# Fostering students' logical thinking ability as one of the 21st-century skills through the blended learning aided by google classroom

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| KEYWORDS | ABSTRACT |
|---|---|
| Logical Thinking Ability<br>Blended Learning<br>Google Classroom<br>The 21st Century Skills | The 21st Century skills are a challenge in the science and technology sector besides excelling in academic performance. Therefore, it is important to innovate the learning process of natural science into learning that refers to the development of 21st-century skills. Digital Age Literacy is one of the 21st Century skills, which requires the ability to have logical thinking ability as the core of digital-age literacy. This study then aimed to analyze the influence of natural science learning aided by google classroom media to foster students' logical thinking ability. This study was conducted by using a quasi-experimental study with a pretest-posttest non-equivalent control group design. Sampling was done using a simple random sampling technique. There were two classes in this study which had 77 participants consisting of 38 students as an experimental class and 39 students as a control class. The researcher collected the data of logical thinking ability using the instrument of logical thinking ability tested for its validity and reliability. The analysis of data employed a t-test using SPSS 21. The results indicated that t-count > t-table (2.67 < 1.99) and p-value = 0.021 <0.05. It could be concluded that the natural science learning aided by google classroom media resulted in a significant influence on students' logical thinking ability. Educators could use the result of the analysis to evaluate natural science learning, especially in elementary school, to encourage the quality of students' logical thinking ability. |

## Introduction

The 21st century presents challenges in line with the development of science and technology. The rapid development has become a reference for countries to be able to compete globally. This competition indirectly demands the quality of human resources who are professional and qualified. Based on Law No. 20 of 2003, improving the quality of human resources can be done through education quality. The development of an appropriate learning process can produce the desired learning objectives achieved (Murtikusuma et al., 2019).

Science learning is carried out by emphasizing students' thinking logically and finding a concept through the logical thinking ability process (Riyanti et al., 2018; Toharudin et al., 2011). Innovative learning methods can also improve students' thinking skills in connecting abstract concepts in science learning (Maharani & Laelasari, 2017). Based on this, science learning using appropriate media and methods will improve the quality of learning and make learning take place more directed. An individual needs the logical thinking ability to understand a science concept and apply it in life (Andriani et al., 2019). The concept of logical thinking ability is an individual's ability to use his skills and knowledge in identifying problems and finding concepts (Çığrık & Ergül, 2010). Indonesian student's logical thinking ability skills are still low. These data indicate that students in Indonesia still have difficulty applying their knowledge because they do not understand the concept of science. Based on interviews with several lecturers who teach in Palembang, the usual learning media used are LKS which contain inadequate material. Learning is still centered on the teacher as a learning resource; students tend to memorize concepts and are not directly involved in concept discovery to not understand the science content they are learning. This impacts students' difficulties in applying their knowledge to a phenomenon that occurs around them. Therefore, learning is needed based on student's active role in using their abilities and knowledge to identify problems and find concepts.

Blended Learning is a type of learning that combines face-to-face meetings with online meetings (Pappas, 2015). There are several advantages in implementing the blended learning type, namely: (a) Effective in improving student learning outcomes and understanding; (b) improve students' ability to communicate, especially in online communication; (c) Reducing the costs involved in face-to-face learning; and (d) more effective than face-to-face learning or online learning (Eryilmaz, 2015; Murtikusuma et al., 2019). Covid-19 pandemic, a global problem, requires individuals to reduce direct interaction with other individuals, including in the world of education. The solution that can be done is by using blended learning. Blended Learning is suitable for the millennial era because it can improve students' higher-order thinking skills. Blended learning will be more optimal if implemented using a learning platform that is easily accessible by teachers and students, namely Google Classroom (Heggart & Yoo, 2018). Google Classroom is a platform created by Google Company to facilitate various online communications that they want to do, one of which is the learning process. The advantages of Google Classroom, which does not require complexity and difficulty in installation, and can be used without paying a fee, make Google Classroom widely used by educators to facilitate the learning process (Fauzan & Arifin, 2019; Shaharanee et al., 2016). Based on this background, it is crucial to use blended learning assisted by Google Classroom to improve students' logical

thinking ability.

## Method

The sample used in this study was taken using a random sampling technique. The sample is a student of the Elementary School Teacher Education Study Program, PGRI University of Palembang. This study's sample was 77 participants consisting of 38 students as the experimental class and 39 students as the control class. Student science literacy data were collected using multiple-choice tests with five alternative answer choices. The student's logical thinking ability assessment instrument was made regarding the material Respiration in humans. Thirty test questions refer to 3 domains of knowledge in logical thinking: ten content questions, ten procedural questions, and ten epistemic questions. The test is then given to students to complete for 60 minutes. The logical thinking ability data obtained were then analyzed descriptively-quantitatively using the SPSS 21 software application to determine student logical thinking ability after blended learning was implemented using google classroom. The results of the students' logical thinking skills obtained were then interpreted into five categories, as shown in Table 1 (Arikunto, 2010).

