THE EFFECTIVENESS OF ANDROID APPLICATION AS A STUDENT AID TOOL IN UNDERSTANDING PHYSICS PROJECT ASSIGNMENTS

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ABSTRACT

Indonesian students are addicted to using gadgets, which unfortunately brings negative impacts. Using the gadget for a long duration will undoubtedly affect the quality of students if it is not directed to appropriate and beneficial use. After school, students are preoccupied with their gadgets so that they waste a lot of their time to play games and leave their homework undone. As a result, their interest in doing science assignments are meager. Gadget addiction and the low level of learning interest in carrying out tasks are the new problems in education. Therefore, efforts need to be made to overcome them. This study aims to determine the effectiveness of android application as student aid tools in understanding the task of Physics. The subjects of this research were all VIII graders of SMP Islam Terpadu Arrozaq Rantauprapat. The type of this research is quantitative with a pre-experimental design (one-shot case study). This study directed the students to utilize their gadgets in completing the task of physics. The instruments used in this research were the video-checking rubric and the effectiveness questionnaire. This research has been carried out for three months, and video-checking was carried out at the end of each month after the project assignments were collected. The results of data analysis in this study indicated that the utilization of an android application as a tool of students is considered sufficient. The students become more enthusiastic about working on assignments and accessing the internet through gadgets on positive uses.

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Keywords: android application, effectiveness, physics, student aid tools, task

INTRODUCTION

Along with the development of sophisticated technology, smartphones have been equipped with several features and modern applications, which facilitate users to reach the world just through the tips of fingers. A study found that college students spent nearly nine hours of a day with their cell-phones. As the functionality of cell-phones keeps expanding, it seems that the addiction to a smartphone is indispensability. The study results suggested that certain activities performed on one's cell-phone be more likely to lead the user to be dependent than others, and the forms of addiction vary across gender (Roberts et al., 2014)and their relationship to cell-phone addiction, across male and female cell-phone users. METHODS: College undergraduates (N = 164.

More than 190 countries around the world use Android. Many users utilize Android to search for apps, games, and other digital content. Indonesia is one of the countries with the most

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active gadget users. There are 171.17 million active users, and it is about 63% of the total population of Indonesia (264.16 million). Almost every student, not only Senior High School but also Primary, has gadgets and operates it for daily activities. Based on the results of a survey conducted in Indonesia, people aged 19-34 years old are the main contributor of users, which reached 49.52%. Then followed by those aged 35-54 years old that scored 29.5%, and teens aged 13-18 years old with 16.68%. In terms of education, postgraduate dominated with 88.24%, then bachelor with 79.23%, senior high school with 70.54%, followed by junior high school with 48.53%, and elementary school with 25.1%. For the duration of internet usage, the average daily time spent to use the internet via any device is 8 hours 36 minutes (BAPJII, 2018).

The data indicated that Indonesian students are addicted to using the smartphone, which, unfortunately, resulted in negative impacts. Using the smartphone for a long duration will undoubtedly affect the quality of students if it is not directed to appropriate and beneficial use. After school, students no longer care about repeating lessons or doing assignments. They are busy with their gadgets without time restrictions so that much time is wasted, even though some school tasks must be completed immediately.

The similar conditions also occur in students of SMPIT (Junior High School) of Arrozaq Rantauprapat, Sumatera Utara. It is a full-day school in which the learning schedule runs from 07.15 a.m to 04.00 p.m. Based on preliminary research by giving a questionnaire to students about their activities at home, 94% of students play their smartphone about 4-5 hours and only 6% of them play their smartphone at less than 4 hours. They use their gadgets for various purposes; averagely, 40% to access social media, 45% to play online games, and 15% to browse some websites. These results are also reinforced by the interview results of 15 student guardians who were randomly selected. They revealed that most students spend all their time with their smartphones and never review their lessons out of school. The students spend their time on accessing social media, playing online games, and trying to update new features of their smartphones. This fact is confirmed by checking their social media account on how often they update their status, share their edited videos, and play online games. All these activities are often shared with their social media accounts (Facebook, Instagram, Twitter, Tiktok, and others). When we ignore it, it can cause

decreasing of learning interest and declining of student's achievement.

