

The Effect of Smartphones Media to Improve Critical Thinking Skills Student of Elementary School

Imas Srinana Wardani^{1,2*}, Ari Widodo³, Munir⁴

¹Department Elementary school teacher education, Universitas PGRI Adi Buana Surabaya, Surabaya, Indonesia.

²Department Elementary school teacher education, Universitas Pendidikan Indonesia, Bandung, Indonesia.

³Department of Biology Education, Universitas Pendidikan Indonesia, Bandung, Indonesia.

⁴Department of Computer Science, Universitas Pendidikan Indonesia, Bandung, Indonesia.

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Corresponding Author:

Imas Srinana Wardani

imas@unipasby.ac.id

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Abstract: 21st-century learning is oriented towards digital lifestyles. Smartphones are a digital technology that many students already have. Smartphones can be used in learning activities. Smartphones have features that can be used for learning activities. Smartphones can make students more actively engaged in the learning process. This study aims to improve the critical thinking skills of elementary school students through the use of smartphones. This research is a quantitative study using Quasi-experimental method. The research design used is the non-equivalent control group design where the sample consists of 43 students. Research data were collected using a multiple-choice test of critical thinking with 21 questions on the human respiratory system material with 5 aspects of thinking questions. The results showed a significant difference between the experiment and control group. This means that learning using smartphones can improve critical thinking skills. It can be concluded that learning becomes more enjoyable with the use of smartphones because students are given time to ask questions, argue about the results of experiments recorded using smartphones, so that students can improve their critical thinking skills.

Keywords: Critical thinking skills; The effect of smartphone media

Introduction

Smartphones are a digital technology that is currently very familiar to society. This is evidenced by the observations of the Indonesian Internet Service Providers Association (APJII) which reported that internet users in Indonesia in 2021-2022 are increasing, with 62.43% of internet users being between the ages of 5-12 years old. Based on this data, it can be stated that elementary school students are already familiar with Android smartphones. This means that all age groups, especially school-age children, already have smartphones that are connected to the internet. The results of a study in 2018 found that in the last three years, it has been observed that school-age children from elementary school to university students tend to be able to operate smartphones (Masitoh, 2018).

Smartphones are a multifunctional tool (Antosik-Wójcińska et al., 2020; Sehgal et al., 2019; Ulfa, 2016). The

results of research conducted in 2010 showed that smartphones can speed up work in the field and in the laboratory (Vogel et al., 2010). The applications on smartphones help students to conduct experiments (Arista et al., 2018). The use of smartphones in learning saves more time because data can be entered directly into the smartphone (Ataş et al., 2019). Educational practitioners need to encourage the development of smartphone utilization strategies that are in line with the government's implementation of the Merdeka Curriculum (Laksono et al., 2014). Smartphones are useful in learning activities, experimenting, and learning outside the classroom (González et al., 2015; Hochberg et al., 2018). The use of smartphones in learning activities with valid instruments that have a high level of reliability can be used to measure students' critical thinking skills (Ismail et al., 2018).

Primary and secondary education in Indonesia, according to PISA research, has not been able to prepare students with critical and analytical thinking skills. This

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is because in daily classroom assessments, students are not accustomed to HOTS (Kemdikbudristek, 2023). Students' critical thinking skills are suboptimal because the learning process has not yet empowered critical thinking skills. The lack of practice and activities in critical thinking is also a cause of low critical thinking skills among students (Agnafia, 2019; Mahanal et al., 2019). This is reinforced by the results of the national Programme for International Student Assessment (PISA) survey conducted in 2022 on 15-year-old students, which stated that Indonesia was ranked 67 out of 81 countries. The lack of critical thinking skills is partly due to students being less involved in the process of constructing a concept in their minds (Husein et al., 2015).

Moreover, involving students in the process of constructing their own understanding can lead to a deeper level of comprehension and better retention of information. By documenting their experiments and observations, students can also practice their skills in critical thinking, analysis, and interpretation of data. This type of active learning encourages students to ask questions, make predictions, and draw conclusions, which are essential skills for success in the 21st century. In addition to documenting experiments, smartphones can also be used to access a wide range of educational resources, such as online textbooks, educational apps, and multimedia content. This enables students to have access to up-to-date information and engage in self-directed learning. With the abundance of information available on the internet, it is important for students to develop the skills necessary to evaluate and filter information effectively. By incorporating technology into the learning process, students can develop these skills and become more critical consumers of information. Furthermore, the use of smartphones in the classroom can facilitate communication and collaboration among students and between students and teachers (Green, 2019). Students can use messaging apps and video conferencing tools to work together on projects and assignments, even if they are not physically present in the same location (Li et al., 2022). This promotes teamwork and helps to develop social and interpersonal skills, which are valuable in the workplace. Smartphones can be used as a tool for conducting experiments (Hillmayr et al., 2020). Experiments are an effective way to increase students' curiosity. Basic education needs to introduce students to the skills of mastering media and information (Sanabria et al., 2017). Overall, the use of smartphones in education has the potential to enhance student learning and engagement. By leveraging technology, educators can provide students with more opportunities for active learning and equip them with the skills they need to succeed in the 21st century. However, it is important to also recognize the potential distractions and drawbacks

