



Analysis Of Vocational Students' Critical Thinking Skills Using The OER-Assisted Blended Learning

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Abstract: One of the competencies in 21st-century learning is critical thinking (CT). Many lessons carried out by teachers do not touch this ability because of the lack of learning innovation and the use of IT-based learning resources. This study aimed to determine and analyze the effect of using the OER (Open Educational Resources)-assisted Blended learning model on vocational students' critical thinking skills. The type of research used mixed methods with embedded design. The samples were 54 students of the Multimedia program at VHS (Vocational High School) in Surakarta, Indonesia, and the instrument used a test based on critical thinking skills, according to Facione. Quantitative data analysis used an independent t-test and the qualitative data used criteria for achieving students' critical thinking skills. The results of the study support the expectation that the BL model assisted by OER has a significant effect on student learning outcomes and that students have excellent critical thinking skills on the indicators of interpretation, analysis, evaluation, explanation, and inference. On the other hand, students are weak in self-regulation.

Keywords: blended learning, critical thinking skills, OER, innovation, vocational

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INTRODUCTION

One of the learning problems in Indonesia now is that it is still oriented to theoretical assignments and tends to emphasize students' memorization of material in all fields of study, resulting in students having difficulty answering questions (Hidayat & Patras, 2013). This issue becomes it difficult for educators to familiarize students to improve their problem-solving and Critical Thinking abilities. Based on the 2018 Program for International Student Assessment (PISA) survey, the quality of education in Indonesia is low, especially in CT skills. The survey results show that Indonesia is ranked in the world's bottom 10 in all competency categories, with a score of 371 in the reading category, 379 in the mathematics category, and 396 in the science category (OECD, 2019). This result is relatively low compared to the average per category of 487.

One important component in modern education today is to develop critical thinking skills (Karakoç, 2016). By the 21st-century learning framework, the learning process is carried out by providing 4Cs to students: communication, collaboration, critical thinking, problem-solving, and creativity and innovation. Critical thinking skills can help students to understand the material well because this ability affects students' understanding of the material (Karimi & Veisi, 2016). Fisher states critical thinking is a skill that can be done better or otherwise (Fisher, 2000). Good critical thinking will meet various intellectual standards, such as clarity, relevance, adequacy, coherence, and others. Critical thinking can develop if students are faced with problems designed in the context of everyday life. This ability will strengthen students' ability in problem solving.

Related to the importance of this critical thinking ability, several educational experts provide their opinions. Robert Ennis states that critical thinking is reasonable thinking and reflection that focuses on deciding what to believe or do (Fisher, 2000). Decision-making is closely related to problem-solving, where decision-making is an activity that takes place all the time in doing something. Decision-making is determined by one's knowledge and thinking skills. The current definition of critical thinking is a metacognitive process consisting of several sub-skills (analysis, evaluation, and inference as core critical thinking skills) and dispositions (Dwyer, 2017). Facione states that there are six indicators of critical thinking skills involved in the critical thinking process (Facione, 2011). These indicators include interpretation, analysis, evaluation, inference, explanation, and self-regulation.

Some research data state that students' critical thinking skills in Indonesia are still low. Lestari et al. (2020) mentioning the level of critical thinking skills of vocational students, especially in technical skills programs,

show that vocational students tend to have low critical thinking skills (Lestari et al., 2020). Mahanal also mentioned that the critical thinking ability of students who use the teacher's learning model is currently low, and there is a need for learning innovation (Mahanal et al., 2019). Some educational facts show low critical thinking skills. Ultimately student learning outcomes are also low. There needs to be a solution to this low critical thinking ability. One of the results of interviews obtained from teachers and students of SMK is due to the implementation of a learning model that is not on the student's character. Students tend to be passive and bored in participating in learning.

