion

3.1. Results of the research
Based on the use of smartphone-based e-book in science learning in the three different schools, the students’ learning outcomes were assessed at the end of each cycle. The scores obtained were subsequently analyzed and used to determine the learning completeness criteria. The recapitulation of the students’ learning outcomes is shown in Table 1 as follows.
3.2. The Development of the Media
Smartphone-based e-book was developed using the EPUB format or electronic publication that utilized moon reader software. The development could be done more easily if the instructional materials had been made in word format first. There were 3 stages of making EPUB as follows: 1) conversing Word format to html, 2) processing e-book in Sigil, and 3) reading EPUB. Figure 1 shows the display of the development result of smartphone-based e-book in EPUB format.

![Smartphone-based e-book](image)

**Figure 1. Smartphone-based e-book**

The smartphone-based e-book with .epub extension was then assessed in terms of its feasibility and validated by media and material validators. Based on the results of media validation, the smartphone-based e-book was confirmed feasible with an average value of product feasibility of 3.35, while the results of material validation indicated feasibility average value of 3.67. Therefore, the use of smartphone-based e-book is suitable for use in science learning.

3.3. Results of the research
Based on the use of smartphone-based e-book in science learning in the three different schools, the students’ learning outcomes were assessed at the end of each cycle. The scores obtained were subsequently analyzed and used to determine the learning completeness criteria. The recapitulation of the students’ learning outcomes is shown in Table 1 as follows.

| Achievement     | School 1 | School 2 | School 3 | School 1 | School 2 | School 3 |
|-----------------|----------|----------|----------|----------|----------|----------|
| Lowest score    | 50       | 50       | 47       | 65       | 52       | 62       |
| Higher score    | 95       | 92       | 90       | 100      | 98       | 86       |
| Average score   | 72.3     | 64.8     | 70.1     | 82.9     | 69.2     | 73.3     |
| Percentage      |          |          |          |          |          |          |
| of learning     | 62%      | 50%      | 75%      | 88%      | 65%      | 93%      |
| Percentage      |          |          |          |          |          |          |
| completeness    | 38%      | 50%      | 25%      | 12%      | 35%      | 7%       |

**Table 1. Recapitulation of Students’ Learning Outcomes**
Based on Table 1, it was found that the students in each school gained increased scores for their learning outcomes in each cycle. In school 1, the lowest score in cycle I was 50, while the highest score was 95. The students' learning outcomes subsequently increased in cycle II with the lowest score of 65 and the highest score of 100. In school 2, the lowest score in cycle I was 50 and the highest score was 92. The students' learning outcomes in school 2 also increased in cycle II with the lowest score of 52 and the highest score of 98. In school 3, the lowest score in cycle I was 47 and the highest score was 90, while in cycle II the lowest score was 62 and the highest score was 86, which decreased by 4 points.

Viewed based on the average score of students’ learning outcomes in the three schools, the students’ average score in school 1 was 72.31 in cycle I and 82.88 in cycle II, so the average score of the students’ learning outcomes increased by 10.57. In school 2, the average score of 64.80 was obtained in cycle I, while in cycle II the average score was 69.2, so the average score of the students’ learning outcomes in school 2 increased by 4.4. Furthermore, in school 3, the average score in cycle I was 70.11, and in cycle II was 73.25, so the average score of the students’ learning outcomes increased by 3.14. Based on the description, it can be concluded that the use of smartphone-based e-book in science learning can improve students’ learning outcomes in terms of the lowest score and students’ average learning outcomes.

The success of the use of smartphone-based e-book in science learning outcomes measured by the increase in students’ learning outcomes in each learning from cycle I to cycle II reached a score of ≥ 65. The completeness percentage of science learning outcomes can be seen in Figure 2.

![Graph showing the percentage of science learning outcomes](image)

**Figure 2.** The percentage of the science learning outcomes

Based on Figure 2, the use of smartphone-based e-book can improve students’ learning outcomes in the three schools. From the completeness percentage of learning outcomes in the three schools, in school 1 the students’ learning outcome in cycle I was 62% and in cycle II was 88%, so the increase in the students’ learning outcomes was 27%. The students’ learning outcome in school 2 in cycle I was 50% and it increased to 65% in cycle II, so it increased by 15%. Meanwhile, in school 3 the students' learning outcome in cycle I was 75% and it increased in cycle II to 93%, so the students' learning outcome increased by 18%.