of technology use and ensure that it is used in a responsible and appropriate manner.

One of the novelties of smartphones is that smartphones are digital technology increasingly experiencing rapid development. The technology provided makes human life easier and more practical. In this way, the misuse of smartphones in the school environment can be suppressed if students understand the function and ease of smartphone data access facilities in the learning process (Adediran et al., 2021). Smartphones can help students' needs in terms of learning content and relationships in teaching and learning activities (O'Connor et al., 2018). Therefore, with some adjustments, smartphones can be a learning tool in elementary school. This adjustment was made to combine the learning system using a smartphone. Smartphones as a learning tool aim to help students master science concepts (Hasanah et al., 2018). Namely, the concept of the respiratory system, think critically, and have digital literacy skills with the help of smartphone features. So far, research on smartphone use is still oriented towards its use in learning. Research conducted Wishart (2018) examined the use of smartphones for teaching and learning science among students in Sri Lanka. The findings stated that smartphones can support science learning (Paramitha, 2019). Research on the use of smartphones in learning, described above, proves that the use of smartphones in learning is very positive. Still, the use of smartphones in measuring more specific variables, for example, regarding the ability to master concepts, critical thinking, and digital literacy, has never been carried out. Careful measurement using valid instruments. Therefore, it is necessary to carry out research regarding the use of smartphones in science learning activities to measure the effectiveness of smartphones on student achievement in the academic field regarding the ability to master concepts, critical thinking, and digital literacy through the use of instruments that are valid and have a high level of trust.

Based on the explanation above, smartphones have extraordinary abilities to solve problems in learning activities, especially addressing students' mastery of concepts, critical thinking, and digital literacy. Based on the explanation above, the use of smartphones appears to have great potential to address issues in learning activities, particularly in improving critical thinking skills.

Method

This research is a quantitative study. Quantitative research requires the researcher to provide an explanation about variables that can affect other variables (Creswell, 2013). This study employs a quasi-experimental method. The research design used in this

study is a non-equivalent control group design, which involves two groups: the experimental group and the control group. The experimental group is the group that uses smartphones in their learning process, while the control group is the group that does not use smartphones in their learning process.

Table 1. Research Design Non-equivalent Control Group Design (Sugiyono, 2011).

Experiment Class	O1	X	O2
Control Class	O3		O4

Description:

- O1 : Pre-test for experiment class
- O2 : Post-test for experiment class
- O3 : Pre-test for control class
- O4 : Post-test for control class
- X : treatment in the form of smartphone usage in learning

The research was conducted at SD Al Falah Darussalam 2 Sidoarjo. The population used in this study was elementary school students in grade V in the academic year 2021/2022. The sample used in the study was taken through purposive sampling, namely grade V elementary school students who met the criteria: having a smartphone, able to operate a smartphone, and having pretest and posttest scores for critical thinking. The sample in the study consisted of 43 students. Class A consisted of 21 students who used smartphones in learning. Class B consisted of 22 students who did not use smartphones in learning.

Data Collection Techniques and Tools

The research used a pretest and posttest critical thinking test as the data collection technique and tool. The test consisted of 21 multiple-choice questions that assessed the students' critical thinking skills, and it was analyzed for its validity, discrimination power, and difficulty level before being used. The test was developed based on the indicators such as providing elementary clarification, building basic support, inference, and making advanced clarification. The test was administered to grade V students who had learned about the human respiratory system, and the results were analyzed to assess the effectiveness of the instruction on critical thinking. Overall, the use of a pretest and posttest critical thinking test is an effective way to evaluate instructional methods and assess students' critical thinking abilities.

