Universitas Muhammadiyah Malang, East Java, Indonesia

JPBI (Jurnal Pendidikan Biologi Indonesia)

p-ISSN 2442-3750, e-ISSN 2537-6204 // Vol. 7 No. 1 March 2021, pp.25-34

Research Article

Smart Apps Creator 3 to improve student learning outcomes during the pandemic of COVID-19

Rori Khoirudin [a,1,*], Ashadi [a,2], Mohammad Masykuri [a,3]

[a] Master program of science Education, Faculty Teacher and Training Education, Universitas Sebelas Maret, Jl. Ir. Sutami No.36, Kentingan, Kec. Jebres, Kota Surakarta, Jawa Tengah 57126, Indonesia

[1] rorikhoirudin@student.uns.ac.id *; [2] ashadi@staff.uns.ac.id ; [3] mmasykuri@staff.uns.ac.id

* Corresponding author

ARTICLE INFO

Article history
Received: 12 October 2020
Revised: 22 November 2020
Accepted: 26 March 2021
Published: 31 March 2021

Keywords
Mobile learning
Smart Apps Creator 3
Covid-19 Pandemic

ABSTRACT

Due to the COVID-19 pandemic, learning activities have encountered obstacles. One of the impacts was the low learning outcomes achieved by students. The purpose of this study was to improve the learning outcomes of junior high school students during the physical distancing period by implementing problem-based learning through Smart Apps Creator 3. This Classroom Action Research (CAR) used Smart Apps Creator 3 as the platform during learning activities of junior high school students. The research subjects were junior high school students (VIII graders of SMP Negeri 8 Surakarta) with a total number of students was 32 which consisted of 16 males and 16 females. The results showed that the application of Smart Apps Creator 3 has improved students' learning outcomes. It has been proven that the average test score increased from 73.43 (pre-cycle) to 85.56 (cycle II). Moreover, the N gain score obtained was 0.45 (categorized as sufficient). In addition, the percentages of classical learning completeness were 59.37% (pre-cycle) and 93.75% (cycle II). Thus, the Smart Apps Creator 3 can improve student learning outcomes.

How to cite: Khoirudin, R., Ashadi, A., & Masykuri, M. (2021). Smart Apps Creator 3 to improve student learning outcomes during the pandemic of COVID-19. *JPBI (Jurnal Pendidikan Biologi Indonesia), 7*(1), 25-34. doi: https://doi.org/10.22219/jpbi.v7i1.13993

INTRODUCTION

Natural Science is knowledge obtained through data collection by experimentation, observation, and deduction to produce a reliable explanation of a phenomenon. The objectives of Science in Junior High School include students to have the ability: (1) to develop an understanding of various natural phenomena, concepts and principles of science that are useful and applicable in everyday life, (2) develop curiosity, a positive attitude, and awareness of the interplay of relationships between science, environment, technology, and society, and (3) increasing awareness to participate in maintaining, protecting and preserving the environment and natural resources (Indriati, 2012). Various efforts have been made to improve the quality of education in schools, among others, by improving the quality of learning. Because learning in school is a series of consciously planned activities, good planning will support learning.

However, various efforts to improve the quality of education in schools have encountered obstacles, due to the outbreak of COVID-19 pandemic in early 2020 (She et al., 2020). Various countries affected by COVID-19 are starting to looking for a new strategy to solve the obstacle in student learning during learning from home. In India, among 175 respondents, around 38.29% of students are learning classes through Zoom, nearly 25% of students are accessing learning materials through Google Classroom and 23.43% are learning through YouTube, and the remaining students prefer WhatsApp (10.29%), Mail (2.86%) respectively (Radha et al., 2020). The Indonesian Ministry of Education and Culture launched the 12 platforms or applications that students can access to study at home (Handarini & Wulandari, 2020). A study using the Google form questionnaire which was filled by 61 respondents consisting of students, which examined the use of applications for online learning, showed that most of the respondents used WhatsApp, Google Meet, and Google Classroom (Surani et al., 2020; Tangkelangi et al., 2021). Many problems affect the effectiveness of learning using online methods in Indonesia, including the Limitedness of mastering Information Technology by Teachers and Students, Inadequate Facilities and Infrastructure, Limited Internet Access (Megawanti et al., 2020; Purwanto et al., 2020; Syah, 2020).

