

Improving Architecture Student Creativity in Project-Based Environmental Knowledge Learning

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Abstract: Problems that arise in the field of architecture are usually related to environmental problems. In education, efforts to protect the environment are possible to incorporate through project-based learning integratively with student eco-literacy abilities. Eco-literacy is an individual understanding of the environment. This study aims to increase the creativity of students in a department of architecture by utilizing used goods available in the surrounding environment. The research method used is a qualitative case study and the research subjects are students majoring in architecture at Sekolah Tinggi Teknologi STIKMA Internasional, Malang, Indonesia who is currently taking the Environmental Knowledge course. Data were collected by doing documentation, interviews, observation sheets, papers, and performance appraisal sheets used to assess the products produced. The results showed that through the application of PjBL (Project Based Learning), students could improve teamwork skills and creativity in creating products with various forms of miniature architectures. The PjBL model provides opportunities for students to be more active and courageous in communicating ideas and discussing between groups to complete a project.

Keywords: Creativity; Learning model; Project-based learning; Miniature project; Environmental knowledge.

1. Introduction

It is very important to instill a sense and environmental concern for each individual. Environmental sustainability can provide many benefits for humans. Humans and the environment are two components that are interrelated and interdependent with one another [1]. Humans need the environment to support their daily activities. They live, grow, and develop in the environment, both in the natural and in the socio-cultural environments. Therefore, as living things, humans must protect and preserve these environments for their survival and future generations.

Life skills in the 21st century require highly educated graduates who have critical thinking, creative, communicative, and able to solve problems [2] [3]. Concerning the environment, students majoring in architecture must have high awareness and concern for the environment [4]. The designs and buildings they produce should not have a detrimental impact on the environment, if possible. Therefore, students majoring in architecture in making designs or buildings must possess aspects of environmental knowledge and creativity.

Creativity is one of the qualities of integration that becomes working capital [5] [6]. It places more emphasis on the product and individual performance

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[7]. Pusca and Northwood stated that creativity is closely related to one's imagination in finding new ideas and opportunities in creating innovative products [8] [9]. The lecture process which is designed as an effort to gain knowledge and is oriented towards the active involvement of students can produce products that will arouse their creativity [10] [11]. Products made by students that become authentic, real, and can be measured by the lecturer as a result of creation.

Basically, architecture students also need to learn new strategies in thinking about the environment, this is to ensure environmental sustainability is always maintained. Students majoring in architecture are required to have skills in the field of building or construction, and also the ability to make detailed modifications to a project that is being worked on [7] [12]. This means that to become a professional architect is not enough only with the ability to make detailed designs, but also requires higher creativity to produce excellent work. For this reason, the environment and teaching and learning process in universities must be able to provide opportunities for students to be more active and creative in expressing their ideas.

The implementation of student-centered learning can increase student creativity because students can freely develop their own ideas. To produce higher education graduates who are able to answer the needs of the industrial world and the challenges of the world of work, learning in architecture education must be directed at student-centered learning, where the critical issue is the changing roles of lecturers and students in the learning process [13] [14]. Students should actively try to develop their knowledge, skills, and creativity. They must change their passive role to be more active to participate optimally in the learning process [15].

One learning model that can place students at the center of learning is project-based learning (PjBL) [16-18]. Xinyan (2016) and Mustapha et al. (2020) stated that PjBL is a learning model that is very suitable for the characteristics of students of engineering [19-21]. It is commonly used in the 21st century learning to improve student skills [22]. This is a constructivism learning model that provides students the opportunity to complete a given project task [14] [23]. This is a lesson with unique characteristics in designing and implementing a project in it to produce a product [24]. Project-based

learning can direct students to solve problems in the real world through a long series of investigative activities [25]. In applying this model, students are required to use their knowledge, attitudes, and skills to solve problems in a project that is carried out either individually or in groups [26].

Various research results indicated that the application of a project-based learning model could increase student creativity in learning [10] [11] [27]. In the PjBL model, student creativity will be seen in their ability to undergo active and creative processes, formulate problems, and solve problems through cognitive thinking [28] [29]. The process of creativity will produce something new in the form of ideas or products that are original and also meaningful [17] [27]. Learning environmental knowledge for students majoring in architecture should not be limited to only abstract mastering material. More than that, they must be allowed to be actively involved in the learning process and analyzing and overcoming problems in the real world at hand, thus acquiring creative knowledge and skills, which are more in-depth and contextual in environmental knowledge. From the description above, this study aims to determine the creativity of students majoring in architecture in learning environmental knowledge through project-based learning designs.