Data Analysis Technique

Data collection techniques were from the critical thinking test. In the data processing, this study collected pretest and posttest data after the treatment of using smartphones in learning. After the data was collected, the data processing was assisted by the SPSS 22

program. The data analysis technique used in this study was as follows: The normality test was used to determine whether the data used were normally distributed or not. This study used the Shapiro-Wilk normality test because the sample used was less than 50. Then, the homogeneity test was conducted to determine the level of similarity in data variance from a population. The independent sample t-test was conducted to determine the difference in the mean critical thinking ability between the two classes (experimental and control). The basis for decision making in the Independent Sample T-Test was as follows. If the significance value (Sig.) < 0.05 indicates that there is an average difference between research subjects, whereas if the significance value (Sig.) > 0.05 means that there is no average difference between research subjects.

Result and Discussion

The results of the critical thinking ability data were analyzed statistically using the SPSS version 22 application to conduct normality, homogeneity, and hypothesis tests. The results of the critical thinking test for grade V students at SDN Al Falah Darussalam 2 Sidoarjo before and after learning with the use of smartphones can be seen in Table 2.

Based on Table 2, it is indicated that the result of the pre-test calculation using non-parametric statistics, namely the Mann Whitney test, obtained a p-value < $\alpha = 0.05$. This indicates that there is a significant difference between the critical thinking skills of the experimental group and the control group. The significant pre-test difference was followed by an N Gain test. In the N Gain test, after the experimental group was given treatment, the result of the post-test data calculation showed a p-value < $\alpha = 0.05$, which means that there is a significant difference in the critical thinking test scores of students after learning using smartphones on the topic of the human respiratory system.

The significant difference in the experimental class shows that learning using smartphones can improve critical thinking skills. The difference can be seen in the data of 5 aspects and 7 indicators which experienced improvement even though the improvement score is still low. The improvement score for each aspect of critical thinking skills varies, with the providing elementary classification aspect experiencing an increase of 19.05%; the aspect of providing reasons for a decision experiencing an increase of 9.52%; the aspect of inferring aspect experiencing an increase of 17.86%; the advanced clarification aspect experiencing an increase of 27.86%; and the aspect of making strategies and tactics experiencing an increase of 4.76%. The improvement in each aspect of critical thinking skills at SD Al Falah Darussalam 2 Sidoarjo is still low, which is in line with the research conducted by Ritonga et al. (2020), which

states that the low critical thinking ability of students in Madrasah Ibtidaiyah is due to the use of learning styles that do not support students' critical thinking skills, so

they are unable to identify a problem or question, observe, and consider the results of observations.

Table 2. Results of Critical Thinking Skills Analysis

Data	Pretest		N-Gain	
	Experiment	Control	Experiment	Control
Class	21	22	21	22
Mean	47.43	39.68	33.15	9.15
Std. Deviation	12.863	14.042	14.9	13.01
Normality Test	Sig	0.13	0.369	0.339
	Interpretation	Normal	Not Normal	Normal
Homogeneity Test	Sig	0.44	0.757	
	Interpretation	Homogeneous	Homogeneous	
Difference Test	Sig	0.021	0.000	
	Interpretation	Significant	Significant	

Improvement in every aspect of critical thinking is due to the use of smartphones in learning, which helps students to better understand the concept of the respiratory system. Smartphones have features that make it easier to understand concepts, including the camera, both photo and video. The photo and video cameras help document every practical activity conducted in every respiratory system lesson, using a student worksheet for each meeting. Utilizing student worksheet in class can support active learning (Lee, 2014). Experimental learning can help develop critical thinking skills (Bakri et al., 2019). Documenting practical activities using smartphones helps students better understand the concept of the respiratory system.

Using the camera on a smartphone to take pictures during the respiratory system experiment can document the results of the experiment. In student worksheet 1, students can observe the color change of the respiratory process using a mirror and observe the substance released when breathing using lime sediment water. Students can clearly observe the results of the experiment by documenting them with a smartphone camera. In student worksheet 2 about the number of breathing in human, students can document the experiment by recording it using the video camera on the smartphone, allowing them to observe the results repeatedly for a clearer understanding. In student worksheet 3, students can use the camera to document the movement of the food coloring in the transparent straw of the artificial respirometer, and record the experiment using the video camera. In student worksheet 4 about the causes of respiratory diseases, the camera can be used to document the cotton wool erhatikan exposed to mosquito repellent smoke, and the experiment can be recorded using the video camera.

A research pdone in 2014 suggests that when students document their experiments using a camera, their memory and understanding of the related science concepts significantly improve when they are tested several months later (Ekanayake & Wishart, 2014). The

pictures on the smartphone provide meaningful learning opportunities where students are engaged in active processing of the information they will learn, both visually and auditory.