Most of the students experience stress in the medium category during online learning (Harahap et al., 2020; Jatira & Neviyarni, 2021). The learning motivation during the pandemic also decreased (Handarini & Wulandari, 2020). There is a significant relationship between learning motivation and science learning outcomes (Everaert et al., 2017; Firmansyah et al., 2018; Rahmadani et al., 2017; Wahyuni et al., 2018; Wulandari & Surjono, 2013), and this problem must be overcome by teachers. One of the strategies to improve learning outcomes by using the Smart Apps Creator 3 application. Smart Apps Creator 3 (SAC-3) is a desktop application for creating android and iOS mobile applications without programming code and can generate HTML5 and .exe formats (Khasanah et al., 2020; Rustandi et al., 2020). Smart Apps Creator 3 can be taught to SD, SMP, SMA / SMK students to increase their creativity in managing content and also creating interesting mobile applications (smartappscreator.com) (Cahyati & Suherman, 2020). This application can be opened via a smartphone which is a learning activity by utilizing a smartphone is classified as mobile learning (Majid & Husain, 2014; Haerunnisa, 2020). In a study conducted in India, Among 175 respondents, around 53.71% of students are preferred mobile phones for e-learning, followed by Laptop 30.29%, and the remaining students mostly prefer Laptop & Mobile (7.43%), Laptop, Mobile and Desktop (2.86%) respectively (Radha et al., 2020). At a junior high school in Indonesia, it was found that 67.7% of students stated that android-based media was an interesting learning medium (Rohman et al., 2019). The existence of an Android-based application can minimize problems that often occur in students, including not having textbooks, books left at home, lost or damaged, and can make it easier for students to understand lessons both independently and at school because there are elements interactive so that students do not experience boredom in learning and make it easier for teachers to manage lessons as additional administrative media (Andrianto et al., 2020).

Research conducted by Jannah et al., (2019) stated that learning media using the Smart Apps Creator application are effective in the learning process. Furthermore, Khasanah et al., (2020); Andrianto et al., (2020); and Widiastika et al., (2020) have also conducted Research and Development of Smart Apps Creator 3 learning media, and the result showed that the Smart App Creator 3 is very appropriate for mobile learning. Based on the previous research showed the effectiveness of Smart Apps Creator 3 in the learning process, but there is lack of information between the use of Smart Apps Creator 3 and student learning outcomes. So, this study was conducted to elaborate the using impact of Smart Apps Creator 3 in the learning process to increase student learning outcomes. Moreover, the results of this study can be applied in various schools and also can be used as a reference for other research on mobile learning in the future.

METHOD

This research subject was 32 students of SMP Negeri 8 Surakarta (VIII graders) which consisted of 16 males and 16 females. The VIII A grader was chosen due to the low learning outcomes especially on science subjects, so this study was designed to improve the student learning outcomes especially on the subject matter of COVID-19 by using Smart Apps Creator 3. The design of the Classroom Action Research (CAR) model consists of four stages, namely: planning, implementing actions, observing, and reflecting (Kunandar, 2011). This research was carried out in a cycle which is all cycles are interrelated. In detail, this classroom action research can be described as follows:

Pre-cycle

The implementation of teaching and learning activities for pre-action / pre-cycle was carried out in April 2020. In the pre-action stage, the subject matter is given in a textual form which is shared via what's app. At the end of the learning process, students were given a post-test to know the student's cognitive science learning outcomes.

Cycle I

The implementation of Cycle I is carried out in 1 meeting or 2 lesson hours (2 x 40 minutes).

Planning stage

At this stage, the activities carried out are: (1) Examining the pandemic emergency curriculum (2) Studying learning materials from various sources. (3) Creating learning scenarios. (4) Providing the necessary supporting facilities, namely making the Smart Apps Creator learning application 3. (5) Preparing data collection instruments by making an assessment (evaluation) tool to measure student science learning outcomes. (6) Make an observation sheet.

Acting stage

In general, the actions are taken for each meeting (learning activities) in cycle I am as follows: (I) Preliminary Activities through the class group WhatsApp, the teacher gave an opening greeting, then prayed together before studying. Provide motivation and advice to avoid COVID-19. (II) Core Activities: 1) The teacher asks students to access the Smart Apps Creator 3 application that has been given by the teacher, 2) The teacher monitors student attendance via WA, 3) Participants click on teaching materials containing COVID-19 materials. The teacher guides students in online classes, 4) The teacher asks students to comment or provide feedback on the delivery of material, 5) The teacher allows students to ask questions in WA, 6) The teacher answers student questions related to the COVID-19 concept. (III) Closing Activities: 1) The teacher and students close the learning through the class group WhatsApp, 2) At the end of the cycle, an evaluation is carried out by providing a post-test to measure the extent to which students have mastered the material that has been taught.

Observation and evaluation stage

At this stage, the process of observation and recording is held during the teaching and learning activities, namely by filling out the observation sheet that has been prepared which includes student attendance, student activeness in solving questions. At the end of this cycle, data collection was also held, where the data source in this classroom action research was class VIII A students of SMP Negeri 8 Surakarta. The data obtained is in the form of quantitative data consisting of physics learning outcomes. The way of collecting data in this study is by giving written tests, to measure the extent to which students have mastered the material that has been obtained during the cycle I. The results of observations and written tests become materials for evaluating the learning process.

Reflection stage

At the end of this cycle, data analysis and reflection on what was obtained, both from the results of student responses and from the observation sheet, were conducted through data analysis. The deficiencies that occur will be corrected in the next cycle. Analysis and processing of research data were carried out after the data was collected. The data on student learning outcomes of class VIIIA SMP Negeri 8 Surakarta were analyzed quantitatively using descriptive statistics, including the highest score, lowest score, score range, average score, median, mode, standard deviation, score gain, and learning completeness that the students obtained at the end of each cycle.

