



Analysis of Critical Thinking and Self-regulation in Blended Method, Module-aided, Problem-Based Learning

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Abstract

In pandemic conditions, the government has established distance learning online. After the pandemic, the learning process has returned to offline activities. However, the technology used during online learning is available. In such conditions, offline and online learning combination is a necessity for learning in the future. To deal with it is very important for students to have the ability to think critically and learn independently. The purpose of this research is to analyze students' critical thinking skills and learning independence after applying module-assisted problem-based learning. This research was conducted at Muria Kudus University, Kudus Regency. The qualitative research subjects consist of nine students selected from 33 students with low, medium, and high critical thinking abilities. The variables in this study are learning independence and critical thinking skills. Learning independence data was obtained by questionnaire and the critical thinking ability was obtained by a written test. The triangulation process was done by comparing test results, interviews, and observations. The treatment given increases student independence in terms of "planning" and "autonomous practice" as well as students' critical thinking skills have improved. This improvement occurred more significantly for high ability students than medium and low ability students. To overcome this, the quality and quantity of teaching materials can be improved. In addition, student interaction should be encouraged during group activities.

Keywords: PBL, critical thinking, learning independence

Analisis Kemampuan Berpikir Kritis dan Kemandirian Siswa Pada Pembelajaran Berbasis Masalah Berbantuan Modul Secara Blended

Abstrak

Dalam upaya menghadapi kondisi wabah saat ini pemerintah telah menetapkan pembelajaran jarak jauh secara daring. Setelah masa pandemic berakhir, pembelajaran telah kembali diterapkan secara luring. Namun, teknologi yang digunakan pada masa pembelajaran daring sudah tersedia. Dalam kondisi tersebut gabungan pembelajaran secara luring dan daring (blended) merupakan keniscayaan dimasa depan. Dalam penerapan pembelajaran blended, pelajar perlu mempunyai kemampuan berpikir kritis dan dapat belajar secara mandiri. Tujuan dari penelitian ini adalah menganalisis kemampuan berpikir kritis dan kemandirian belajar mahasiswa setelah diterapkan pembelajaran berbasis masalah berbantuan modul. Penelitian dilakukan di Universitas Muria Kudus. Subyek penelitian kualitatif, yaitu 9 mahasiswa yang dipilih dari 33 mahasiswa yang mempunyai kemampuan berpikir kritis kategori rendah, sedang, dan tinggi. Variabel pada penelitian ini adalah kemandirian belajar dan kemampuan berpikir kritis. Adapun data kemandirian belajar diperoleh dengan angket dan kemampuan berpikir kritis diperoleh dengan tes tertulis. Triangulasi metode dilakukan dengan cara mengambil data tes observasi, dan wawancara. Perlakuan yang diberikan meningkatkan kemandirian mahasiswa dalam segi "perencanaan" dan "berlatih mandiri" serta kemampuan berpikir kritis sampel mengalami perbaikan. Peningkatan terjadi lebih signifikan terjadi pada mahasiswa kemampuan tinggi dibandingkan kemampuan sedang dan rendah. Untuk mengatasi hal tersebut, kualitas dan kuantitas bahan ajar dapat ditingkatkan. Selain itu, dapat dimaksimalkan interaksi antara mahasiswa selama pembelajaran.

Kata kunci: PBL, berpikir kritis, kemandirian belajar

INTRODUCTION

Learning is the practice of solving problems. [Schunk & DiBenedetto \(2020\)](#) state that problem solving and critical thinking skills are essential because they are advantageous in mastering cognitive, psychomotor, and social abilities. Critical thinking is an integral ability to solve problems in mathematics. According to [Zhou et al., \(2015\)](#), critical thinking skills support one's ability to criticize, ask questions, evaluate, and reflect. [Holmes et al. \(2015\)](#) stated that it is vital for scientists and ordinary citizens in society to critique data, to identify whether conclusions are supported by evidence and to distinguish factual events from mere coincidences. In conclusion, learning independence supported by critical thinking skills is essential to achieve learning goals in the mixed learning process that is currently applied.