Meanwhile, at school, students often do not respond when the teacher gave tasks and homework. Based on observations and interviews with science teachers at SMPIT Arrozaq, it was only 10% of the students doing the homework or task by themselves, 80% of the students copying their friend's homework, and the other 10% of the students do not work on it at all. When the teacher checked out the assignments, it was found that only 10% of the students understood their tasks well. This fact is quite shocking since giving task is one effective method in learning to encourage students to review the lesson at home. The low interest of students in doing homework certainly has something to do with the unlimited use of smartphones.

The result of the preliminary research has shown that interest and attention are two things that are considered similar in everyday use. The students' attention is their concentration to observe and to understand the exclusion of others. The interest and attention following the learning process must arise based on the high awareness of students for learning. Furthermore, the teacher is expected to provide motivation and guidance for students so that they have a stronger desire for learning, and their attention to learning will get better (Nurhasanah & Sobandi, 2016).

Nonetheless, these students have exceptional abilities and creativity in using smartphones. For this reason, it is not a wise decision to alienate the smartphone from students because it remains to have benefits for educational purposes. Taking a closer look, most students have excellent ability and creativity to operate some features or applications of their smartphones, such as photo and video editing. This video or photo editing application can be downloaded for free in the play store or app store, and it is the challenge for teachers to collaborate lessons with creativity and passion of students to build up a learning interest.

Mobile learning is more effective than the use of traditional teaching methods in helping students enrolled in the "Strategies of Teaching and Learning" course to achieve better and develop their skills (Elfeky & Masadeh, 2016). These features are provided in a very supportive Android learning because it is beneficial to help students to understand the subject matter. These features also allow teachers to explain the lessons learned through the media, so the teacher does not have to explain repeatedly (Adi et al., 2016). Smartphone applications can be flexible media

facilitating students to learn everywhere and every time. As a result, the learning frequency will be higher, bringing a pass to the students' retention (Lubis & Ikhsan, 2015). By using this method, students will keep their learning without stopping their hobby.

Based on the explanation above, it is necessary to research the effectiveness of the android application as a learning aid in doing assignments. The android application in this study is a type of photo or video editing application that is already available on smartphones and can be downloaded for free through the play store or app store.

The assignment method is the way of presenting the lesson in which the teacher assigns the students to do the learning activities, then account it (Sutriani et al., 2014). Learning by giving an assignment is a suitable method to apply to learners as it encourages them to grow their sense of responsibility to answer, and provides the experience of real learning (Cahyati et al., 2015). In this study, the assignments given to students were completed with the help of an android application, namely the Viva Video and Kinemaster.

The assignment of this study referred to the implementation of the PBL model. It consisted of projects that integrate science, technology, society, history, mathematics, politics, and even arts that serve productive discussion opportunities for students and gives them the excitement of learning. Within that context, the students have the chance to investigate challenging topics of real-world issues, share the issues with others, search knowledge from varied sources, make decisions and present their products/results (Efstratia, 2014). The Project-Based Learning includes seven steps, these are the determination of the topics, organization of the groups, planning the project, application of the project, planning the presentation, making the presentation, and the evaluation (Kızkapan & Bekta☐, 2017).

This research supports the use of electronic media in learning, particularly physics learning. Referring to Yamin et al. (2017), PBL-based in science learning has been proven to be able to enhance the concept mastery of junior high school students. They gave the students' project assignments which must be completed according to the agreement. Moreover, Winatha & Abubakar (2018), have examined the usage of e-module on the students' concept mastery and found a remarkable increase in it. Other than that, android applications are flexible and adjustable to the students' needs and the environment. Just as explained by Liliarti et al. (2018), a culture-based

android application has been confirmed to improve the students' competence of diagrammatic and argumentative representation in physics learning. Similarly, Arista & Kuswanto (2018) elucidated that the use of Android applications could promote learning independence and conceptual understanding.