Sources of research data are teachers and students which include student learning outcomes. The quantitative data were obtained from the learning outcomes test, while the formulas used were as follows:

Determining the value of student learning outcomes, the range of values used for the essay test in this study is 0 to 100, it can be calculated by using the following Formula (1) :

$$Xi = \frac{Spi}{Sm} \times 100 \quad (1)$$

Where: Xi = The value obtained by the student: Spi = Score obtained by a student I ; Sm = maximum score that may be achieved (ideal score)

The average value of student learning outcomes was calculated by using the following Formula (2):

$$\bar{X} = \frac{\sum_{i=1}^{n} Xi}{N} \quad (2)$$

Where: $\bar{X}$ = average value obtained by students; Xi = The total number of scores obtained by all students; n = total number of students

The post-test scores were analyzed by calculating the normalized gain score. The Gain / n-gain normality test is a test that can provide an overview of the increase in learning outcome scores between before and after the application of the method, it can be calculated by using the following Formula (3):

$$\text{Normalized Gain} = \frac{\text{post-test score} - \text{pre-test score}}{\text{Maximum score} - \text{pre-test score}} \quad (3)$$

As for the category, the interpretation of Normalized Gain index (g) according to Hake is used which has been provided (Table 1):

Table 1. Normalized Gain Index (g)

Normalized Gain Score	Interpretation
-1.00 ‹ g ‹ 0.00	Decrease
G = 0.00	Stable
0.00 ‹ g ‹ 0.30	Low
0.30 ‹ g ‹ 0.70	Average
0.70 ‹ g ‹ 1.00	High

To determine the categories of student learning completeness (KKM), the guidelines for categorizing learning outcomes according to the standards set by SMP Negeri 8 Surakarta are 0%-74.9% not complete and 75%-100% complete.

Cycle II Activities

The activities in cycle II are the same as the activities in cycle I. However, in cycle II there are some improvements and additions to the deficiencies that exist based on the discussion and reflection in cycle I.

RESULTS AND DISCUSSION

The data on the results of classroom action research that has been implemented can be described as follows:

Pre-cycle

Based on the test results given to students at the end of the pre-cycle, the results of quantitative descriptive analysis for the students' science learning outcomes can be seen in Table 2.

Table 2. Results of quantitative descriptive analysis for the value of science learning outcomes in the pre-cycle

Statistics	Pre cycle statistical value
The number of students	32
Ideal score	100
The highest score	100
Lowest score	55
Score range	45
Average score	73.4375
Median	75
Mode	80
Standard deviation	10.521675

Based on the data from the pre-cycle science learning outcomes table, it can be seen that the average science learning outcomes score is 73.43. The average learning outcome value has not met the minimum completeness criteria set by the school, which is 75. If the students 'science learning outcomes test in the pre-cycle were analyzed and then categorized under the minimum completeness criteria applicable at SMP Negeri 8 Surakarta, the percentage of students' learning completeness in the pre-cycle was obtained as in Table 3.

Table 3. Description of pre-cycle learning completeness

Completeness Criteria	Category	Frequency	Percentage (%)
0% - 74.9%	Not complete	13	40.63
75% - 100%	Complete	19	59.37
Amount		32	100

After being analyzed, it turns out that the results obtained do not meet the indicators of success, students who get ≥ learning completeness are 19 students with a percentage of 59.37%. After the learning activities and learning outcomes, test was carried out in the pre-cycle at the 1st meeting, a reflection was carried out on the learning outcomes. Because, the average value of learning outcomes is still below the minimum completeness criteria of school, amounting to 75, so it is necessary to take action cycle I.

Cycle I

Based on the test results given to students at the end of the cycle I, the results of the quantitative descriptive analysis were obtained for the results of the VIIIA grade students of SMP Negeri 8 Surakarta on the COVID-19 material taught in cycle I for 1 meeting through a problem-based learning approach. in the learning process can be seen in Table 4.

Table 4. Results of quantitative descriptive analysis for the value of science learning outcomes in cycle I

Statistics	Cycle I statistical value
The number of students	32
Ideal score	100
The highest score	100
Lowest score	60
Score range	40
Average score	78.96875
Median	78
Mode	85
Standard deviation	8.399249

Based on the data of science learning outcomes in cycle I, it can be seen that the average value is 78.96. The average learning outcome score has met the minimum completeness criteria set by the school. Based on the data that has been obtained in pre-cycle and cycle I, the N-Gain test is carried out, which aims to obtain an overview of the increase in the learning outcomes scores between before and after the implementation of the action. The N-Gain test of the science learning outcomes data in the pre-cycle and cycle I obtained a score of 0.20, which is still low. The percentage of students learning completeness in the cycle I was obtained as in Table 5.