Critical thinking is the ability to enter into reflective and independent thinking ([Gupta & Ahmad, 2018](#)). This means making reasonable, logical, and well-thought-out judgments. Critical thinking is one of the many crucial thinking skills that aims to encourage people's abilities to criticize, question, evaluate, and reflect ([Zhou et al., 2015](#)). Furthermore, ([Gupta & Ahmad, 2018](#)) states that critical thinking includes thinking abilities, cognitive skills, and disposition of attitudes or mindset. The ability to think critically is an important life skill. [Ennis \(2015\)](#) argues that critical thinking is a rational, reflective way of thinking that focuses on decisions about what to believe or what to do. From the descriptions of several experts above, critical thinking includes cognitive abilities and skills. In addition, critical thinking skill includes attitudes in using logic, reflecting on thoughts, and evaluating these thoughts.

In this study, the assessment of critical thinking skills will be accomplished with a written test in the form of long text questions. The focused assessment of the written test uses the following indicators: (1) focus on the problem, (2) ask, explain, and answer questions, (3) take actions in the right order according to the situation, and (4) make an assessment ([Ennis, 2015](#)).

[Beach \(2017\)](#) describes Self-Directed Learning as an approach in which students are encouraged to take personal responsibility and the student's ability to control their own cognitive processes in building and confirming meaningful and valuable learning outcomes. Students with learning independence learning, characterized by the ability to plan, manage, and control their learning process, can learn faster and outperform students with weaker learning independence ([Kizilcec et al., 2017](#)).

The assessment of learning independence was developed by [Zimmerman and Martinez-Pons in Oxford \(2016\)](#) through a structured questionnaire known as the Self-Regulated Learning Interview Schedule (SRLIS). The instrument contains 10 strategies related to independent learning in students. The strategies are (1) Self-evaluation, (2) organizing and transforming, (3) planning and setting goals, (4) seeking information, (5) keeping records and monitoring, (6) environmental conditioning, (7) consequences for yourself, (8) practicing and memorizing, (9) seeking help, and (10) reviewing learning resources.

In its application, PBL (Problem Based Learning) is often applied in collaborative group learning. This statement is in accordance with [Bosica et al. \(2021\)](#) writing one of the principles of PBL is the knowledge that develops through a collaborative and negotiation process. PBL is also expected to be used for independent learning to support the mixed (online and offline) learning process. This is because the main points of PBL learning are that students are responsible for their own learning, learning how to use previous knowledge and how to acquire knowledge ([Ali, 2019](#)).

PBL is student-centered learning that empowers students to examine, integrate theory and practice, and apply knowledge and skills to develop appropriate solutions to specified problems ([Walker et al., 2015](#)). Furthermore, the ability to think critically, solve problems, and communicate is the result of the PBL learning process ([Ali, 2019](#)). According to [Bosica et al. \(2021\)](#), the goals of PBL include lifelong learning through independent learning, the ability to gather information, collaborate in groups, and the ability to think evaluatively and reflectively. So PBL not only supports the process towards student learning independence but also encourages students to think critically.

For the application of PBL in online conditions, the implementation of PBL activities can be carried out without overly burdening teachers and students by utilizing the flexibility of online learning ([Kim & Kee, 2013](#)). In addition, students can work at their own pace in implementing online PBL ([Annisa et al., 2021](#)). Some of the positive impacts of implementing online learning are increasing students' intrinsic goal orientation, triggering student self-efficacy, and supporting students to self-regulate their learning ([Delen & Liew, 2016](#)). The stages of implementing online PBL are (1) the problem presentation stage, (2) the exploration stage, (3) the integration stage, and (4) the solution and reflection stage.

Scaffolding can generally be classified into two types, hard and soft ([Choo et al., 2011](#)). Soft scaffolding refers to the teacher's actions in response to the efforts of students when they have special needs. On the other hand, according to [Choo et al. \(2011\)](#) hard scaffolding can be given based on students' difficulties

before the task is presented to students. Hard scaffolding here is generally in physical form. Hard scaffolding can be provided with computer-based or paper-based cognitive tools, for example, worksheets, or modules (Belland et al., 2013). Worksheets can provide learning support when needed (Ransom & Manning, 2013). To apply PBL in distance learning which is implemented by the current government, individual learning modules are needed.

Critical thinking is important in everyday life. In addition, learning ability and independence support student achievement. In previous research, it has been shown that higher-order thinking skills which include critical thinking skills in students are still not satisfactory. In addition, the pandemic conditions that have not subsided have forced learning to be carried out at home. Therefore, action is needed to overcome this problem.