This research aimed to see the effectiveness of android application as a tool for students in completing physics projects or tasks. By utilizing the android application, it is expected to be able to increase student interest in working on the assignments. The task was given in the form of a video-making; hence, the utilization of android applications in this research focused on making videos containing physics materials. Each student was given the freedom to choose the application to be used in making videos. The subject matter presented in this study was about Accelerated Uniform Motion covering horizontal rectilinear motion, vertical rectilinear motion, and parabolic motion.

METHODS

Research Type

The type of this research is quantitative, which is called the positivistic method as it is based on positivism (Sugiyono, 2010). This research focused on gathering numerical data to explain a particular phenomenon (Babbie, 2010). The goal of quantitative research was to determine the relationship between one thing (an independent variable) and another (a dependent or outcome variable) within a population (Muijs, 2010). The design of this research was a pre-experimental design with a one-shot case study. This research gave treatment to the students who had a low interest in doing the assignment of Integrated Science subject in Integrated Islamic Junior High School of Arrozaq (SMPIT Arrozaq) Rantauprapat. The population of this research included SMPIT Arrozaq Rantauprapat consisting of two classes, VIII A with 17 students and VIII B with 18 students. Hence, the total of subjects was 35 students.

Instrument and Reseach Procedure

The project assignments given to the students were to make learning videos through an Android application on a smartphone. The android applications used in this study were Viva Video and Kinemaster. The instruments used in this study were a rubric of video-checking indi-

cators to measure student-made video content and effectiveness questionnaires to measure the effectiveness of utilizing Android applications. The research procedure consisted of several stages, i.e.:

Planning Stage, this stage included: (1) Observing the students' condition when following the classroom learning process; (2) Interviewing science teachers to find out the students' presentations on assignments or homework as well as recapping the students' daily values; (3) Interviewing some parents to find out the students' activities at home, including about the interaction with their smartphones; and (4) Making a rubric for video checking indicators to measure student-generated video content and questionnaires to measure the effectiveness of android apps as an aid for them in doing homework or assignments.

Implementation Stage, this stage included: (1) Inviting science teachers to collaborate in assignment provided for the students. The project was creating an original video about science materials that have been taught through android applications; (2) Giving an understanding to all students of SMPIT Arrozaq about the importance of using an android application in learning, after that, explaining the task mechanism and how to use viva video and kinemaster to complete project assignments; (3) Implementing the learning process. At this stage, the students were trained to acquire the understanding of scientific concepts and the process needed to participate in the digital society (Science and Technology) era (Saefi et al., 2017); (4) Giving project assignments. This project was given once a month for each class; and (5) Collecting video project assignments from each group and then evaluated based on the rubric of content indicators. This assessment was performed every month after the collection of video project assignments.

Data Collection and Analysis Techniques

The data analysis technique used in this research was a descriptive statistic, which aimed to explain the effectiveness of the efforts done according to the benchmark made by the researchers. Moleong (2000) explained that descriptive research reports the state of the research object based on facts. This research is an attempt to disclose a problem or circumstance or event as it is so that it is only a disclosure of facts. The following is the table of effectiveness criteria of android application utilization. This table is a reference to determine the effectiveness category based on the average percentage score that has been generated.

Table 1. The Criteria for the Video Content Indicator Achievement

Percentage Value	Criteria
0% - 25%	Less than satisfactory
26% - 50%	Satisfactory
51% - 75%	good
76% - 100%	Very good

Table 2. The Criteria for the Effectiveness of Android Application Utilization

Percentage Value	Criteria
0% - 20%	Ineffective
21% - 40%	Less effective
41% - 60%	Quite effective
61% - 80%	Effective
81% - 100%	More effective