**Table 1**. The results of the students' logical thinking skills

| Score Percentages | Interpretation |
|---|---|
| 80 - 100 | Very Good |
| 66 - 79 | Good |
| 56 - 65 | Enough |
| 40 - 55 | Poor |
| 0 - 39 | Very Poor |

## Results and Discussion

The results of students 'logical thinking ability obtained through tests were then analyzed using descriptive-quantitative analysis techniques to obtain a picture of students' logical thinking ability after receiving blended learning assisted by google classroom. Students' logical thinking ability abilities are measured based on the number of correct answers obtained after answering the questions. A score of 1 is given for each correct question a score of 0 is given for the answered questions incorrectly. The prerequisite test consists of the normality test and the homogeneity test of the research data. The normality test was carried out by the Kolmogorov-Smirnov test using SPSS 21 to find out whether the data came from a normally distributed population or not. The data is said to be normally distributed if the significance value obtained is> 0.05. The normality test of the experimental class pretest results obtained a significance value of 0.190 while the control class was 0.154. Then for the normality test of the experimental class's post-test results, a significance value of 0.175 was obtained, while the control class was 0.067. Based on these results, the significance value obtained from the pretest and posttest

results in the experimental class and control column> 0.05. Thus it can be concluded that the data are typically distributed.

After the normality test was carried out in the two research groups, the next step was the research data's homogeneity test. The homogeneity test was carried out with the Levene test using SPSS 21 to determine whether the data obtained came from a homogeneous population or not. The data is said to be homogeneous if the significance value obtained is> 0.05. The calculation of the homogeneity test on the pretest data obtained a significance value of 0.352. Based on these results, the significance value obtained is> 0.05, so it can be concluded that the pretest data come from a homogeneous population. Furthermore, for calculating the homogeneity test on the posttest data, a significance value of 0.673 was obtained. The significance value obtained is> 0.05, so it can be concluded that the post-test results of the experimental class and the control class are homogeneous. Hypothesis testing is the next step if the data analysis results' results show that the data obtained is normally distributed and homogeneous. In this study, the hypothesis test was carried out by using the t-test (t-test). This test is used to determine whether there is a significant difference between students' logical thinking abilities in the experimental and control classes.

In this study, the t-test was calculated using SPSS 21 software. Degrees of freedom df = (n1 + n2) - 2 = 75 at the 5% significance level obtained t table = 1.66. H0 is rejected, and H1 is accepted if the t count ≥ t table and the significance value <0.05. The results of the hypothesis test calculation obtained t count of 2.67 and a significance value of 0.021. Thus the results of the t-test show that t count> t table (2.67> 1.99) and a significance value of 0.021 (<0.05), so it can be concluded that H0 is rejected and H1 is accepted. There is a significant difference between students' logical thinking abilities in the experimental and control classes. In other words, there is an effect of the application of blended learning assisted by google classroom on students' logical thinking abilities. Then T-Test using SPSS21 is then interpreted according to Table 2.

**Table 2**. T-Test of Students' Logical Thinking Ability

|  | *T-test for Equality of Means* | | |
| --- | --- | --- | --- |
|  | *t* | *df* | *Sig. (2-tailed)* |
| Equal variances assumed | 2.67 | 75 | 0.021 |
| Equal variances not assumend | 2.69 | 56.4 | 0.021 |

Related to these results, a study shows that generative learning strategies are a promising approach to improve students' metacognitive calibration abilities (Pilegard & Fiorella, 2016). This ability will lead students to improve their logical thinking skills (Riyanti et al., 2018). As is well known, metacognitive is the ability of students to control their cognitive domains. The

blended learning using google classroom encourages students to understand the material using their language and then relates it to their knowledge (Fiorella & Mayer, 2016). This can facilitate students to develop their logical thinking skills (Pezzuti et al., 2014).

## Conclusion

Based on the analysis and description of the research results that have been carried out, it can be concluded that the ability to think logically between the experimental class students who are applied blended learning using google classroom with students in the control class experiences a significant difference. The increase in students' average logical thinking ability who apply blended learning using google classroom is higher than the control class. Blended learning using google classroom is better in providing real phenomena that require students to use their reasoning to think logically about the relationships contained in these phenomena. Whereas in the control class, students are more likely to put their ideas and ideas into writing. There are several indicators of logical thinking abilities that cannot be optimized. Educators can use the analysis results to evaluate science learning, especially in elementary schools, to encourage students' logical thinking skills. Moreover, further researchers can use it to conduct similar research on other materials and develop better analytical thinking ability test instruments.

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