Table 5. Description of the cycle I learning completeness

Completeness Criteria	Category	Frequency	Percentage (%)
0% - 74.9%	Not complete	7	21.87
75% - 100%	Complete	25	78.12
Amount		32	100

After being analyzed, the results do not meet the indicators of completeness, students who get ≥ KKM are 25 students (78,125%). The results in the second cycle also showed there are 80% of student who obtained scores ≥ KKM. The objective of the action has not been achieved, since there are several deficiencies in the implementation of the action, such as 1) Less attractive appearance of the Smart Apps Creator 3 learning application. 2) Lack of clear information on the Smart Apps Creator 3. 3) Lack of motivation given by the teacher to students to do assignments. Because the indicators of the success of the action have not been fulfilled, where the N gain test results get a score of 0.20, which is still low, and the percentage of students who get a score of ≥ KKM has not reached 80%, the action is continued in cycle II.

Cycle II

In the second cycle of action research, various improvements were made as follows: 1) Making the Smart Apps Creator 3 learning application look more attractive with pictures and back sound. 2) Adding information about learning materials in the Smart Apps Creator 3 application. 3) Motivating students to do assignments by linking them with videos that show teachers providing motivation and explanations.

Based on the test results given to students at the end of the pre-cycle, the results of the quantitative descriptive analysis were obtained, it can be seen in Table 6.

Table 6. Results of quantitative descriptive analysis for the value of science learning outcomes in cycle II

Statistics	Cycle II statistical value
The number of students	32
Ideal score	100
The highest score	100
Lowest score	73
Score range	27
Average score	85.5625
Median	85
Mode	85
Standard deviation	8.277203

Based on the data from the table of science learning outcomes in cycle II, it can be seen that the average value of learning outcomes in science learning is 85.56. The average learning outcome value has met the minimum completeness criteria set by the school. The data that has been obtained in pre-cycle until cycle II aims to describe the increase of the learning outcomes scores between before and after the implementation of the action. The N-Gain test of the science learning outcomes data in the pre-cycle and the cycle II obtained a score of 0.45, which is sufficient. If the student's science learning outcomes test in cycle II were analyzed and then categorized can be seen in Table 7.

Table 7. Description of completeness of learning cycle II

Completeness criteria	Category	Frequency	Percentage (%)
0% - 74.9%	Not complete	2	6.25
75% - 100%	Complete	30	93.75
Amount		32	100

The analysis showed that students who get ≥ KKM scores are 30 students or (93.75%). The results in cycle II indicate that classical learning completeness has met the performance indicators that must be achieved. Due to the action indicators that have been fulfilled, where the results of the N-gain test score are sufficient (0.45), and the proportion of students who get score ≥ KKM is more than 80%, so the action can be stopped in cycle II.

Based on the data in Tables 2, 4, and 6, it can be seen that there is an increase in the average score of students' science learning outcomes, from pre-cycle (73.43), cycle I (78.96), and cycle II (85.56). The increasing average value of learning outcomes in each cycle can be seen in Figure 1.

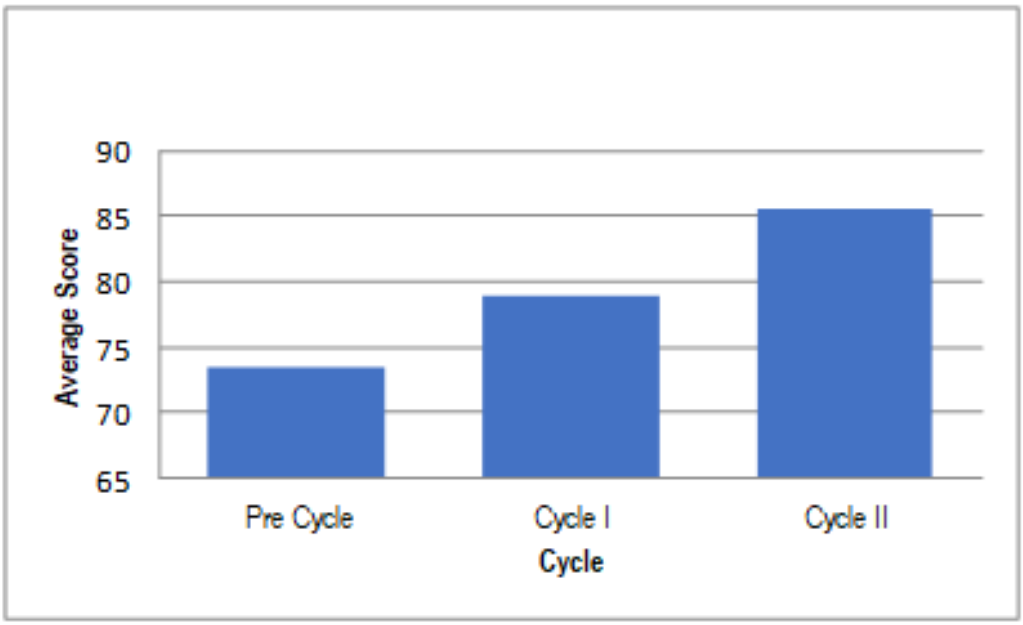

Figure 1. Graph of the average test value of students

Based on the results of the N gain test carried out on learning outcomes between pre-cycle and cycle I, and between pre-cycle and cycle II, it can be seen that there is an increase in the N Gain score of the VIIIA grade student's science learning outcomes. The increase of N Gain score in each cycle can be seen in Figure 2.

