

Problem-Based Learning and Project-Based Learning Integration in Online Learning to Enhance Students' Critical and Creative Thinking Skills

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Abstract: *Effective online learning to develop students' higher critical and creative thinking skills is highly important to be conducted in the classroom nowadays.* **Objectives:** This study investigates the integration of problem-based learning and project-based learning implemented by the teachers in online learning to enhance students' critical and creative thinking skills. **Methods:** Qualitative approach was used through conducting in-depth interviews with teachers and online classroom observation. **Findings:** This study revealed that problem-based learning and project-based learning were integrated into online learning to enhance students' critical and creative thinking skills. Moreover, teachers used several learning platforms, such as Google Meet, Zoom, Google Classroom, and WhatsApp. **Conclusions:** Findings provide implications to enrich the body of knowledge relevant to the theories about effective learning models to develop students' critical and creative thinking.

Keywords: online learning, problem-based learning, project-based learning, critical and creative thinking skill.

Abstrak: *Pembelajaran online yang efektif untuk mengembangkan kemampuan berpikir kritis dan kreatif siswa yang lebih tinggi sangat penting dilakukan di kelas saat ini.* **Tujuan:** Penelitian ini mengkaji integrasi pembelajaran berbasis masalah dan pembelajaran berbasis proyek yang diterapkan oleh guru dalam pembelajaran online untuk meningkatkan keterampilan berpikir kritis dan kreatif siswa. **Metode:** Pendekatan kualitatif digunakan melalui wawancara mendalam dengan guru dan observasi kelas online. **Temuan:** Studi ini mengungkapkan bahwa pembelajaran berbasis masalah dan pembelajaran berbasis proyek diintegrasikan ke dalam pembelajaran online untuk meningkatkan keterampilan berpikir kritis dan kreatif siswa. Selain itu, guru menggunakan beberapa platform pembelajaran, seperti Google Meet, Zoom, Google Classroom, dan WhatsApp. **Kesimpulan:** Temuan memberikan implikasi untuk memperkaya hazanah pengetahuan yang relevan dengan teori tentang model pembelajaran yang efektif untuk mengembangkan pemikiran kritis dan kreatif siswa.

Kata kunci: pembelajaran daring, pembelajaran berbasis masalah, pembelajaran berbasis proyek, keterampilan berpikir kritis dan kreatif.

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■ INTRODUCTION

Since the outbreak of the Covid-19 pandemic in Indonesia, online learning has gained popularity. Almost all learning institutions have to implement online learning to avoid the spread of the virus. With limited knowledge of technology, teachers have to conduct the learning activities using various online learning systems. (Chaijum, 2020). This sudden change needs a great effort to be carried out by the teachers and the students to maximize learning conditions to achieve the learning goals. However, with the advancement of technology, especially in online learning technology has been deemed beneficial to a certain extent, allowing the learning activities could be conducted smoothly and effectively.

As a matter of fact, since the beginning, online learning has always used technology for the learning activities implementation, starting from the simplest technology to the current one. Nowadays, electronic media is currently easy to obtain, and also the internet network is easy to access for teachers and students (Kartika et al., 2019), therefore, it becomes easier to conduct online learning effectively. The online learning process is a learning process that can be used for distance and makes it easier for students to get global sources of knowledge, a learning process that is in great demand by all corners of the world and many applications attract students' attention in learning. The development of online learning educational applications makes all students can not only access knowledge from various online sources.

In a broad sense, whatever the learning system conducted in educational institutions including online learning, the most important to be acknowledged is that education is mainly conducted to transfer values including cultural values to enrich students' characters and the same time to achieve learning objectives (Mantra et al., 2019). Education is one of the main pillars in anticipating the future, education is always

oriented to preparing students to play a role in the future. Therefore, the development of educational facilities is one of the main prerequisites to pick up the future with all its opportunities and challenges (Maba, 2018). Moreover, the development of human resources such as teachers and educational personnel should also be carefully developed to attain higher professionalism to provide a better education for the students.