2. Research Method

This research used a case study approach to describe about a variable or phenomenon observed in detail [30] [31]. The research location was conducted at private college in Malang, Indonesia. The research subjects were 16 students majoring in architecture who were taking the Environmental Knowledge course. In this study the researcher also acts as a lecturer who teaches the Environmental Knowledge course. The research consisted of three stages, namely preparation, implementation, and the final stage. Research instruments used included 1) observation sheets; and 2) interviews; 3) documentation; and 4) the assessment sheets for the products resulted. Figure 1 below shows the procedures or stages carried out in the research process:

Figure 1 above shows that this research was conducted through three main stages, namely: 1) the preparation process; 2) implementation; and 3) the final stage. Researchers are directly involved in the learning process. The purpose of this study is to provide opportunities for students to develop their

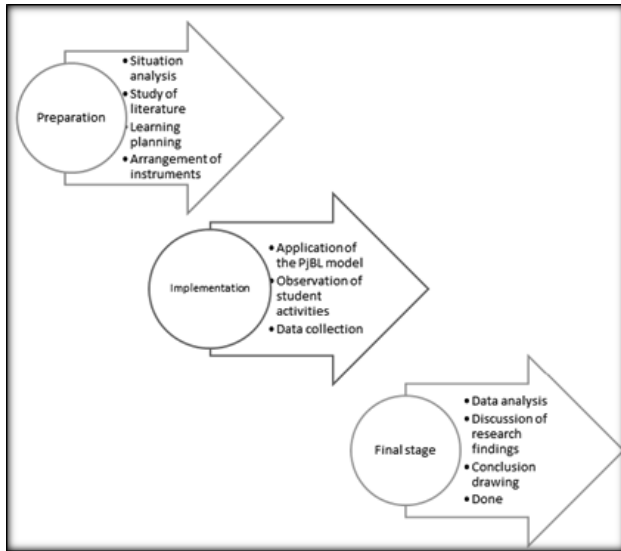


Fig. 1 : Research Procedures

creativity in the Environmental Knowledge course through a project-based learning model.

The collected data were analyzed using the descriptive analysis to describe the process of implementing the PjBL model and its effect on the creativity of students majoring in architecture in working on projects related to the Environmental Knowledge course. The research steps were carried out through observation sheets, interviews, documentation, literature reviews, and assessment sheets for products produced by students. Thus, the data descriptions carried out in this stage were more in the form of descriptive words instead of numbers.

Table 1: Observation sheets

No	Step	Student Activities	Observation result	
			Yes	No
1	Project determination	Students determine the project theme / topic		
2	Creating project design	Students design the steps for project completion activities from start to finish		
3	Arrange scheduling	Students can schedule all activities that have been designed		
4	Monitoring project progress	Students implement the project design that has been made		
		Students are active in discussion activities during the learning process		
		Students dare to ask questions in the group		
		Demonstrate a caring attitude and discuss openly in groups		

		Understand the tasks and roles in the group		
		Show an attitude of responsibility for each process carried out		
5	Preparation of reports and presentations	Students complete reports and present project results in front of the class		
6	Evaluation of project process and results	Students reflect on the activities and results of project assignments, as well as the difficulties they face		

The observation sheets are used to observe student performance during learning and project completion. This instrument is a check list that is filled in by the observer when an activity is carried out according to the results of the observations [32]. Filling in the observation sheet was done by giving a sign (√) in the available column of Table 1 according to the observations when students carried out PjBL learning. The interview technique used in this study was semi-structured interviews. This interview technique is commonly used in qualitative research because it is more flexible so that respondents can provide more in-depth information about an experience or phenomenon that is the focus of the study [33]. Interviews were conducted by the instructor of record at the end of the course after students had finished working on a project. The main focus in the interview was to find out student responses about PjBL on Environmental Knowledge learning in improving their teamwork skills and creativity.

Documentation techniques are used to collect and analyze documents, both written documents, images and electronics [34]. In addition, documentation in this study is also carried out by taking pictures (documenting) of each stage of progress of the completion of a project that is done by students. The literature review is carried out by researchers by collecting and analyzing various kinds of literature such as journals, reference books or research reports related to research topics such as the application of PjBL and creativity. The assessment sheet or evaluation sheet is used to view and provide an assessment of the project produced by students. Through this assessment sheet, researchers can see the extent to which students' creativity in producing architect miniature products which are the final project of learning.

3. Results and Discussion

The implementation of Environmental Knowledge learning for students majoring in architecture applies

the PjBL model carried out in 16 times meetings (16 weeks) with the following learning syntax, namely 1) formulating learning objectives; 2) delivering learning materials; 3) designing projects to be implemented; 4) carrying out the designed project, and 5) presenting the resulting project report.