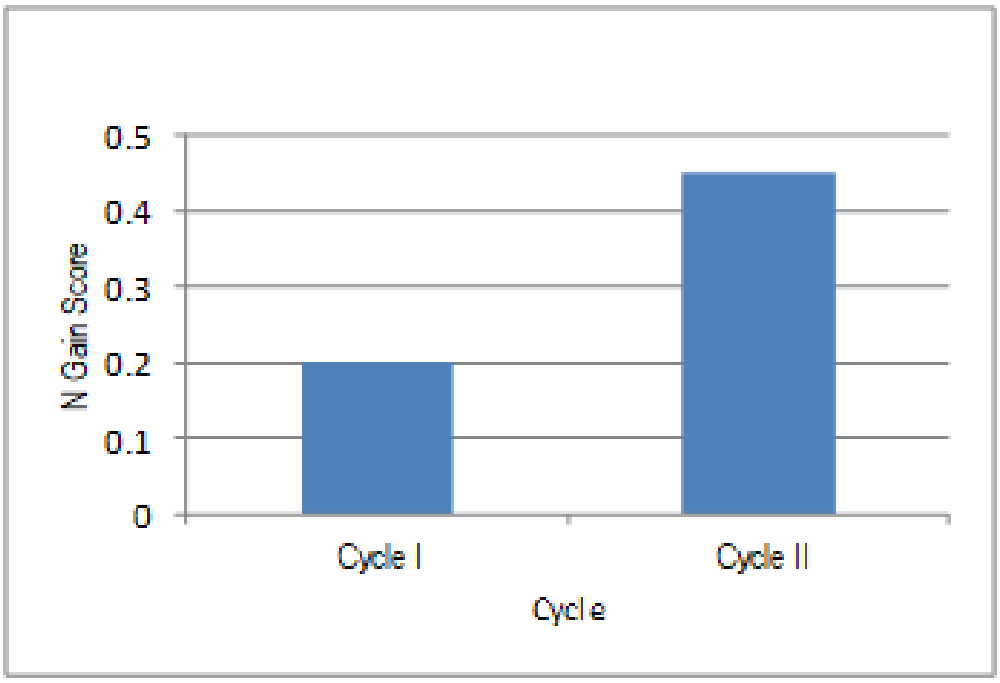

Figure 2. Graph of N Gain score

Based on the data in Table 3, 5, and 7, it can be seen that there is an increase in the percentage of classical learning completeness of class VIIIA students, from pre-cycle, cycle I, and cycle II. If in the pre-cycle, the percentage of classical learning completeness was 59.37%, then in the first cycle it increased to 78.12%, and in the second cycle, it increased again to 93.75%. The increase in the percentage of classical learning completeness of class in each cycle can be seen in Figure 3.

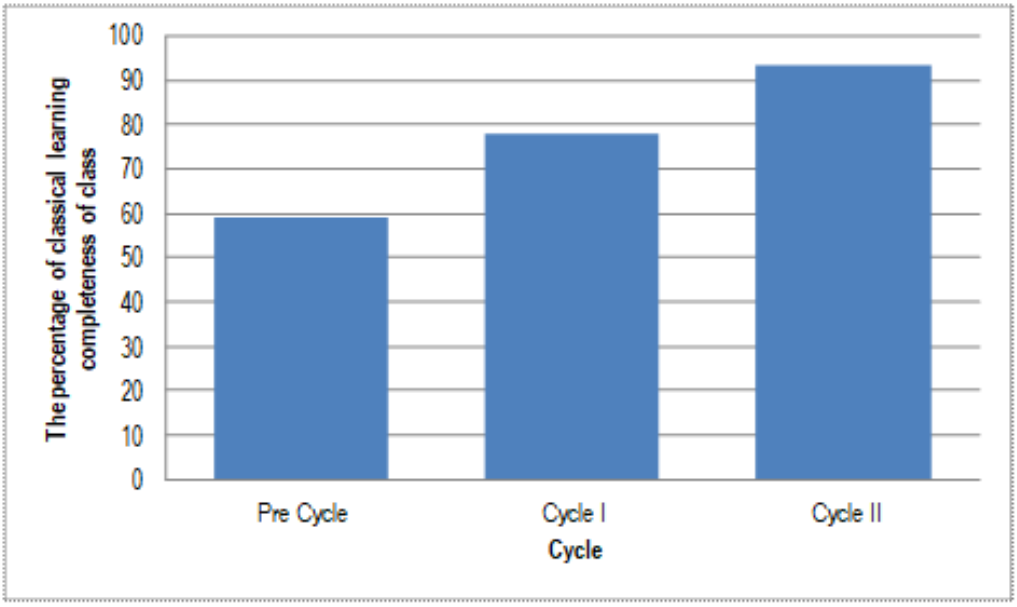

Figure 3. Graph of the percentage of classical learning completeness of the class

Classroom action research was carried out in 2 cycles. This is due to the failure to achieve success indicators in cycle I, so it must be continued in cycle II. The failure to achieve success indicators in cycle I is due to deficiencies of the actions in cycle I and it is supposed to be completed in cycle II, and it would be

stopped after the result met the criteria (Fitria & Andriesgo, 2019; Husamah & Pantiwati, 2014). The result of evaluation and reflection need to be elaborated and the lack of the supplementary in the last cycle must be improved in the next cycle (Glaze, 2018; Husamah et al., 2018; Indriati, 2012). So, by making improvements in cycle II, it turns out that there is an increase in student learning outcomes in science so that indicators of success can be achieved.