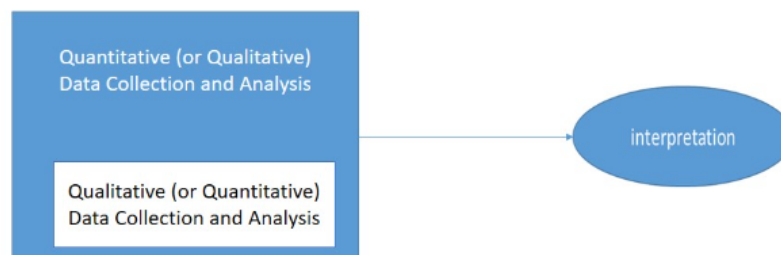
For this reason, a learning model is needed following the character of today's students, who are already very familiar with the use of IT and gadgets for learning. Besides, it also creates a learning atmosphere that is comfortable, interesting, fun, and abundant with learning resources. One of the most appropriate models to accommodate IT is Blended Learning (BL). Meanwhile, to provide learning resources that suit the needs of students, an OER (Open Educational Resource) is needed. OER will help students obtain material according to their competence. Graham explains BL with a combination of face-to-face and online learning (Graham, 2013). Bryan and Volchenkova (2016) state that blended learning is a form of learning using the internet using various applications by combining direct learning in the classroom with online learning (Bryan & Volchenkova, 2016). Various studies have concluded that BL contributes to the improvement of critical thinking (Chen & He, 2020; Venkatarayalu, 2020; Stites et al., 2021; Yu et al., 2021; Chen et al., 2021).

UNESCO states that OER is learning, teaching, and researching material/object in any format and media that is in the public domain (UNESCO, 2019). Afiani (2018) explains that OER is all the provision of open learning resources, which are facilitated by technology, information, and communication as learning materials, which the user community can use for non-commercial purposes (Afiani, 2018). Another opinion states that OER is a learning resource that can be accessed by the public and allows everyone to use, copy, and redistribute what is obtained for free (Syaifudin, 2016). OER, in its implementation, cannot stand alone without someone managing it because OER is in the form of a stand-alone learning resource. To be effective, OER is integrated with one of the learning models that match the characteristics of being online and accessible via the internet. Several studies explain the benefits of OER on student understanding and learning outcomes (Datt & Singh, 2022; Huang et al., 2022; Engler & Shedlosky-Shoemaker, 2019; Georgiadou & Kolaxizis, 2019; Hettige et al., 2022; Huang et al., 2020).

The OER Assisted Blended Learning Model is an alternative to overcome students' low critical thinking skills. The novelty of this research is the integration of learning using face-to-face and online. Online learning uses a content management system-based website. The learning system is carried out through three stages consisting of initial face-to-face meetings, online meetings, and final face-to-face meetings. At the initial meeting, learning was carried out in the form of presenting cases and explaining the material. The second meeting was held online to provide enrichment in the form of presenting OER on a CMS-based website. The final meeting was face-to-face for reflection and evaluation. The implementation of this research is to find out how far the integration of the OER-assisted BL learning model with these three syntaxes influences the students' critical thinking skills.

METHODS

This research was a mixed method with embedded design (Creswell & Clark, 2011). This study aims to analyze the effect of the treatment/independent variable (OER-based blended learning) on the impact variable (critical thinking skills). This type of research is used to dig deeper into the effect of implementing the OER-Assisted Blended Learning model which was packaged in experimental research (quantitative methods). Furthermore, a more specific deepening regarding how to improve each component of critical thinking based on Facione is carried out by a qualitative study.



(Source: Creswell & Clark, 2011)

Figure 1. Mixed methods with embedded design

For the quantitative methods, the researchers used an experimental method with a posttest-only control group design.

Table 1. A posttest-only control group design

	Group	Independent Variable	Post-test
R	Experiment	X	Y ₁
R	Control	-	Y ₂

Source: Ary et al. (2018)

R: Random

X: Treatment given

Y₁: Posttest in the experimental groupY₂ : Posttest in the control group

This study used a cluster random sampling technique that obtained 54 students of the Multimedia program at VHS in Surakarta, Indonesia. The subjects used basic programming and data collection techniques used a CT test. The test used an essay based on critical thinking skills, according to Facione in [Table 2](#).