Learning is a process of helping students to obtain information, ideas, skills, values, ways of thinking, and ways of learning how to learn. The learning process must really pay attention to student involvement. So far, learning activities still, emphasize developing students' thinking skills at the basic level, not maximizing students' higher-order thinking skills. Higher-order thinking skills are also very important for mental development and changes in students' mindsets so that the learning process is expected to be successful (Utami et al., 2020). The higher critical thinking skill becomes very important for the students to have in this millennial era. Consequently, teachers should really pay attention to developing the students' critical thinking skills.

In relation to 21st-century learning, students are required to be more productive, creative, and innovative. These can be done through the implementation of effective learning that can be carried out in various scopes by developing critical and creative thinking skills (Syahrin et al., 2019). Therefore, all learning should be carried out innovatively by empowering high-order thinking. Moreover, the demands of the curriculum which enable students to learn creatively should be developed and teachers should be well-trained to carry out the learning activities according to the designed curriculum and always make an effort to enhance students' critical and creative thinking skills. Through nurturing high-order thinking skills, students find it easier to produce something because they

become more selective and creative (Rudibyani, 2019).

The success of the learning process cannot be separated from the ability of teachers to develop learning models that are oriented towards increasing the intensity of student involvement in the learning process (Hadi et al., 2018). To be able to develop an effective learning model, every teacher should have adequate knowledge regarding the concepts and ways to implement these models in the learning process (Suparsa et al., 2017). A teacher who lacks understanding of the concepts of learning activities and poor understanding of various learning conditions causes the inability to optimally increase the role of students in learning and also finds it hard to gain the learning objectives.

Studies have been conducted by several researchers to reveal the effectiveness of problem-based learning and project-based learning to improve students' critical and creative thinking (e.g.: Ulger, 2018; Sri et al., 2019; Al-Hassawi et al., 2020). The studies conducted by these researchers also revealed that problem-based learning and project-based learning have significant effects towards students' critical and creative thinking. These studies found that students' critical and creative thinking developed when problem-based learning and project-based learning were implemented in the learning activities. These previous studies indicated that problem-based learning and project-based learning are highly important learning models to be implemented in the classroom to improve students' critical and creative thinking.

Since the critical and creative thinking skills of the students are very important to be developed in education, teachers are expected to be able to provide their students with learning activities that activate and develop students' critical and creative thinking skills (Rahmawati et al., 2019). Every student has critical and creative potential, but the problem is how to develop that

potential through the learning process in the classroom. Students' critical and creative thinking skills can be trained by learning that requires students to explore, inquiry, discovery, and solve problems as well as through learning in small groups by applying a scaffolding approach and then tasks that require students' cognitive and metacognitive strategies (Gurcay & Ferah, 2018). Basically, during learning, students are required to be active and creative. However, as matter of fact, students tend to only receive knowledge from the teachers, as well as the teachers tend only to convey their knowledge and learn the information without actively involving students to use their critical and creative thinking skills. This learning situation made the students' critical and creative thinking skills have not been optimally trained in the classroom.

Having critical and creative thinking skills are highly useful for the students to solve their problems more effectively and efficiently. Of course, there are several problems faced by students and the teachers during the learning activities. In this case, teachers should be able to find solutions to the problems in order for the learning activities to become effective. Teachers are required to find appropriate learning models to facilitate students achieving the goals of learning (Heong et al., 2020). To achieve the predetermined learning goals, students should continually be engaged in learning activities and they should train to solve the problems. Giving the students regular problems to solve could also become a very useful practice for the students to develop their critical and creative thinking skills. The problems given to the students should require a high level of thinking processes so that students find them challenging to solve (Ermayeni et al., 2020).

Students who have critical thinking skills become more creative in the classroom and also in their daily life. Therefore, it is important for the

teachers to continually encourage students to maximize their creative thinking skills by providing them the opportunity to practice their skills. (Syahrin et al., 2019). Students' creative thinking skills can be used as a guide to determine the quality of their development during the learning process (Borodina et al., 2019). The creative thinking skill of the students should be continually practiced both in the classroom and outside the classroom. In the classroom, teachers may provide students with assignments to solve problems. Meanwhile, outside the classroom, students can be given a series of problems to be solved by conducting projects, field studies, or research.