RESULTS AND DISCUSSION

Video-Checking in Three Months

Here is a description of the video-checking data in three months based on the established indicators. Each video was collected after four weeks of learning at the end of the month.
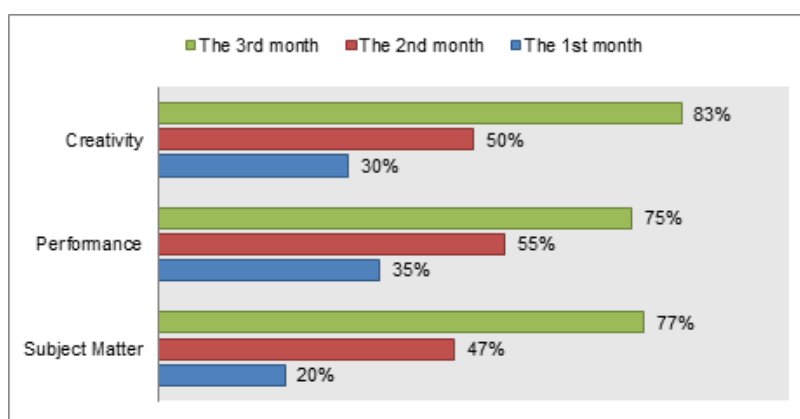

Figure 1. Percentage of Video Content Indicator Achievement in Three Months

Video Checking Description in The First Month

The first videos were collected after four weeks of learning at the end of May 2018. The topic presented in the videos was "accelerated uniform motion on the horizontal rectilinear motion." The applications used encouraged the implementation of design thinking and creativity as the learners moved through each stage of the inquiry process (Stevenson et al., 2015). There were three indicators of video content achievement, subject matter, performance, and creativity. On the subject matter indicators, the things assessed included the clarity of the materials presented and the suitability of the content with the concept of the subject matter. At the performance indicator, the things evaluated included confidence in delivering explanations and fluency in conveying the concept of the materials. Then on the creativity indicator, the elements assessed included the use of camera angles, writing effects, sound, and music, image quality, and storyline in the video.

The above data are the overall results of the video content created by the students. The results of the first checking video content showed that the average achievement indicators were still too low at 20% for the subject matter, 35% for performance, and 30% for creativity. Referring to Table 1, the subject matter was **less than the satisfactory** category, while the performance and creativity were in the **satisfactory** category.

In relation to the content of the materials presented in the videos, the groups averagely were not able to convey the materials accurately. The students were still transfixed by the text of the books or notes they memorized. They also mispronounced several terms that caused inconsistency in the actual concept. Besides, there were still 4 out of 10 groups that have not submitted the sub-materials completely.

Confidence is an essential element in mastering a particular concept (Sihotang et al., 2017). For the performance of group members recorded in the video, the students were not confident enough in delivering their explanation. More students haltingly spoke and expressed a thinking face, just like memorizing every word. Besides, the gestures were unrested so that the video looked rigid. There were few animations, images, or writing on the video display. Instead, they just displayed the recording of the video-making process without editing. It means that their editing ability was lacking. So are the media used, the students were not keen on the objects around them, which can be used as media in delivering materials. However, the students have not been able to use them so that the expected learning media has not yet appeared.

An excellent learning video is a video that fulfills two aspects of media development; materials and media. The material aspects include the accuracy, breadth, clarity, and attractiveness of the presented materials. On the other hand, the media aspect covers the quality of video content and technical quality (Suryansyah & Suwarjo, 2016).

Video Checking Description in The Second Month

The second videos were submitted after four weeks of learning at the end of June 2018. The topic presented in this video was about "accelerated uniform motion on the vertical rectilinear motion." The second videos scored 47% for the subject matter, 55% for performance, and 50% for video creativity. The results of this second check indicated that the average achievement indicator has increased by about 20%.

Related to the contents presented in the videos, the groups have generally begun to convey the materials on the topic correctly, although it was not very well explained. The students were not stuck by memorizing textbooks or notes. Nevertheless, the linguistics in delivering or presenting the materials had to be developed. Moreover, the group members' performance recorded in the video has shown an improvement seen from their self-confidence. Nevertheless, the thinking face and halting speaking were still seen.