Table 2. Students' question instruments grid based on critical thinking skills according to Facione

Competencies	Question	Question	No.	Aspects of CT
Implement the use of data types, variables, constants, operators, and expressions	Essay	C3	1	Explanation
	Essay	C4	2	Analysis
	Essay	C4	3	Interpretation
	Essay	C3	8	Explanation
	Essay	C5	5	Conclusion
Create program code with data types, variables, constants, operators, and expressions	Essay	C4	6	Analysis
		C5	7	Evaluation
		C6	4	Self-regulation

The validity and reliability of the instrument showed: 1) the validity of the critical thinking instrument on 26 students of the Multimedia program at VHS in Surakarta with $r_{table} = 0.3882$. Items were valid if the value of $r_{count} > r_{table}$. Six questions were obtained from the tryout results, which were declared valid. There are questions number 2, 3, 4, 5, 7, and 8; 2) the item reliability test aims to test the questions before they are used to retrieve data on whether they are reliable and consistent. The reliability test provisions are said to be good if Cronbach's Alpha value is > 0.05 . The result of Cronbach's Alpha value shows 0.765, which is declared reliable. The data analysis technique used the t-test (independent samples t-test). The t-test will show an independent variable's influence in explaining the dependent variable. The t-test has a significance of 5% using SPSS 22. For qualitative data, analyzing the results per item indicator of critical thinking skills used the criteria for achieving students' critical thinking skills ([Riduwan, 2013](#)). The grouping criteria consist of very high, high, medium, low, and very low. [Table 3](#) shows the categorization of CT criteria.

Table 3. The category of CT (Riduwan)

Percentage (%)	Category
81-100	Very high
61-80	High
41-60	Medium
21-40	Low
0-20	Very low

RESULT AND DISCUSSION

The data presented in this study is the distribution of learning outcomes for the control group and the experimental group. In addition, there was a distribution of the percentage of critical thinking skills in the experimental group. [Table 4](#) and [Table 5](#) showed the distribution of student learning outcomes after participating in the lesson. The control group used the discovery model learning, and the experimental group used OER-assisted blended learning.

Table 4. Frequency distribution of control group values

Interval	Frequency	Percentage (%)
54-60	7	25.9
61-67	7	25.9
68-74	4	14.8
75-81	5	18.5
82-88	4	14.8

Furthermore, the following is the distribution of the experimental group using OER-assisted blended learning.

Table 5. Frequency distribution of experimental group values

interval	Frequency	Percentage (%)
62-68	2	7.4
69-75	4	14.8
76-82	6	22.2
83-89	10	37
90-96	5	18.5

For more details, Table 6 is a summary of the data description of the learning outcomes of the control group and the experimental group.

Table 6. Description of the learning outcomes of the control and experimental groups

Information	Control group	Experiment group
Number of respondents	27	27
Mean	68.83	81.79
Minimum value	54.17	62.5
Maximum value	87.5	95.83

Before the research data was processed using the t-test, the post-test results were tested for normality and homogeneity as a condition for the t-test. The normality test was carried out by testing the post-test data about the description of the control group and the experimental group using the Kolmogorov-Smirnov test to determine whether the sample came from a normally distributed population. The normality test results for the control group Sig. of 0.200 and for the experimental group of 0.073. Both have effects, Sig. > 0.05, meaning that the post-test data about the description of students' critical thinking skills were normal. The homogeneity test was carried out by testing the post-test data about the description of the control class and the experimental group using Laveane's test to determine whether the sample came from a homogeneous population. The homogeneity test results have a Sig. of 0.062, where the results of Sig. > 0.05 means that the post-test data describing students' critical thinking skills is homogeneous. After the prerequisite data analysis test is met, process the data using the t-test. The hypotheses in this study are:

H₀: Using a blended learning model assisted by OER does not affect improving learning outcomes in the Basic Programming subject for Multimedia program at VHS in Surakarta.

H₁: Using the OER-assisted blended learning model improves learning outcomes in the Basic Programming subject for the Multimedia program at VHS in Surakarta.

The results of the hypothesis with a t-test showed Sig. 0.003, or Sig. < 0.05 means that H₀ is rejected and H₁ is accepted. The results of this test indicate that using a blended learning model assisted by OER improves students' critical thinking skills in the Basic Programming subject for the Multimedia program at VHS in Surakarta.