Students love to do challenging tasks, therefore the tasks should be planned and constructed to ensure students develop their critical and creative thinking skills. Students can be said to be learning when there is an activity that results in changes in behaviour, for a change in behaviour to occur, in the learning process each student must be actively involved in order to achieve the goals of learning (Widiastuti et al., 2020). Encouragement and motivation in the learning process are certainly important to be nurtured in every learning activity so that students are totally involved in learning. Moreover, learning materials and learning strategies should be appropriately conducted and learning conditions should be enjoyable to create effective learning (Handayani et al., 2019).

To carry out effective learning, the following conditions are needed: active learning, both mentally and physically, effective learning methods, a good and balanced curriculum, valuing individual differences, appropriate learning plans, learning encouragement, a democratic atmosphere, and problems that stimulate thinking and creativity (Tiruneh et al., 2018). All lessons given to students need to be integrated. Efforts of creating a conducive learning atmosphere

through online systems are a challenging task to do. It requires a great effort to design learning activities. Moreover, learning models need to be modified to meet the goals of learning and at the same time develop students' critical and creative skills (Malik et al., 2019).

Students should be provided with learning models and learning sources that stimulate their critical and creative thinking skills (Mantra et al., 2019). Well-planned online learning may stimulate students' critical and creative thinking as long the tasks are constructed and organized in a such way to enable students to develop their critical thinking. for example, by giving the students a series of barnstorming questions, problems to solve, or projects to be conducted. Additionally, learning models can be utilized to develop which can be integrated into online learning such as problem-based learning, and project-based learning. Through integrating these learning models, online learning can be enjoyable for the students to participate in because they find it more challenging and interesting (Widiastuti, 2018).

Several studies related to online learning have been conducted by several scholars and researchers (e.g.: Rahayu and Wirza, 2020; Wargadinata et al., 2020; Hussin et al., 2018). These studies mainly investigated the teachers' perception and the implementation of online learning during the covid-19 pandemic. There were only limited studies concerning the innovation of online learning by integrating the existing learning methods into online learning. Therefore, this study was considered to be very important to be conducted to reveal the integration of problem-based learning and project-based learning to develop the critical and creative thinking of the students. This study can be beneficial for the improvement of learning activities in all learning institutions.

■ METHODS

This study used a qualitative research design with descriptive analysis. The study was conducted in a senior high school consisting of 60 teachers and six teachers were selected as the participants of the study. Teachers were selected based on the length of their teaching experiences. Two teachers had 5 years of teaching experience, 2 teachers had 10 years of teaching experience, and 2 teachers had 15 years of teaching experience. All selected teachers conducted online learning during the pandemic of covid-19. The data were collected by conducting interviews and online learning observations with the selected school teachers and students concerning the implementation of online learning activities and critical and creative thinking skills. The data were collected by conducting two interviews, and two online classroom observations.

To find out the implementation of problem-based learning and project-based learning to develop students' critical and creative thinking skills, teachers were interviewed concerning (1) whether students were able to ask questions, (2) whether students were able to answer questions, (3) whether students were able to analyze arguments or opinions, (4) whether students were able to solve problems, and (5) whether students were able to evaluate and assess the results of the projects or their learning activities. Then, to find out the students' creative thinking skills, the teachers were asked questions about (1) whether students were able to ask questions, (2) whether students considered new information, (3) whether students were able to combine ideas from their friends, (4) whether students were able to conduct an experiment or activity in the form of a project, (5) whether students were

to propose new ideas about the project/activity to be implemented, (5) whether students were happy and active to carry out projects/learning activities assigned by the teachers. The questions were asked to confirm the integration of problem-based learning and project-based learning implemented by the teachers through online learning to develop students' critical and creative thinking skills.

