



## Increasing Critical Thinking Skills and Communication Skills in Science: Blended Learning Project

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*Received: September 14<sup>th</sup>, 2020    Revised: September 30<sup>th</sup>, 2020    Accepted: Oktober 19<sup>th</sup>, 2020*

### ABSTRACT

This study aims to obtain an overview of improving students' critical thinking skills and communication skills whose learning activities use integrated blended learning of local wisdom. Learning activities are carried out by modifying blended learning stages, namely at the seeking information stage. The research subjects were 109 students of the 2<sup>nd</sup> semester of science education study program. The research was conducted using a quasi-experimental method with a pretest-posttest design. The instrument used was a multiple-choice test using an assessment rubric and an observation sheet. The research data were analyzed using multivariate analysis. The results showed that the improvement of students' critical thinking and communication skills with blended learning (treatment class) was more significant than students whose blended learning was not integrated with local wisdom.

**Keywords:** blended learning, local wisdom, critical thinking skills, communication skills

## INTRODUCTION

There are three additional essential literacies in the current disruptive era, namely information literacy, media literacy, and ICT literacy (Binkley et al., 2014). Changes in literacy have a profound impact on education to adapt not to experience significant imbalances from other sectors. The world of education adjusts to the needs of students to adapt to life in the real world. Higher education is experiencing changes in the rules in the world of education, and there is increasing pressure on universities to evolve and adapt (Swil, 2002). Authorities in the world of education are closely related to the policies of higher education. The adaptation from higher education includes adaptation to each element in the college. The paradigm shift, which was initially only literacy in reading, writing, counting, and now adding

information, media, and ICT literacy as the basis of expertise, must be addressed wisely (Eggen, P. & Kauchak, 2012). One form of adaptation that is being intensified in higher education is by developing ICT literacy. Developing ICT literacy has become an object of study that is of concern in some programs and long-term life goals (Ala-Mutka et al., 2008; Anderson, 2008; *A Digital Agenda for Europe*, 2010; *WSIS Forum 2016*, 2016). ICT literacy supports the acquisition of 21st-century life skills. 21st-century skills need to be provided to students as an outcome in higher education. 21st-century skills are considered necessary as provisions for students to enter the world of work and real life. The problems that will be faced require students to have the skills to solve them.

21st-century skills need to be provided to students as a basis of competence that can be used to compete in a disruptive era

like today (Dass, 2014; Greiff & Demetriou, 2014; Larson & Miller, 2012). The skills in question are Creativity, Critical thinking, Communication, and Collaboration, or often abbreviated as 4C (Trilling & Fadel, 2009). These skills are synchronizing the needs of higher education and the world of work. These four skills can be developed simultaneously or separately.

Students have a very positive attitude towards critical thinking, meaning that they play critical thinking (Din, 2020). Three methodologies that can be used to develop critical thinking skills are verbal reflection and argumentation, reading, analyzing and synthesizing resources, and case studies (Bezanilla et al., 2019). Critical thinking skills can be developed by problem-based learning (Trisnowati & Firdaus, 2017; Widodo, 2016). Problem-based learning is carried out by bringing problems in everyday life as materials to be resolved in learning activities. The issues that arise to be resolved will direct students to think critically in solving these problems. Apart from the need for students to think critically in solving problems, students must also be able to communicate what they have learned or completed. Communication skills will bring students to a bright spot to solve issues through discussions or seek information with other parties.

Communication skills can be in the form of verbal communication skills and nonverbal communication skills. Communication skills can be improved through several activities, including communication in small groups, lectures with textbooks and videos, role-playing, and peer discussions (Fujimori, 2019). Cooperative learning models, including the Jigsaw learning model, can improve communication skills (Gaffar, 2017; Marfuah, 2017). Besides, communicating pregnancy can be enhanced through learning approaches in the environment (Awang & Daud, 2015).