In a nutshell, it can be concluded that there was an effect of the use of smartphone-based e-book on students’ learning outcomes. This is in line with [5] research that there is a significant effect of the use of learning media on learning outcomes. This is in accordance with [6] that evaluation is an important aspect in learning process.
### 3.4. Learning Motivation

In addition to students’ learning outcomes, students’ learning motivation in science learning which utilized smartphone-based e-book was also investigated. The success of smartphone-based e-book use on science learning motivation was confirmed since the students had attention, confidence, self-satisfaction and relevance to the lesson or in other words, there was an increase in student motivation in learning cycle I to cycle II by 62.5% in the high category. The increase in the students’ learning motivation can be seen in Figure 3.

![The Percentage of Improving Learning Motivation](image)

**Figure 3.** The Percentage of Improving Learning Motivation

Based on the results of this research, it was found that after smartphone-based e-book was implemented in science learning in cycle I, the students’ learning motivation was 61.01% and in cycle II it increased to 73.08%, so the use of smartphone-based e-book could increase the students’ learning motivation by 12.8%. Referring to the use of smartphone-based e-book in natural science learning which could improve learning outcomes, the learning motivation of students also increased. This is consistent with the study of [7] that learning motivation and students’ learning achievement have a significant influence, so it can be concluded that there is an effect of learning motivation on science learning achievement.

The results of the analysis for each indicator of students’ motivation toward science learning which utilized smartphone-based e-book can be seen in Table 2.

| No | Indicator      | Average Cycle 1 (%) | Average Cycle 2 (%) |
|----|----------------|----------------------|----------------------|
| 1  | Attention      | 23.04                | 39.35                |
| 2  | Confidence     | 25.57                | 21.22                |
| 3  | Self-satisfaction | 21.77          | 24.28                |
| 4  | Relevance      | 25.85                | 17.6                 |

The analysis results of students’ motivation in science learning which used smartphone-based e-book showed that overall the value obtained for each indicator in the questionnaire increased, yet only the value on indicators of confidence and relevance decreased. Increased motivation of 23.04% was found in the indicator of student attention in cycle I and 39.35% in cycle II, so an increase by 16.3% was obtained. The value on the self-satisfaction indicator in cycle I was 21.77% and in cycle II was 24.28, which increased by 2.51%. This increase in average student motivation occurred since during the teaching process the students were actively involved and felt happy when they were using smartphone-based e-book. Moreover, the values on the indicators of confidence and relevance decreased only by 4.4% and 8.3%, respectively. Nevertheless, overall the students who provided positive responses when using smartphone-based e-book showed that they were motivated towards the...
science learning that was conducted. This is in accordance with [8] that student learning motivation (X1) and the use of learning media (X2) simultaneously affect learning outcomes.

3.5. Learning Activities
Based on the result of observation conducted when science learning took place by using smartphone-based e-book, the data in the form of numbers that showed students’ learning activities were obtained, namely 65.9% or with active criteria. After cycle I was carried out, there was an increase in the students’ learning activities since in cycle II the result of the calculation of the students’ learning activities was 73.9% or with active criteria. The success of the use of smartphone-based e-book in science learning was measured by the increase in students’ activity from cycle 1 to cycle II reaching 65% with the active category. The increase in the students’ learning activities through learning using smartphone-based e-book in cycle I and cycle II was 8% which can be seen in Figure 2 as follows.

![Figure 4. The average percentage of students’ learning activities](image)

3.5.1. The average percentage of students’ learning activities

It can be inferred that the use of smartphone-based e-book in Natural Science learning has increased students’ learning outcomes and learning activities. With regard to this finding, the ability of teachers to provide interesting media for students is necessary. This is in accordance with [9] who states that students’ increasing activities and learning outcomes are supported by the involvement of teachers’ activities in a constructive manner with their skills and ability to operate multimedia.

The results of the analysis for each indicator of the students’ activities in using smartphone-based e-book can be seen in Figure 5.

![Figure 5. The Percentage of Students’ Learning Activities](image)

Based on Figure 4, an increase in the percentage of the students’ learning activities in various aspects was depicted. In cycle I, the percentage of the students' reading activity was 17.9% and in
cycle II, it was 21.9%, so it increased by 4%. In the activity of asking questions in cycle I, the percentage was 16.6% and in cycle II it was 18.6%, indicating an increase by 2%. Moreover, the percentage of students' listening/observing activity in cycle I was 13.1%, while in cycle II it was 13.3%, increasing by 0.2%. The percentage of students' writing/note-taking activity in cycle I was 18.3% and in cycle II was 20.1%, which increased by 1.8%. From the whole aspects, it can be concluded that smartphone-based e-book can be used as an alternative in stimulating learning activities. Students are more active in participating in the lessons. This is in accordance with [10] who states that there are differences in learning activities between students who utilize audio visual media and those who do not utilize audio visual media in learning.