Nonetheless, every group began to enjoy appearing in the video seen from their calmness. The creativity of video presentation has been widely seen. Some groups have started to use things around them as simple media. For instance, two old mineral bottles, an empty bottle, and a filled bottle. Both of them were then dropped simultaneously and to see which bottle first reached the floor. This demonstration was to show that the object's mass does not affect the velocity in a vertical motion. This, therefore, implies that the demonstration method increases students' interest and understanding; also, consequently promotes a high achievement rate (Daluba, 2013). Nevertheless, they remained to require synchronization of the media related to the concepts delivered.

The creativity of each group has shown an enhancement. They just needed to learn a bit further to make the video better. A well-created video is required to help to improve the learning

process quality. Thus, the video display should be as attractive as possible.

Video Checking Description in the Third Month

The third videos were collected after four weeks of learning in August 2018. The topic presented in this videos was about "accelerated uniform motion on the parabolic rectilinear motion." Figure 3 shows that the groups achieved 77% for the subject matter, 75% for performance, and 83% for creativity. The results of this third checking revealed that the averages of indicator achievement had increased rapidly.

The materials contained in the videos have been explained by the groups very well. All groups could explain the parabolic motion concept wholly and correctly. The students mainly no longer stuck with memorizing textbooks or notes. Instead, they could inform the material comfortably. Their confidence in explaining the materials could be observed clearly in the videos. The thinking face has no longer seen frequently, but only in 2 out of 10 groups. It has happened because video learning influenced the students' learning habits. These facts supported other studies that revealed that multimedia learning (video) has a considerable impact on the learning outcomes. A well-designed multimedia learning can promote better performance among learners (Syed et al., 2012).

The videos collected in this round were diverse, which means that the groups' creativity has enhanced brilliantly. All groups have been able to utilize things around them as simple learning media. In presenting the parabolic motion, each group employed balls as a medium. One member of the group kicked the ball at a point with a certain angle, then identified how far the ball was thrown. By kicking a ball at one point with

various angles, the students understood the relationship between the angle and the distance.

Each group has been able to insert animations, images, music, and exciting writings, which make the videos looked attractive. The selection of colors and fascinating icons according to their age, made the videos looked slicker than before. Nonetheless, their editing skills must also be upgraded to produce more exciting works. The improvements achieved by these students indicated an interest in utilizing android applications for their learning tools.

The repetitive submission was the form of training for the students. The feedback they got each time of submission has encouraged their efforts to escalate the scored. This is in line with Ismanto et al. (2017), who argued that training could raise interest and need to keep up with the latest updates on information technology.

The increase in the quality of the videos was caused by the students' interest in doing the task. They no longer thought that the assignments given were burdensome. The students' interest in completing tasks that are charged by themselves will be higher than the tasks given by the teacher (Sanjaya, 2008).

The Comparison of Preliminary Research Data with Research Result Data

After checking the videos, an evaluation was carried out on the students about the completion of the video project assignments. The science teachers orally tested each group about the subject matter they presented in the videos to see their understanding of competencies. The teacher also gave the students some questions about completing the videos to see their work on the assignment. The following is a comparison table of preliminary research data with research result data.

Table 3. The Comparison of Preliminary Research Data with Research Results Data

	Homework completion			
	Finishing Homework by Themselves	**Finishing Homework by Copy-Pasting**	**Do Not Finish Homework**	**Understanding the Task Well**
Before (%)	10	80	10	10
After (%)	100	0	0	95

Table 3 informs that there was an increase in the students' interest in doing the assignments. Initially, only 10% of students finished the homework by themselves, 80% copied their friends'

assignments, and 10% did not finish the homework, but after being given a video project assignment using the Android apps, 100% of students finished the assignments by themselves. This

happened because the video project assignments given to the students were completed in groups with the help of the android application. Each group member learned to organize, choose leaders, and obey group rules; this was the positive value of the group work (Djamarah, 2011). Every member could explore his/her talents into the project being worked on. They helped each other in the completion of the project. Those who are proficient in design and IT focused on working on video displays, while the students who are proficient in mastering the materials focused on

drafting the materials and teaching other students to understand the materials. Thus, each student was able to comprehend the materials they presented, which increased from 10% to 95%.