Problem-based learning is student-oriented learning. The success of this learning is very dependent on the independence of students in managing themselves in obtaining resources, processing problems, and answering and solving these problems. Thus it is hoped that the application of PBL can trigger an increase in student independence in learning. Critical thinking ability is one of the higher-order thinking skills. In learning online, this ability is important to help students process and sort learning resources. Mastering these abilities in the online learning process requires independence in student learning. By increasing student learning independence in the online learning process, it is hoped that it will encourage higher-order thinking skills, especially critical thinking skills. The purpose of this research is to describe students' critical thinking skills and learning independence after applying module-assisted problem-based learning.

METHODS

The scope of this study is to analyze learning independence and critical thinking skills and the effects of blended, module-aided, problem-based learning given to these two variables. The method used to answer the research question is a mixed method which combines quantitative and qualitative methods. The design chosen for this research is sequential explanatory. The variables used are learning independence and critical thinking skills.

In this study, PBL-assisted learning was carried out using blended modules. The learning process is carried out in 16 meetings. At the initial meeting, an initial test was held to measure students' initial abilities. The process was then continued with 7 online meetings and 7 offline meetings alternately. The online meeting process is carried out through the sunan.umk.ac.id website. Offline meetings are conducted in class using PBL. The last meeting held a final test as an evaluation.

The research was conducted at Universitas Muria Kudus, Kabupaten Kudus. Quantitative analysis was done with data collected from 33 students. Critical thinking ability was measured using a test and learning independence was measured using an online questionnaire.

The data used for Qualitative analysis was collected from 9 selected students categorized as low, medium, and high in critical thinking skills. The categorization process is done by dividing students into three groups determined by average (\bar{x}) and standard deviation (s). The guidelines used in determining the low, medium, and high categories are as follows.

Table 1. Categorization Criteria

Category	Critical thinking score (x)
Low	$x \leq \bar{x} - s$
Medium	$\bar{x} - s < x < \bar{x} + s$
High	$x \geq \bar{x} + s$

- x : CT Score
- \bar{x} : Average score
- s : standard deviation

The validation process on qualitative data was carried out using triangulation (Natow, 2020). In this study, data triangulation was carried out using the results of tests, observations, and interviews. The process was carried out on 9 sample students previously selected. This process guarantees that the results found can be accounted for for their validity.