Table 7. T-test analysis from the learning outcomes of the control and experimental groups

Post-test from control and experimental groups	Df	Sig. (2-tailed)	Mean difference	Decision
	52	0.003	-5,39	H ₁ accepted

Table 7 shows the study results related to the value per indicator of students' critical thinking skills, according to Facione. This data is obtained from the value of learning outcomes that are mapped based on CTs from Facione.

Table 8. Category of students' CTs for each indicator (Facione)

Indicator	Percentage (%)	Category
Interpretation	91.75	Very high
Analysis	97.25	Very high
Evaluation	84.25	Very high
Inference	76.75	High
Explanation	86	Very high
Self-regulation	54.75	Medium

Based on the research data, it can be explained how the learning outcomes and critical thinking skills of multimedia program students at VHS. The average student learning outcomes with questions based on critical thinking skills, the control group scored 68.83. While the experimental group, the group using the BL model assisted by OER, obtained 81.79. The value of the experimental group showed a very significant increase compared to the learning carried out by teachers in general. This result is reinforced by the t-test that has been carried out. The results of the t-test show Sig. 0.003, or Sig. < 0.05. That is, using the OER-assisted BL model has a significant effect on student learning outcomes. BL emerged simultaneously with the development of information technology in education. With this technology's emergence, students can access learning resources more easily, both offline and online. One of the media that provides learning resources is OER facilities that are easily accessible to students (Markin, 2021; Marín et al., 2022; Sumarmi et al., 2021). Obtaining information makes it easier for students to understand the learning material. The existence of a deep understanding of the learning material will provide maximum learning outcomes (Siregar, 2019; Kandari & Qattan, 2020; Hariadi et al., 2022). Some of the benefits of BL that are in line with improving student learning outcomes: 1) save more time and costs, and learning is more effective and efficient (Graham, 2013; Moskal et al., 2013; Alabdulwahhab et al., 2021); 2) ease in facilitating the learning process (McGee & Reis, 2012); 3) the emergence of LMS can increase critical thinking skills (Masalela, 2009; Comer & Lenaghan, 2013); 4) teachers and students can discuss outside of face-to-face hours in advance (Graham, 2006; Fadde & Vu, 2014; Puspitarini, 2022).

The percentage data from each indicator of critical thinking skills (Facione, 2011) in implementing the OER-assisted BL model shows high criteria. The interpretation, analysis, evaluation, and explanation indicators are very high, with 91.75%, 97.25%, and 84.25%. The inference indicator obtained the high category with 76.75 %. Only the self-regulation indicator received a medium category value with a percentage of 54.75 %. The results show that students have excellent critical thinking skills on the indicators of interpretation, analysis, evaluation, explanation, and inference. It offers students can do: 1) students can solve the problem correctly according to what is being asked about or can understand the meaning of the problem well; 2) students can write down the concepts used in solving problems clearly and precisely; 3) students can write down the problem solving clearly and precisely; 4) students can give reasons about the conclusions drawn clearly and precisely; 5) students can conclude from what is asked logically (Purbonugroho et al., 2020). On the other hand, students are less able or have difficulty when students are asked to review their answers. One of the causes of this inability is the lack of learning experience and lack of practice (Susanto, 2006). Susanto (2006) explains how to improve self-regulation in students: 1) directing our students to start setting targets when participating in the learning process; 2) determining the strategy for achieving the target; 3) guiding them during the process of achieving the target; 4) training students to divide the tasks into small parts and sort out the important parts; and 5) students are asked to re-evaluate the targets that have been set with the results that have been obtained so far.

CONCLUSION

Based on the results and the discussion of the effect of using the OER-assisted BL learning model on students' critical thinking skills, the research shows that the t-test results show Sig. 0.003 or the use of the OER-assisted BL has a significant effect on student learning outcomes with questions of critical thinking skills. The findings in this study show that there is an increase in learning outcomes and students' high critical thinking skills. The implication of this research is an increase in critical thinking skills in the components of interpretation, analysis, evaluation, explanation, and inference. On the other hand, students are weak in the self-regulation component. One of the causes of weak self-regulation abilities is a lack of learning experience. Teachers must train students in the learning process by setting learning targets, fighting for target achievement, and evaluating targets.

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