Questionnaire of Effectiveness

The questionnaire was given at the end of the research to measure the effectiveness of using android applications. The following are the results of the dissemination of effectiveness questionnaires to all students.
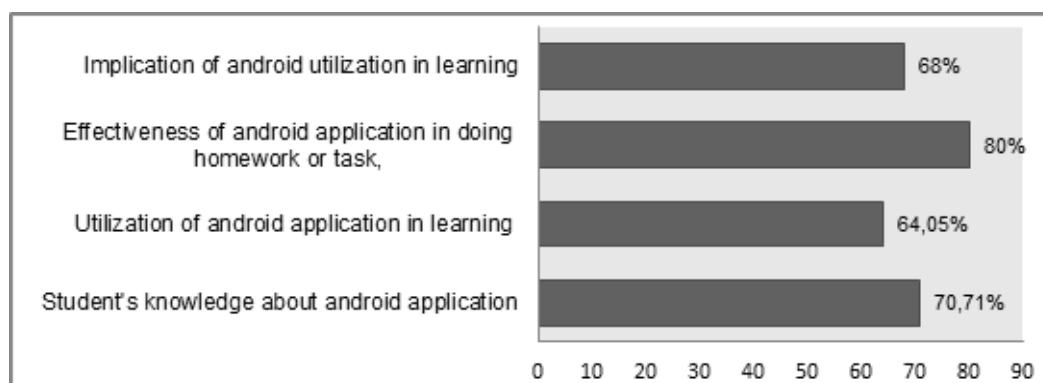

Figure 2. The Percentage of the Effectiveness of Android Application Utilization

To measure effectiveness of the android application, there were four things determined as achievement indicator, i.e., 1) students' knowledge about android application; 2) utilization of android application in the learning process; 3) effectiveness of android application as an aid in doing assignment; and 4) implication of android utilization in learning.

Figure 2 conveys the percentage of student knowledge indicators about the android application in the smartphone, which reached 70,71% and categorized as 'effective.' This showed that the students are familiar with the applications employed so that they had no difficulty in exploring the components of the applications. This approach of learning is highly receptive to students as they are more likely to seek and use learning content via mobile services rather than to find proprietary courseware that is difficult to access (Hanafi & Samsudin, 2012).

Due to Android's friendly use, the percentage of performance indicators on the utilization of an android application was 64.05%, which belonged to the 'effective' category. This is parallel with Huang et al. (2012), who stated that available applications in smartphones could be used as learning media to facilitate the acquisition of science and to learn materials effectively and efficiently.

The third indicator that is the effectiveness of the android application as an aid in doing assignments scored 80.00% and categorized as 'very effective.' The use of android apps in finishing homework or task has turned the students from lazier ones to competitive ones in creating and presenting their best video. They were challenged to further explore their abilities in presenting exciting videos. By using the agreed Android applications, the students were not burdened by the science assignments because they remained to be able to interact with smartphones without any neglected schoolwork. Besides, the students can also do their project assignments anywhere, both indoors and outdoors.

According to Rambitan (2015), students learning with smartphones in the classroom appeared to be more active in the discussion. Each member of a group worked well together in discussing the material given by the teacher, and they were very enthusiastic in the discussion/question and answered session among groups. The questions asked by students are also more meaningful. This happened because learning with smartphones could open the students' perspectives and at once made them got much knowledge that was not covered and included in the course books. Each group also revealed high competitiveness to produce the best results in the discussion.

The implication of android apps utilization scored 68.00%, which included in the 'effective' category. Integrating passion into an assignment could boost the students' interest in doing assignments. Necessarily, the places for learning were not limited by the classroom so that they could learn anywhere and anytime through their smartphone, which resulted in more enthusiastic students. This fact is revealed from the comparison of preliminary research data and research result data, which generally increased.