All collected data from the interviews were transcribed and put into the right category according to the classification of the data. Similarly, the data obtained from the observation were also put into the right category to match with the data of the interviews. Once all data were put into the right category, then the data were triangulated to establish valid and reliable data. Data obtained from the first and the second interviews were matched and then confirmed with data collected from the online classroom observation. The data were discussed descriptively based of the facts obtained from the interviews and the online classroom observations.

■ RESULT AND DISCUSSIONS

The data in this study were mainly collected through interviews and online learning observations conducted to gather the required data. The selected excerpts of the interviews with the teachers can be presented as the following.

“Well, I am integrating problem-based learning in online learning and I notice my students really engage in learning and they are always active in solving the problems.” (Teacher A)

”I think online learning is effective enough for my students, some students find it difficult due to their unfamiliarity with the use of communication technology. But after a while, they were okay with online learning. I integrate problem-based learning and project-based learning in my online learning classes. I provide my students with problems to solve during the learning activities. Then I also

often assign a project to do. This helps my students to boost their critical thinking and creative thinking. (Teacher B)

“Online learning provides broad opportunities for students to actively learn independently so that they are more stable in understanding through internal activities, discussions and independent strengthening”. (Teacher C)

“Online learning sometimes can be a challenge to carry out because my students have to do a lot of projects to do. I have to modify the learning activities. I usually explain the lesson through google meet or zoom, then I give my students some problems to solve. They can solve the problems during an online meeting or at their home and then report the result on the upcoming online meeting” (Teacher D)

“Well, until now I am still using zoom to teach my students, I explain the lesson and then provide my students a project to do they can do it from their home and then they take turn to present their report every week through online meeting”. (Teacher E)

“Teaching online is very challenging for me because I should practice my students to solve problems and do some projects. Therefore, I utilize several learning models in teaching for example problem-based learning, and project-based learning”. (Teacher F)

The excerpt of the interviews indicated that teachers integrate the existing learning models such as problem-based learning and project-based learning in their online learning. This is done to ensure that students were actively engaged in learning. Nurturing students’ motivation in learning is very important because online learning could be boring for some students due to some limitations in interacting with the teachers and the other students. problem-based learning can be used to challenge the students in learning and they may develop their ability to solve problems which

are useful for them later on in doing the job as an engineer.

Moreover, when the students asked about how they enjoyed online learning, most students explained that they loved online learning because they can learn from home and sometimes, they can do the tasks or the projects whenever they have time. They also described that they could talk to the teachers through WhatsApp or mobile phone. WhatsApp seemed a very popular way of communication in Indonesia and can be operated almost everywhere since it does not require a high-speed internet connection.

“I love learning through online learning because I can learn anywhere and anytime, I like. My teachers also provide some exercises and projects through Google classroom and often my teachers chat us on WhatsApp group to explain the lesson if there is still something urgent to be explained” (Student A)

“I like the lesson through online because my teachers provide us some problem to discuss and we may discuss the problems through WhatsApp group, Google classroom and also zoom or google meet”. So, we have a lot of choices how we communicate” (Student B)

“Well at the beginning I found online learning was difficult because I live in a remote area, but now I feel relaxed and I find it interesting because I can learn more at home since I don’t need to travel to the university to study” (Student C)

“I like the learning activities conducted by my teachers because all the exercises are very challenging to do” (Student D)

“I never get bored when studying through online learning because my teachers give me problems to solve and also projects to do” (Student E)

“I really enjoy learning when my teachers use problem-based learning and project-based

learning. The learning activities make me active in learning and I have opportunities to do some works after the class, too” (F)

This excerpt of the interview showed that students enjoy learning through online learning because they can communicate with their teachers and their classmate using zoom, google meet, WhatsApp, google classroom, and also mobile phone. Moreover, students feel more relaxed in learning with online methods and more enjoyable because they were provided with problems and projects to do. Conducting innovative online learning can further develop students’ engagement in learning. The excerpts showed that students really enjoyed solving problems and doing projects given by the

Moreover, during online learning classroom observation, teachers were creatively teaching by integrating problem-based learning and project-based learning to enhance students’ critical and creative thinking skills. Students were assigned many challenging problems to be solved. Students were also given projects to be carried out to enhance their creativity. It was found also teachers utilized several online learning platforms to conduct the lesson, such as zoom, google meet, WhatsApp, and google classroom.