Five approaches can improve 21st-century skills, namely associating, questioning, observing, experimenting, networking (Dyer, J., Gregersen, H. B. &

Christensen, 2011). This approach can be packaged in a learning model by the 4.0 industrial revolution, namely, technology-based learning. The learning model that is suitable for application in the 21st century is the Blended Learning model (Eagleton, 2017; El-Mowafy et al., 2013; Garrison & Kanuka, 2004; Yimyam, 2015). This learning model can combine various strategies, approaches, and methods to support learning achievement in a disruptive era.

Currently, much higher education institutions have implemented the Blended Learning model in their learning activities (Bonk & Graham, 2006; Graham & Robison, 2007). However, in reality, the implementation of Blended Learning is mostly not well-realized (Driscoll, 2002). Blended Learning is a learning model that combines direct face-to-face learning delivery strategies with online-based learning. Blended learning that is carried out is integrated with local wisdom. The integration of local wisdom is carried out when students are looking for information as material that is being studied. One of the local wisdom in the Magelang is the mountainous areas close to Mount Merapi. Students can study the concept of heat by looking at the temperature of the water when it boils in the Mount Merapi area and compared to the Magelang area which is quite low.

One of the stages in Blended Learning, namely seeking information, students search for information from various sources of information available both in books and online sources. The integration of local wisdom is done by students looking for or obtaining information in their surroundings. Students critically dig up the information conveyed by authorities, and students will learn to communicate the information appropriately obtained. Such distance learning activities will be beneficial because they can overcome various limitations, namely time and space constraints, travel costs, and time efficiency.

## RESEARCH METHODS

This study used a quasi-experimental method, with a pretest-posttest nonequivalent control group research design. This study used two groups of students, one group as an experimental group who received blended learning treatment integrated with local wisdom. As a control group, the other group received only blended learning treatment without being combined with local insight. In the experimental class, a group of students looked for information related to the study material by visiting a location in the Magelang area that was in accordance with the material being studied. Students who are looking for information then make narrative stories in the video related to the material being discussed. In the control class, Blended learning activities are carried out by exploring information that is already on the internet.

The research stages include the preparation, implementation, and final stages. The preparation stage includes: 1) Determining the problem to be studied through preliminary observations and interviews. 2) Study literature to obtain a theory about the issues to be explored. 3) Develop blended learning tools by integrating local wisdom, including IPA lesson plans, science teaching materials, and student worksheets with blended learning that incorporates local knowledge. 4) Arranging only blended learning tools without combining them with local wisdom, including IPA lesson plans, science teaching materials, and blended learning-based student worksheets. 5) Creating and compiling research instruments. 6) Expert validation (judgment) of learning tools and research instruments. The implementation stage includes: 1) Providing a pretest before being given treatment. 2) Provide treatment to the experimental group and the control group. 3) Provide a final test (posttest) and questionnaire responses to students after being given treatment. The final stage includes 1) Processing data from the pretest and posttest results and analyzing other test instruments. 2) Conducting hypothesis

testing and data analysis between before and after being treated to see and determine whether there is a significant difference between improving students' critical thinking and communication skills in the experimental and control groups. 3) Provide conclusions and suggestions based on the results of data analysis. The research sample was 109 students of the 2<sup>nd</sup> semester of science education study program.

## RESULTS AND DISCUSSION

Current research tends to implement Blended Learning. Based on the literature review, several things have not been explored, namely the development of integrated Blended Learning. Researchers integrate local wisdom with existing Blended Learning lessons. With this integration, it is hoped that it can utilize the various potentials in the Magelang area to be recognized by students both from Magelang and outside Magelang. For example, in Blended Learning in online learning, students can obtain information directly from the source as an expert in explaining local potential in the resource area.

Researchers see the effect of integrated local wisdom Blended Learning on the improvement of various 21st-century skills. This study focuses on critical thinking skills (critical thinking) and communication (communication). With critical thinking and problem-solving skills, it is hoped that students will be able to use various kinds of ideas/ideas, such as inductive or deductive, in multiple situations to make decisions in solving problems. With communication skills, students are expected to be able to communicate well and clearly.