3.6. The ability of creative thinking

The success of the use of smartphone-based e-book toward science learning outcomes was measured by an increase in students' creative thinking ability which indicated that the students were said to be creative if $\geq 67\%$ of the total students reached the applied creativity index. Comparison of students' creative thinking ability through learning using smartphone-based e-book in cycle I and cycle II can be seen in Figure 5 as follows.

![Figure 6. The Percentage of Students’ Creative Thinking Ability](image)

Based on the results of the analysis, it was found that the percentage of the students' creative thinking ability in natural science learning using smartphone-based e-book in cycle I was 54% and in cycle II was 46.43%, which decreased by 7.57%. Thus, there was no effect of the use of the e-book on the students' creative thinking ability. This is in accordance with [11] study that there is no significant effect of interaction between learning media and creative thinking of students. The results of the analysis for each indicator of the students' creative thinking ability in science learning using smartphone-based e-book were obtained from the achievement of scores 3 and 4 on each indicator, which can be seen in Table 3.

| Analysis Aspect | Cycle 1  | Cycle 2  |
|-----------------|---------|---------|
| Fluency         | 53.6%   | 46.40%  |
| Flexibility     | 50.0%   | 46.40%  |
| Originality     | 32.1%   | 46.40%  |
| Elaboration     | 71.4%   | 46.40%  |

Table 3. The Analysis Results for Each Indicator of Creative Thinking Ability

Based on the results of the analysis for each indicator of students' creative thinking ability, the percentage on the aspect of fluency, flexibility, and elaboration declined from cycle I to cycle II, and
only the percentage on the originality aspect has increased from cycle I with 32.1% to cycle II with 46.40%, meaning that it increased by 14.26%. This indicates that the use of smartphone based e-book in science learning can improve the originality of the students' creative thinking ability.

4. Conclusion
Based on the results of the data analysis, some conclusions are drawn as follows. 1) The use of smartphone-based e-book can improve students' learning outcomes in science learning. The students in school 1, school 2, and school 3 gained an increase in learning outcomes by 27%, 15%, and 18%, respectively. 2) The use of smartphone-based e-book can improve students' learning motivation in science learning in which in cycle I the students' learning motivation was 65.01% and in cycle II it was 73.08%, so the use of smartphone-based e-book could increase the students' learning motivation by 12.8%. 3) The result of the students' learning activities in cycle I was 65.9% and in cycle II was 73.9%, so the use of smartphone-based e-book could increase the students' learning activities by 8%. 4) However, in terms of students' creative thinking ability, the use of smartphone-based E-book could only improve the originality aspect, namely 14.26%.

Acknowledgement
This work is partially supported by research teams and also gratefully acknowledge the helpful comments and suggestions of the reviewers.

References
[1] Tahta R and Tahta S 2013 Jurnal Mahasiswa Teknologi Pendidikan Vol 1 No 3 1-12
[2] Jurike Y I S S A H M International Journal of Engineering & Technology vol. 7 (4.9)
[3] Kurnia S G D I 2015 Journal of Sociotechnology vol. 14 no. 2 170-178
[4] Hasbiyati H 2017 E-book Berekstensi Epub Sebagai Media Pembelajaran Berbasis Smartphone (Jember: Kyai Mojo)
[5] Kartikasari G 2016 Dynamics Research vol. 16 no. 1 60-77
[6] Bentri A 2018 The International Journal of Engineering & Technology vol. 7 (4.9) 108-111
[7] Hamdu L A G 2011 Journal of Education Research vol. 12 no. 1 81-86
[8] Mismiati 2017 Journal of research and education IPS (jppi) vol. 11 no. 1 54-75
[9] Hikmah T 2017 e-Jurnal Mitra Sains, vol. 5 no. 3 60-67
[10] Muttaqien F 2017 Jurnal Wawasan Ilmiah vol. 8 no. 1 25-41
[11] Sudiantini N D S D 2018 JPPM vol. 11 no. 1 177-186