Furthermore, based on the interviews and classroom observation, teachers utilized various online learning platforms in carrying out the learning activities such as Zoom, Google Classroom, Google Meet, and WhatsApp. It can be seen from the various forms of online learning that students run, which is an application that is intended to facilitate the teaching and learning process, especially when it is still in a pandemic period. Moreover, based on the classroom observation, it was found that the use of online learning applications such as zoom, google meet, and google classroom was designed creatively for the students to have sufficient practice of doing a series of projects.

Based on the interviews and the observation conducted in the online classes, it was found that there were two learning models integrated into online learning. They are problem-based learning and project-based learning. Those two learning models were considered to be effective to develop critical and creative thinking for the students because the learning models allow students to maximize their competence in learning through engaging themselves actively in learning by solving problems and doing several projects.

The main objective of problem-based learning conducted in online classes was not only to convey large amounts of knowledge to students but rather on developing critical thinking skills and abilities in problem-solving and at the same time developing students’ abilities to actively build their knowledge (Rustam, Sidabutar and Edy, 2017). Moreover, problem-based learning was also intended to develop independent learning and students’ social skills. Independent learning and social skills can be formed when students collaborate to identify relevant information, strategies, and learning resources to complete problems. The problem-based learning model is a learning model with a learning approach to authentic problems so that students can organize their knowledge, develop skills that are higher and inquiry, self-reliant students, and increase confidence themselves (Khoiriyah & Husamah, 2018).

The success of the implementation of problem-based learning and project-based learning are mainly based on the appropriateness of learning syntax implementation. The syntax of problem-based learning are 1) problem orientation; 2) organizing students to conduct research; 3) assisting independent and group investigations; 4) developing and presenting artifacts; and 5) analyzing and evaluating the problem-solving process. Meanwhile, the syntax

of project-based learning are 1) introduction and team planning the project; 2) initial research phase in terms of gathering information; 3) creation, development, initial evaluation of presentation, and prototype artifacts; 4) second research phase; 5) final presentation development; and 6) publication of product (Anazifa & Djukri, 2017). Problem-based learning and project-based learning are effective in developing students' critical thinking and creative thinking because both learning models enable students to maximize their skills in problem-solving and creatively find an alternative solution to the problems (Rudibyani, 2019, Sari & Prasetyo, 2021).

Students' critical thinking was developed intensively when students were asked to analyze and evaluate the problems. In this learning stage, students were asked to find solution to the problems introduced by the teachers and also their friends. The solutions presented by the students should be based on their analysis and their critical thinking. Moreover, the solutions should be based on factual argumentation or real phenomena. Furthermore, students' creativity was developed the learning stage of planning projects/ learning activities, and also during conducting projects and learning activities assigned by the teachers.

This model is characterized by the use of real-life problems as something students have to learn to train and improve critical thinking and problem-solving skills and gain knowledge of important concepts, where the task of the teacher should focus on helping students achieve skills directly (Anazifa & Djukri, 2017). Problem-based learning, its use in a higher level of thinking, in problem-oriented situations, including how to learn (Trishchenko, 2018). Problem-based learning models include asking questions or problems, focusing on interdisciplinary linkages, authentic inquiry, cooperation, and producing

works and demonstrations. based learning problems are not designed to help teachers provide information to as many students as possible. Problem-based learning, among others, aims to help students develop critical thinking skills and problem-solving skills.

Problem-based learning is considered to be effective for the students because this learning model uses authentic problems that are unstructured and open as context for students to develop solving skills problems and think critically as well as build new knowledge. It is different from conventional learning which makes real problems as the application of concepts, problem-based learning makes problems real as a trigger for the learning process of students before they know formal concepts (Yusuf et al., 2020). Students critically identify information and strategies that are relevant and conduct investigations to resolve the issue. By solving the problem, students get or build certain knowledge and at the same time develop abilities critical thinking and problem-solving skills.