The critical thinking indicator used refers to the literature described by (Binkley et al., 2014), which is presented in table 1. While the indicators of communication skills are shown in table 2.

Table 1. Indicators of critical thinking skills

No	Indicator	Number of items
1.	Using various types of reasoning (inductive, deductive, etc.) according to the situation at hand	2
2.	Examine ideas and identify	1
3.	Synthesize and make connections between information and arguments	2
4.	Interpret data and draw conclusions based on analysis	2
5.	Draw a conclusion	1
6.	Analyze statements, state results, and correct procedures	2

Table 2. Indicators of communication skills

No	Indicator	Number of items
1.	Able to hear and understand various spoken or written languages	2
2.	Able to read and understand different types of data or writing	2
3.	Able to write multiple types of paper or data	2
4.	Able to understand the arguments given by others	2

Learning activities carried out by doing blended learning. At the seeking information stage, the experimental class group looked for data by visiting the data source's location. Several places visited to collect data were waste processing sites in Magelang. Another place to get data information is the main road in Magelang Regency, a learning resource for students related to straight motion. Another source of knowledge studied by the students was a local game that has been largely abandoned, namely the "otok-otok" boat. This local game is used to gather information related to the dynamics of motion. In addition, students assess the concept of heat by visiting the area around Mount Merapi.

The data of the pretest and posttest results were taken to the gain value of the critical thinking skills test and communication skills. The gain value of each value is tested for the hypothesis using the Manova test, which begins with the assumption test. The assumption test results obtained Box's M value of 3.175 with a significance value of 0.259. Based on these results, it can be concluded that the variance matrix of critical thinking skills and communication skills are the same. The work shows that the MANOVA assumption

is fulfilled, so the MANOVA analysis is continued. The MANOVA test results were to see the effect of blended learning types on critical thinking skills and communication skills together and separately. The results show that the results for the four MANOVA statistical tests obtained a significance value of 0.000. Therefore, the MANOVA test results to see the combined effect can be concluded that there are differences in critical thinking skills and communication skills between the treatment class and the control class.

Some of the authors' analyzes of the effect of integrated blended learning on local wisdom associated with increasing critical thinking skills can be seen from the aspects of preparation carried out by students. Students train themselves to be essential in determining learning resources related to the material to be studied. Besides, students must be critical in finding supporting learning sources associated with the primary source to be explored. In this case, students seem to have problems that can be solved critically. These results are in line with research that shows an increase in critical thinking skills through issue solving learning (Trisnowati & Firdaus, 2017). Before students visit the location of learning resources, students must first study the material to be studied. By studying the material being studied, students can determine which location in the Magelang area will be used as a learning resource. In this case, students critically process the information obtained. Students use various types of reasoning (inductive, deductive, etc.) according to the situation they are facing in order to obtain a solution to these problems.

Communication skills experienced a higher increase in the experimental class than the control class. However, improving communication skills is no better than increasing critical thinking skills. Analysis from the author that communication skills can be through verbal and nonverbal. This is not supported by an assessment conducted to measure communication skills. Communication skills are only measured

through tests. The improvement in test results was not as significant as for critical thinking skills.

## CONCLUSION

Blended learning integrated local wisdom can improve students' critical thinking skills and communication skills. The modification of the blended learning stage lies in the information-seeking setting. Based on the research findings, it is concluded that (1) the application of integrated local wisdom blended learning can significantly improve critical thinking and communication skills compared to blended learning without integrating local knowledge. (2) The improvement of critical thinking skills is more significant than the improvement of communication skills. Learning by integrating the potential of an area can be pursued as an innovation in learning and can be used to get to know the potential of an area better.

## ACKNOWLEDGEMENT

The author would like to thank the Ministry of Research, Technology, and Higher Education for providing research grants for beginner lecturers for 2020 number B / 87 / E3 / RA.00 / 2020, so that this research can run smoothly.

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