Improvements in cycle II were made to the appearance of the Smart Apps Creator 3 learning application, namely by displaying more audio-visual media. This right is due to the audio-visual media having several advantages, including (1) Clarifying the presentation of the message so that it is not to verbalize (in the form of words, written and spoken). (2) Overcoming the limitations of space, time, and senses, such as objects that are too large are replaced by reality, pictures, film frames, films, or models. (3) Audiovisual media can play a role in tutorial learning (Adittia, 2017; Asmara, 2015; Fujiyanto et al., 2016; Niswatuzzahro et al., 2018; Purwono, 2014).

There are some obstacle found in cycle I, one of the problems is the motivation of the student are getting unmotivated, so the teacher need give motivation to the student first due to the learning motivation are closely related to the learning outcomes (Everaert et al., 2017; Firmansyah et al., 2018; Rahmadani et al., 2017; Wahyuni et al., 2018; Wulandari & Surjono, 2013). The result showed that mobile learning is effective to improve student learning outcomes, it is following the research results of Putra et al. (2017); Fatmawati (2015); Nugroho (2014); Surahman and Surjono (2017) that the use of android application-based learning media was able to improve learning outcomes. These results are also following the research conducted by (Andrianto et al., 2020; Jannah et al., 2019; Khasanah et al., 2020) that students are more helped to understand the material by using the Smart Apps Creator learning media, so the score of the student test has increased from before to after using the learning media.

CONCLUSION

The average score of science learning outcomes increased from the pre-cycle to cycle II (73.43; 78.96; 85.56 respectively). Moreover, the results of N gain test carried out on learning outcomes were increase as well from 0.20 to 0.45 (which is sufficient). Then, the increasing value also depicts the percentage of classical learning completeness, wherein the pre-cycle it was 59.37%, then in the first cycle it increased to 78.12%, and in the second cycle is increased to 93.75%. It concludes that the implementation of the mobile learning model using the Smart Apps Creator 3 application is effective to improve student learning outcomes.

ACKNOWLEDGEMENT

The highest appreciation goes to all the experts involved in the validation of the Smart Apps Creator 3 application, SMP Negeri 8 Surakarta, and all students involved in this research.

REFERENCES

Adittia, A. (2017). Penggunaan media pembelajaran audio visual untuk meningkatkan hasil belajar IPS pada siswa kelas IV SD. *Mimbar Sekolah Dasar*, *4*(1), 9–20. https://doi.org/10.23819/mimbar-sd.v4i1.5227

Andrianto, R., Sulaiman, M. M., & Yulianto, M. A. (2020). Aplikasi interaktif teknolog layanan jaringan sebagai media belajar siswa berbasis android. *Journal of Multi-Disciplinary Sciences*, *1*(01), 34–43. http://e-journal.univ-nuku.ac.id/index.php/kolano/article/view/24

Asmara, A. P. (2015). Pengembangan media pembelajaran berbasis audio visual tentang pembuatan koloid. *Jurnal Ilmiah Didaktika*, *15*(2), 156. https://doi.org/10.22373/jid.v15i2.578

Cahyati, S., & Suherman, W. S. (2020). Development of martial arts learning media for junior high school students. *Solid State Technology*, *63*(1), 1146–1162. http://solidstatetechnology.us/index.php/JSST/article/view/507

Everaert, P., Opdecam, E., & Maussen, S. (2017). The relationship between motivation, learning approaches, academic performance, and time spent. *Accounting Education*, *26*(1), 78–107. https://doi.org/10.1080/09639284.2016.1274911

Fatmawati, S. (2015). *Pengembangan mobile learning berbasis android menggunakan adobe flash cs6 pada mata pelajaran bahasa inggris untuk meningkatkan hasil belajar siswa kelas X TKJ SMK Hidayah Semarang*. Tesis. Universitas Negeri Semarang. http://lib.unnes.ac.id/23804/1/1102411015.pdf

Firmansyah, F., Komala, R., & Rusdi, R. (2018). Self-efficacy and motivation: Improving biology learning outcomes of senior high school students. *Jurnal Pendidikan Biologi Indonesia*, *4*(3), 203–208. https://doi.org/10.22219/jpbi.v4i3.6878

Fitria, D., & Andriesgo, J. (2019). Penerapan model pembelajaran scramble berbasis powerpoint untuk meningkatkan hasil belajar siswa pada bidang studi sejarah kebudayaan Islam. *J-PAI: Jurnal Pendidikan Agama Islam*, *5*(2). https://doi.org/10.18860/jpai.v5i2.5857