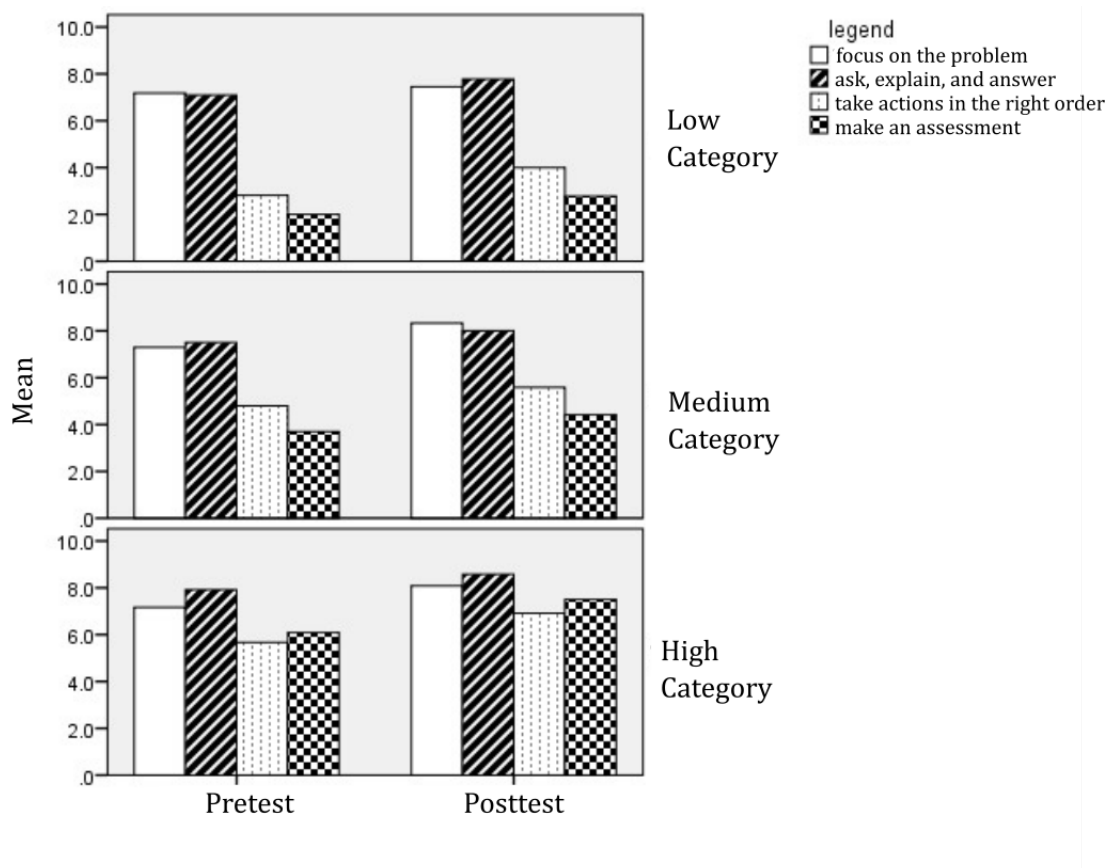


RESULTS AND DISCUSSION

Table 2. Summary of Critical Thinking Ability

		focus on the problem	ask, explain, and answer	take actions in the right order	make an assessment	Total Score
N	Valid	33	33	33	33	33
	Missing	0	0	0	0	0
Mean		8.000	8.152	5.636	5.091	74.655
Std. Deviation		.8660	.8704	1.6167	2.4414	10.8367
Variance		.750	.758	2.614	5.960	117.434
Range		3.0	3.0	7.0	9.0	38.8
Minimum		6.0	6.0	2.0	.0	55.6
Maximum		9.0	9.0	9.0	9.0	94.4

Chart 1. Pretest and Posttest of Critical Thinking Ability



Critical Thinking Ability

The results of critical thinking skills after learning show an average of 74.7 out of a maximum score of 100. Based on the table, in "focus on problem", and "ask, explain, and answer", the average is 8.0 and 8.1 out of a maximum score of 9. In these indicators, student results are still consistent, as indicated by minimal variance. In taking actions in the right order and making an assessment, the average is 5.63 and 5.09 with quite high variations. In the low, medium, and high categories, an average increase in critical thinking skills was found. The biggest increase was obtained by students in the medium category, and the lowest increase was obtained by students in the low category. This is unfortunate because it is hoped that students in the low category will benefit more from the treatment.

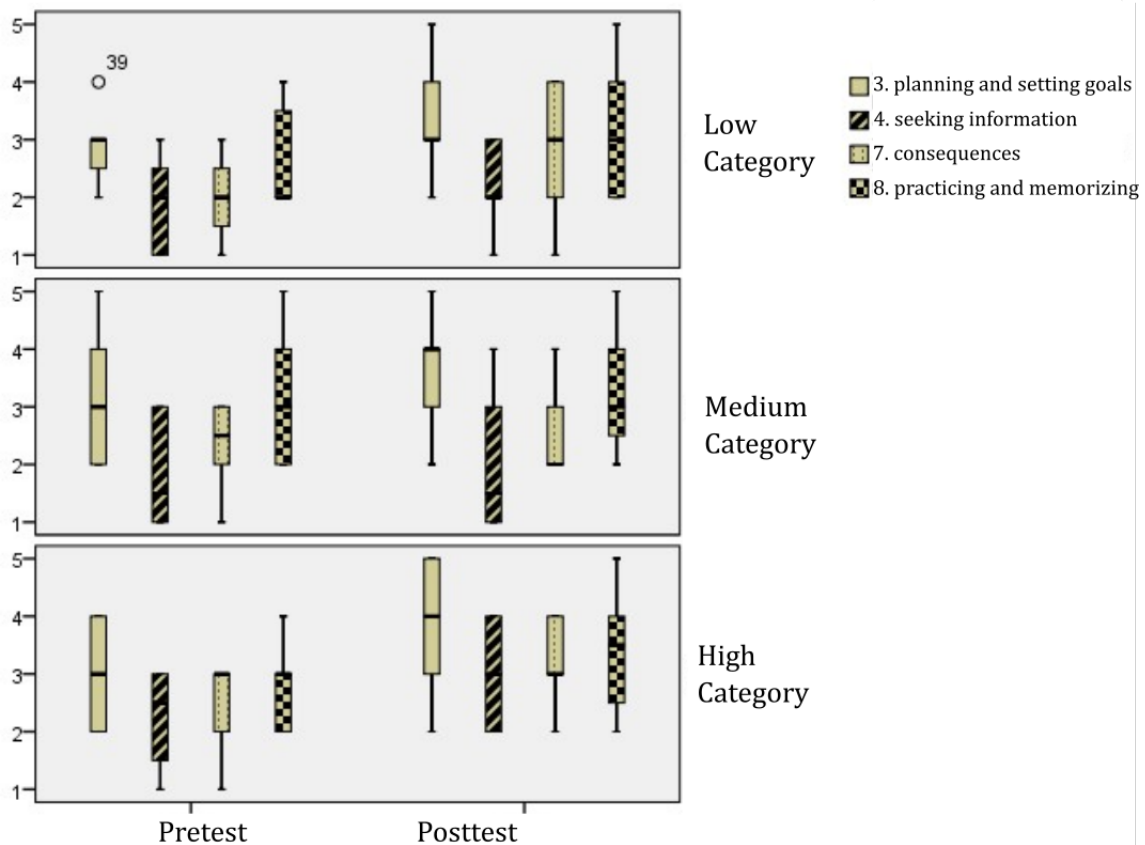
In general, the increase in critical thinking skills was seen in all categories of students. For students in the low category, the visible increase is in indicators 2 and 3, namely "ask, explain, and answer" and "take