Teachers in the digital era are demanded to experience, practice, apply, analyze, synthesize, and evaluate rather than understand and provide information to students (Purwanti, 2015). This follows the explanation in the previous research that students taught using project-based learning are more active and creative; also, think critically than students taught using classical learning. By providing a pleasant ambiance, students can get along during the learning process (Gerhana et al., 2017). Referring to Vygotsky's theory, knowledge is not concluded from within individuals but is built through interaction with others in cooperative activities (Syarif, 2013).

CONCLUSION

The Android apps as students' aid tools in doing the integrated science task were considered effective. It is proven by the percentage of effectiveness questionnaires given to the students.

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REFERENCES

Adi, N. P., Yulianto, R. A., Irwan, M., & Endris, W. M. (2016). Android for the 21st Century Learning Media and Its Impact on Students. In *Nurtuting Innovative and Higly Literate Generation through Science Education.* Proceedings of the 2nd International Seminar on Science Education (ISSE) (pp. 173-178). Yogyakarta: Graduate School Yogyakarta State University. Retrieved from http://pps.uny.ac.id/sites/pps.uny.ac.id/files/ISSE 2016.pdf

APJII. (2018, April). Potret Zaman Now: Pengguna dan Perilaku Internet Indonesia, 1–7. Retrieved from https://apjii.or.id/downfile/file/BU-LETINAPJIIEDISI23April2018.pdf

Arista, F. S., & Kuswanto, H. (2018). Virtual Physics Laboratory Application Based on the Android Smartphone to Improve Learning Independence and Conceptual Understanding. *International Journal of Instruction*, *11*(1), 1-16.

Babbie, E. R. (2010). *The Practice of Social Research* (12th ed.). CA: Wadsworth: Belmont.

Cahyati, A., Sulastri, M., & Magta, M. (2015). Penerapan Metode Pemberian Tugas Melalui Kegiatan Finger Painting Untuk Meningkatkan Kreativitas. *Jurnal Pendidikan Anak Usia Dini Undiksha*, *3*(1), 1-11.

Daluba, N. E. (2013). Effect of Demonstration Method of Teaching on Students' Achievement in Agricultural Science. *World Journal of Education*, *3*(6), 1-7.

Djamarah, S. B. (2011). *Psikologi Belajar*. Jakarta: Rineka Cipta.

Efstratia, D. (2014). Experiential Education through Project Based Learning. *Procedia-Social and Behavioral Sciences*, *152*, 1256-1260.

Elfeky, A. I. M., & Masadeh, T. S. Y. (2016). The Effect of Mobile Learning on Students' Achievement and Conversational Skills. *International Journal of higher education*, *5*(3), 20-31.

Gerhana, M. T. C., Mardiyana, M., & Pramudya, I. (2017, September). The Effectiveness of Project Based Learning in Trigonometry. In *Journal of Physics: Conference Series* (Vol. 895, No. 1, p. 012027). IOP Publishing.

Hanafi, H. F., & Samsudin, K. (2012). Mobile Learning Environment System (MLES): The Case of Android-based Learning Application on Undergraduates ' Learning. *International Journal of Advanced Computer Science and Applications (IJACSA)*, *3*(3), 1–5.

Huang, H. W., Wu, C. W., & Chen, N. S. (2012). The Effectiveness of Using Procedural Scaffoldings in a Paper-Plus-Smartphone Collaborative Learning Context. *Computers & Education*, *59*(2), 250-259.

Ismanto, E., Novalia, M., & Herlandy, P. B. (2017). Pemanfaatan Smartphone Android Sebagai Media Pembelajaran Bagi Guru SMA Negeri 2 Kota Pekanbaru. *Jurnal Pengabdian UntukMu NegeRI*, *1*(1), 42-47.

Kızkapan, O., & Bektaş, O. (2017). The Effect of Project Based Learning on Seventh Grade Students' Academic Achievement. *International Journal of Instruction*, *10*(1), 37–54.

Liliarti, N., & Kuswanto, H. (2018). Improving the Competence of Diagrammatic and Argumentative Representation in Physics through Android-Based Mobile Learning Application. *International Journal of Instruction*, *11*(3), 107-122.