Fujiyanto, A., Jayadinata, A. K., & Kurnia, D. (2016). Penggunaan media audio visual untuk meningkatkan hasil belajar siswa pada materi hubungan antarmakhluk hidup. *Jurnal Pena Ilmiah*, *1*(1), 841–850. https://doi.org/10.23819/pi.v1i1.3576

Glaze, A. L. (2018). Teaching and learning science in the 21st century: Challenging critical assumptions in post-secondary science. *Education Sciences*, *8*(1), 1–8. https://doi.org/10.3390/educsci8010012

Haerunnisa, Adrian Permana1, dan R. F. (2020). Peranan Smarthphone dalam dunia pendidikan di masa pandemi Covid-19, *TEMATIK - Jurnal Teknologi Informasi dan Komunikasi*. *7*(2), 1–10. https://doi.org/10.38204/tematik.v7i2.460

Handarini, O. I., & Wulandari, S. S. (2020). PembelajarHandarini, O. I., & Wulandari, S. S. (2020). Pembelajaran daring sebagai upaya study from home (SFH). Jurnal Pendidikan Administrasi Perkantoran (JPAP), 8(3), 465–503.an. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, *8*(3), 465–503. https://journal.unesa.ac.id/index.php/jpap/article/view/8503

Harahap, A. C. P., Harahap, D. P., & Harahap, S. R. (2020). Analisis tingkat stres akademik pada mahasiswa selama pembelajaran jarak jauh dimasa covid-19. *Biblio Couns : Jurnal Kajian Konseling dan Pendidikan*, *3*(1), 10–14. https://doi.org/10.30596/bibliocouns.v3i1.4804

Husamah, Fatmawati, D., & Setyawan, D. (2018). OIDDE learning model: Improving higher order thinking skills of biology teacher candidates. *International Journal of Instruction*, *11*(2), 249–264. https://doi.org/10.12973/iji.2018.11217a

Husamah, & Pantiwati, Y. (2014). Cooperative learning STAD-PjBL: motivation, thinking skills, and learning outcomes of biology department students. *International Journal of Education Learning and Development*, *2*(1), 77–94. https://www.eajournals.org/journals/international-journal-of-education-learning-and-development-ijeld/vol-2-issue-1-march-2014/cooperative-learning-stad-pjbl-motivation-thinking-skills-learning-outcomes-biology-department-students/

Indriati, D. (2012). Meningkatkan hasil belajar ipa konsep cahaya melalui pembelajaran Science-edutainment berbantuan media animasi. *Jurnal Pendidikan IPA Indonesia*, *1*(2), 192–197. https://doi.org/10.15294/jpii.v1i2.2138

Jannah, I. M., Murtiyasa, B., & Kom, M. (2019). *Rancang bangun media pembelajaran matematika matriks untuk kelas x di smk muhammadiyah 1 sragen berbasis mobile learning*. Tesis. Universitas Muhammadiyah Surakarta. http://eprints.ums.ac.id/76883/

Jatira, Y., & Neviyarni, S. (2021). Fenomena Stress dan pembiasaan belajar daring dimasa pandemi Covid-19. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(1), 35–43. https://doi.org/10.31004/edukatif.v3i1.187

Khasanah, K., Muhlas, M., & Marwani, L. (2020). Development of e-learning Smart Apps Creator (SAC) learning media for selling employees on paid tv. *Akademika*, *9*(02), 129–143. https://doi.org/10.34005/akademika.v9i02.819

Kunandar, K. (2011). Evaluasi program pengembangan dan implementasi kurikulum tingkat satuan pendidikan (KTSP). *Jurnal Evaluasi Pendidikan*, *2*(2), 171. https://doi.org/10.21009/JEP.022.05

Majid, A., Aini, N., Husain, H., & Nooraidah, K. (2014). Mobile learning application based on augmented reality for science subject: Isains. *ARPN Journal of Engineering and Applied Sciences*, *9*(9), 1455–1460. https://www.semanticscholar.org/papere

Megawanti, P., Megawati, E., & Nurkhafifah, S. (2020). Persepsi peserta didik terhadap PJJ pada masa pandemi COVID-19. *Jurnal Ilmiah Pendidikan*, *7*(2), 75–82. https://journal.lppmunindra.ac.id/index.php/Faktor/article/view/6411

Niswatuzzahro, V., Fakhriyah, F., & Rahayu, R. (2018). Penerapan model discovery learning berbantuan media audio visual untuk meningkatkan literasi sains siswa kelas 5 SD. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *8*(3), 273–284. https://doi.org/10.24246/j.js.2018.v8.i3.p273-284

Nugroho, S. (2014). Pemanfaatan mobile learning game barisan dan deret geometri untuk meningkatkan minat dan hasil belajar matematika SMA Kesatrian 1 Semarang. *Indonesian Digital Journal of Mathematics and Education*, *1*(1), 1–7. http://idealmathedu.p4tkmatematika.org/wp-content/uploads/2015/07/Sugeng-Nugroho.pdf