Figure 1. Practical video result

Every week, students conduct a respiratory system experiment in five meetings. The experiments are carried out based on student worksheets. Those are documented using a smartphone camera to take pictures during the experiment, and recording the experiment using the smartphone's video camera, in order to help students better understand the concepts. According to (Ekanayake & Wishart, 2014) science is a subject that is difficult for most students to access because learning involves processes that are not easy to observe, such as those that are too small, slow, or on too large of a scale. Therefore, in teaching science, it is recommended to use a variety of different resources such as movement and action, photos and video evidence, statistics, diagrams, tables, graphs, demonstrations, models, scientific equipment and everyday entities in the science classroom, in addition to lectures (Webb, 2010).

The use of smartphone video cameras can document the results of practical activities through recorded videos. The recorded results can be repeatedly observed by students, allowing them to better understand the respiratory system concept. Video

recording using smartphone cameras can help students accurately record and observe, allowing them to validate experiments and repeat them as needed. A research quantitatively shows that learning with smartphones can enhance students' critical thinking (Sung et al., 2016). Fifth-grade elementary school students who have high critical thinking skills will also have high science literacy skills (Cahyana et al., 2017).

but these skills sometimes do not develop well. Therefore, learning that can develop students' critical thinking skills is needed. One effort that can be made to develop critical thinking skills is through the use of smartphones.

Conclusion

Based on the results of the analysis, it can be concluded that critical thinking skills, after being treated in the experimental class, obtained significant results from the calculation of the difference test, which means that learning using digital technology smartphones can improve critical thinking skills. The difference in results can be seen in the data from the 5 aspects that have improved using smartphones. The use of smartphones in the learning process provides many opportunities for students to ask and answer questions, as learning using smartphones is fun. Fun learning will create a sense of curiosity in students. Smartphones can equip students with experiences to develop 21st-century skills so that they can develop problem-solving, collaboration, communication, and knowledge construction skills.

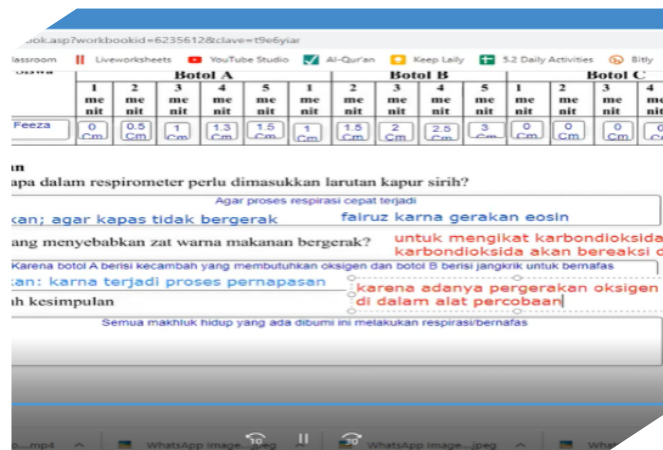


Figure 2. Discussions of practical results

The usage of smartphones are capable of developing students' critical thinking skills, and after using smartphones in learning, there is an increase in students' attitudes and creativity (Al-Emran et al., 2016). The usage of smartphones are able to change students' behaviour and are a form of modern learning that can provide critical thinking learning (Liaw et al., 2010). Learning with smartphones can stimulate students to think critically and can bring unique and different learning experiences (McQuiggan et al., 2017). It builds communication skills and can encourage students to come up with many ideas (Mccann et al., 2015). This means that using smartphones provides many opportunities for students to ask and answer questions, as learning using smartphones is fun. Fun learning will create a sense of curiosity in students. This is in line with a research which states that smartphones can equip students with experiences to develop 21st-century skills so that they can develop problem-solving, collaboration, communication, and knowledge construction skills (Lee et al., 2016).

Learning using digital technology smartphones can improve the learning experience (Alrasheedi et al., 2016), increase learning scores in groups of students who have high learning independence (Cahyana et al., 2017) and encourage students' critical thinking skills (Lee et al., 2016). Students using technology will become more active in learning when using smartphones in class (Alaba et al., 2015). Basically, students have critical thinking skills in learning such as questioning, hypothesizing, classifying, observing, and interpreting,

Author Contributions

Imas Srinana Wardani, wrote the introduction, methods, results, discussion and conclusions. Ari Widodo and Munir supervised and edited.

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Conflicts of Interest

There is no conflict of interest in this writing.

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