Lubis, I. R. & Ikhsan, J. (2015). Pengembangan Media Pembelajaran Kimia Berbasis Android untuk

Meningkatkan Motivas Belajar dan Prestasi Kognitif Peserta Didik SMA. *Jurnal Inovasi Pendidikan IPA*, *1*(2), 191–201.

Moleong, L. J. (2000). *Metode Penelitian Kualitatif, Edisi Revisi*. Bandung: PT. Remaja Rosdakarya.

Muijs, D. (2010). *Doing Quantitative Research in Education with SPSS*. (2nd ed.). London: SAGE Publication.

Nurhasanah, S., & Sobandi, A. (2016). Minat Belajar Sebagai Determinan Hasil Belajar Siswa. *Jurnal Pendidikan Manajemen Perkantoran*, *1*(1), 128-135.

Purwanti, B. (2015). Pengembangan Media Video Pembelajaran Matematika dengan Model Assure. *Jurnal Kebijakan Dan Pengembangan Pendidikan*, *3*(1), 42–47.

Rambitan, V. M. M. (2015). The Effect of Smartphone on Students' Critical Thinking Skill in Relation to the Concept of Biodiversity. *American Journal of Educational Research*, *3*(2), 243–249.

Roberts, J., Yaya, L., & Manolis, C. (2014). The Invisible Addiction: Cell-Phone Activities and Addiction among Male and Female College Students. *Journal of Behavioral Addictions*, *3*(4), 254–265.

Saefi, M., Lukiati, B., & Suarsini, E. (2017). Developing Android-Based Mobile Learning on Cell Structure and Functions Lesson Subject Topic to Optimize Grade XI Students' Cognitive Comprehension. *Jurnal Pendidikan Sains*, *5*(2), 57–63.

Sanjaya, W. (2008). *Kurikulum dan Pembelajaran* (1st ed.). Jakarta: Kencana Prenada Media Group.

Sihotang, L., Setiawan, D., & Saragi, D. (2017). The Effect of Learning Strategy and Self Confidence Toward Student's Learning Outcomes in Elementary School. *IOSR Journal of Research & Method in Education (IOSRJRME)*, *7*(4), 65–72.

Stevenson, M., Hedberg, J., Highfield, K., & Diao, M. (2015). Visualizing Solutions : Apps as Cognitive Stepping-Stones in the Learning Process. *The Electronic Journal of E-Learning*, *13*(5), 366–379.

Sugiyono. (2010). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (10th ed.). Bandung: Alfabeta.

Suryansyah, T., & Suwarjo. (2016). Pengembangan Video Pembelajaran untuk Meningkatkan Motivasi dan Hasil Belajar Kognitif Siswa Kelas IV SD. *Jurnal Prima Edukasia*, *4*(2), 209-221.

Sutriani, Tandiayuk, M. B., & Paloloang, B. (2014). Penerapan Metode Pemberian Tugas untuk Meningkatkan Hasil Belajar Pada Materi Penjumlahan Dan Pengurangan Pecahan di Kelas V SDN 2 Bukit Harapan. *Jurnal Kreatif Tadulako*, *4*(1), 18–34.

Syarif, K. (2013). *Perkembangan Peserta Didik*. Medan: Unimed Press.

Syed, S. J. A. N. B., Asirvatham, D., & Khalid, H. H. M. (2012). Quality Framework for Assessment of Multimedia Learning Materials Version 1.0. *Procedia-Social and Behavioral Sciences*, *67*(2012), 571-579.

Winatha, K. R., & Abubakar, M. M. (2018). The Usage Effectivity of Project-Based Interactive E-Module in Improving Students' Achievement. *Jurnal Pendidikan Teknologi dan Kejuruan*, *24*(2), 198-202.

Yamin, Y., Permanasari, A., Redjeki, S., & Sopandi, W. (2017, September). Application of Model Project Based Learning on Integrated Science in Water Pollution. In *Journal of Physics: Conference Series* (Vol. 895, No. 1, p. 012153). IOP Publishing.