Purwanto, A., Pramono, R., Asbari, M., Hyun, C. C., Wijayanti, L. M., Putri, R. S., & Santoso, P. B. (2020). Studi eksploratif dampak pandemi covid-19 terhadap proses pembelajaran online di sekolah dasar | EduPsyCouns: Journal of Education, Psychology and Counseling. *Journal of Education, Psychology*

and Counseling, *2*(1), 1–12. https://ummaspul.e-journal.id/Edupsycouns/article/view/397

Purwono, J. (2014). Penggunaan media audio-visual pada mata pelajaran ilmu pengetahuan alam di Sekolah Menengah Pertama Negeri 1 Pacitan. *Jurnal Teknologi Pendidikan Dan Pembelajaran*, *2*(2). https://jurnal.fkip.uns.ac.id/index.php/tp/article/view/3659

Putra, R. S., Wijayati, N., & Mahatmanti, F. W. (2017). Pengaruh penggunaan media pembelajaran berbasis aplikasi android terhadap hasil belajar siswa. *Jurnal Inovasi Pendidikan Kimia*, *11*(2). https://journal.unnes.ac.id/nju/index.php/JIPK/article/view/10628

Radha, R., Mahalakshmi, K., Kumar, V. S., & Saravanakumar, A. R. (2020). E-learning during lockdown of Covid-19 pandemic: A global perspective. *International Journal of Control and Automation*, *13*(4), 1088–1099. https://d1wqtxts1xzle7.cloudfront.net/64029090/covid-pandemic- Learning-during-Lockdown-of_Covid_19_P.pdf

Rahmadani, W., Harahap, F., & Gultom, T. (2017). Analisis faktor kesulitan belajar biologi siswa materi bioteknologi di SMA negeri se-kota Medan. *Jurnal Pendidikan Biologi*, *6*(2), 279–285. https://doi.org/10.24114/jpb.v6i2.6546

Rohman, A. A., Ismail, M., & Siswanah, E. (2019). Media Pembelajaran Matematika SMP Berbasis Android Berorientasi UoS untuk meningkatkan Hasil Belajar Siswa. *Square : Journal of Mathematics and Mathematics Education*, *1*(1), 19. https://doi.org/10.21580/square.v1i1.4057

Rustandi, A., Asyril, A., & Hikma, N. (2020). Pengembangan media pembelajaran berbasis android pada mata pelajaran simulasi dan komunikasi digital kelas x sekolah menengah kejuruan teknologi informasi airlangga tahun ajaran 2020/2021. *Media Bina Ilmiah*, *15*(2), 4085–4092. http://ejurnal.binawakya.or.id/index.php/MBI/article/view/880

She, J., Jiang, J., Ye, L., Hu, L., Bai, C., & Song, Y. (2020). 2019 novel coronavirus of pneumonia in Wuhan, China: emerging attack and management strategies. *Clinical and Translational Medicine*, *9*(1). https://doi.org/10.1186/s40169-020-00271-z

Surahman, E., & Surjono, H. D. (2017). Pengembangan adaptive mobile learning pada mata pelajaran biologi SMA sebagai upaya mendukung proses blended learning. *Jurnal Inovasi Teknologi Pendidikan*, *4*(1), 26–37. https://doi.org/10.21831/jitp.v4i1.9723

Surani, D., Kusuma, J. W., & Kusumawati, N. (2020). Platform Online Dalam Perkuliahan Pada Masa Pandemi Covid-19. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *5*(9), 1338–1349. http://dx.doi.org/10.17977/jptpp.v5i9.14057

Syah, R. H. (2020). Dampak covid-19 pada pendidikan di Indonesia: Sekolah, keterampilan, dan proses pembelajaran. *SALAM: Jurnal Sosial Dan Budaya Syar-I*, *7*(5). https://doi.org/10.15408/sjsbs.v7i5.15314

Tangkelangi, E. E., Megawati, R., & Akobiarek, M. (2021). Persepsi mahasiswa program studi pendidikan biologi dalam pembelajaran online pada masa pandemi covid-19. *Celebes Biodiversitas*, *4*(1), 25–32. https://doi.org/10.51336/cb.v4i1.247

Wahyuni, S., Miarsyah, M., & Adisyahputra, A. (2018). Correlation between achievement motivation and reading comprehension ability through science literacy to high school students. *Indonesian Journal of Science and Education*. https://doi.org/10.31002/ijose.v2i2.613

Widiastika, M. A., Hendracipta, N., & Syachruroji, A. (2020). Pengembangan media pembelajaran mobile learning berbasis android pada konsep sistem peredaran darah di sekolah dasar. *Jurnal Basicedu*, *3*(2), 524–532. https://doi.org/10.31004/basicedu.v5i1.602

Wulandari, B., & Surjono, H. D. (2013). Pengaruh problem-based learning terhadap hasil belajar ditinjau dari motivasi belajar PLC di SMK. *Jurnal Pendidikan Vokasi*, *3*(2). https://doi.org/10.21831/jpv.v3i2.1600