actions in the right order". In the medium category, improvement is seen in indicators 1 and 4, namely "focusing on problems" and "making assessment". For students in the high category, the indicator that experienced the most improvement was indicator 4, namely "making assessments".

From the results of the study it can be seen that there is a lack of improvement in critical thinking skills in students with low abilities. This can be seen in lack of the ability to making assessment. The cause of low ability on students can be caused by their lack of ability to conclude (Di Pietro et al., 2020). In the observations made on NM (pseudonym), not only was the process did wrong, but the conclusions reached were not the results requested by the problem.

Self Regulation

Chart 2. Pretest and Posttest of Student’s Self Regulation



If viewed by category, in terms of "seeking information" and "consequences", significant improvement is seen in high ability students. This shows that high-ability students benefit from the treatment given. For students in the high category of indicators "planning" and "practicing", there was an increase but insignificant. This means that for students in the high category, the improvement in student planning ability and disposition to practice independently is measurable but not as great.

For medium ability students, improvements were seen in indicators "planning" and "practicing". In this indicator, significant improvements were also seen for low ability students. This indicates that online module-assisted problem-based learning can improve independence when viewed from the perspective of student planning ability and disposition to practice independently. In terms of "seeking information" and "consequences", there is an increase but not as good as in the high ability students.

In general, student independence and students' critical thinking skills have increased, but insignificantly, especially for students in the low category. This can be seen from the data of questionnaires filled out by students. The results of the written test also provide an overview of students' critical thinking skills. However, students in the low category indicated that they experienced a significant increase in student planning ability and disposition to practice independently.

For students with medium and low abilities, the increase was less significant in terms of seeking information and self-consequences. This can indicate the lack of resources students have. In addition, positive responses to online module-assisted problem-based learning were reported by some students.

One thing that received positive responses from both students and teachers was the quality of the modules. This is in line with the results reported by some researchers (Faidati & Sinuraya, 2021; Lidia et al., 2018; Widayanti, 2020). The economic factors felt during the pandemic are indicated by the teacher's statement. The economic effect on learning is also stated by some researchers (Mukminah et al., 2021; Winarti, 2021).

The lack of significant effect on medium and low ability students indicates that the PBL process can be further improved. One of the factors that influence the success of PBL is collaboration among students. Quality group work becomes important when heterogeneous classes can affect group performance among some students leading to unequal learning possibilities with some students having more resources than others (Thondhlana & Belluigi, 2017). To overcome the problems of medium and low students, efforts can be made to make problems in PBL clearer. Novice students always need explicit instructions that explain all targeted concepts and procedures without the need for students to conclude anything on their own (Wijnia, 2016). Only after the learner has acquired task-specific knowledge can these explicit guides be removed in further instructional phases (Sherrington, 2020).

CONCLUSION

The use of the blended method, module-aided, problem-based learning increases student independence, especially in students' ability to plan and disposition to practice independently. The learning process applied also improves students' critical thinking skills. For high-ability students, the most significant improvement was in students' ability to practice independently and their ability to search for learning sources. For medium and low-ability students, the most significant improvement was students' ability to plan for study and do it by themself.

The improvement was shown more significantly for high abilities students compared to medium and low abilities students. To better cope with this, the quality and quantity of teaching materials should be improved.

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