Another learning model integrated into online learning classes is project-based learning. This learning model is considered to be effectively employed by the teachers because students should be continually practicing their skills in doing projects so that they can develop a higher level of creativity. Moreover, this learning model allows students to develop their academic ability (hard skills), and personal abilities (soft skills), so that they are ready to enter the real world of work after completing their studies. Education institutions should, in addition to providing relevant theories, also necessarily provide examples of solving real projects by utilizing learning strategies that support students' improvement.

Teachers who participated in this study described that they found some difficulties in the implementation of problem-based learning and

project-based learning. Most of the problems were because the teachers were not familiar with the use of the learning platforms to carry out the learning models to accommodate all the learning syntaxes. Making the students active in participating in the lesson was found to be a challenge because students were learning at a distance where teachers could not really be capable of monitoring all the learning activities of the students. However, with a lot of practice, the learning process could be conducted effectively, and finally found the learning activities interesting.

Based on the observation, it was found that students who took part actively in the learning process during the implementation of project-based learning are confident and optimistic that it can implement project-based learning in the world of work and can improve performance academics. Project-based learning can help equip students to prepare for entering the world of work because students do not only need to the theory but they need to practice in the field (Syakur et al., 2020). The activities that are built between the project groups take place enthusiastically. Based on the observation, the students seemed to enjoy the online learning which was developed based on a project-based learning scenario. Students critically express ideas in collaborative groups, starting from planning something about acquiring knowledge, processing it collaboratively and meaningful, concluding, to exchanging information between groups before then doing a group presentation.

Soft skills are a fabric of personality attributes, both intra-personal and personal inter-personality. Intra-personality is a skill that a person has self-regulation, such as time management, stress management, change, character transformation, creative thinking, having a positive goal reference, and fast learning techniques. While inter-personality is a skill relating to or interacting

with the community group environment and the work environment as well as interactions with individual humans so that they can develop maximum performance, motivating ability, leadership ability, negotiation skills, presentation skills, communication skills, the ability to establish relationships, and the ability to speak in public. This is in line with Mahasneh and Alwan (2018) found that the project-based learning model enables students to enhance their soft skills by doing analytical and critical thinking in planning and doing the project, oral communication, collaboration, group or teamwork, and presentation.

The integration of problem-based learning and project-based learning in online learning classes certainly helps students practice their critical and creative thinking. Moreover, through problem-based learning and project-based learning, students also develop their social skills because these two learning models enable students to work in groups and share their knowledge with others. The integration of problem-based learning and project-based learning are not only good for the development of the students' critical and creative thinking skills but also helps students improve their social skills.

■ CONCLUSIONS

Online learning is one of the learning models that widely used recently in all Indonesian education institutions and many students were encounter problems when learning through online systems. Some students felt demotivated due to some limitations experienced in online learning. Through the integration of problem-based learning and project-based learning, students could develop their critical and creative thinking. Students were also more active in participating in the teachers because they were practiced solving problems and also conducted a series of projects to develop their hard and soft skills. The integration of problem-based learning and

project-based learning was mainly using several available learning applications such as Zoom, google meet, google classroom, and communication was also conducted through WhatsApp since this application can be easily accessed by the students and it does not need high speed of internet connection. Considering the findings of the study, therefore, this study suggests that problem-based learning and project-based learning should be integrated into online learning to create a conducive learning atmosphere.

This study implies that to be successful in teaching, teachers should be carefully choosing the learning model according to the situation and conditions of students and the learning environment. This is important to make the students active, interactive, and creative in the learning process. The selected learning model should enable students to enhance their critical and creative thinking skills in order they can solve their problems and survive successfully in this millennial era. Moreover, teachers should be able to integrate several learning models in their teaching process to make their students always enthusiastic to participate in learning and play active roles in the whole learning activities.

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