Table 2 : Syntaxes in the Project-based Learning Method

Syntax	Duration	Learning Activities
Delivering learning objectives	1 week	<ul style="list-style-type: none"> ➤ Lecturers explain to students the learning objectives to be achieved.
Delivering learning materials and project preparation	3 weeks	<ul style="list-style-type: none"> ➤ Learning activities are carried out to provide students with a mature understanding of concepts related to environmental knowledge subjects. ➤ Students are divided into 4 groups in completing the project given by the lecturer. ➤ The learning process is carried out using the self-learning method using modules provided by lecturers, group discussions, and material presentations.
Designing product / project planning	2 weeks	<ul style="list-style-type: none"> ➤ The topic or material to be worked on is contextual and is easily designed to be an exciting project/product. ➤ Lecturers and students discuss the design of project assignments to be carried out. ➤ The project design is carried out by utilizing used goods in the surrounding environment as raw materials for completing projects to be carried out.
Project completion	8 weeks	<ul style="list-style-type: none"> ➤ Project completion is carried out in groups through a process of discussion, formulating problems, finding solutions, and finding new ideas. ➤ Lecturers observe student activities during assignment completion. ➤ Lecturers guide students when they experience difficulties. ➤ The data collection is carried out by the lecturers using the instruments prepared.
Presenting project reports	2 weeks	<ul style="list-style-type: none"> ➤ Lecturers provide the opportunity for each group to submit the reports on the projects on which they worked. ➤ Students present their experiences and the projects they have worked on and discuss with other groups.

Table 2 shows the syntax or steps taken in the implementation of the project-based environmental knowledge course learning. The syntax in the table

above was adopted and modified from the research conducted by Jalinus, et al (2020) [14]. From table 1 it can be seen that the delivery of learning objectives is carried out in the first week. The second to fourth week (3 weeks) is used to deliver learning material and prepare students for the project-based learning process. The next two weeks, learning activities focus on planning or designing projects that students will work on. Completion of the planned project is carried out for approximately 2 months or 8 weeks. And finally, on the fifteenth and sixteenth week, each group of students presented the results of their completed projects.

The observations results indicated that during project completion, each group demonstrated good teamwork skills. There are several indicators of teamwork skills, namely 1) commitment to achieving common goals; 2) high contribution to the work team; 3) ability to discuss openly, honestly, and showing a caring attitude; 4) understanding of the duties and roles in the team; and 5) having responsibility to each process carried out in groups. This indicator raises the awareness of each team member of the project they are working on and helps each other, resulting in a strong commitment to students to achieve the goal, which is to work successfully. Chandrasekaran & Al-Ameri (2016) and Brown (2020) stated that the implementation of the PjBL method positively encourages student teamwork skills and their critical thinking skills in solving problems [35] [36]. Research conducted by Jalinus et al. (2020) also found that this method can improve student learning activities and even better teamwork skills, compared to direct learning models [14].

The results of interviews with 75% students also indicated that some students experienced difficulties in completing projects compared to other learning methods. But on the other hand, students also perceived that this project learning method could improve their teamwork skills, such as communication, expressing ideas, and the skills needed to take part in group discussions. All students agreed that the PjBL method has a more technical focus that can support their competence and skills in the field of architecture in designing an architectural design. Mustapha et al. (2020) stated that the PjBL model is indeed appropriate and suitable for use in the learning process of engineering students [20]. Furthermore, Uziak (2016) also stated that PjBL is an effective and innovative learning model for engineering education because it allows students to

practice professionally to meet the needs of the industrial world [21].

The application of PjBL also allows students to connect their creativity with the learning process they are undergoing. In the Environmental Knowledge course, architecture students are required to be able to apply their knowledge and insights about environmental issues in designing projects or tasks they are working on, so they must have creativity in making products. Figure 2 below shows the works or products of students majoring in architecture in learning environmental knowledge with the application of PjBL. The level of student creativity can be seen from the products produced which include product aesthetics, novelty, quality, quantity, process, and product.



Fig. 2 : Examples of students' products

Figure 2 above shows some examples of raw materials and the results of projects undertaken by students. In general, the projects that have been completed by students have the concept of miniature buildings such as traditional houses, modern houses, and other building forms. They did the projects with the primary materials coming from used materials or items that they can find in their daily life. The results of the projects indicate that students' creativity can be optimized through a project-based learning model. As stated by Pusca & Northwood, one of the creativity indicators can be seen from the aspects of flexibility and originality [8] [37]. Flexibility is an ability to build multiple ideas, namely the ability to try different approaches to solving problems. Furthermore,

originality is the ability to generate extraordinary ideas that are not common. Research conducted by Ningsih (2020) and Ulfah et al. (2018) also found that the implementation of project-based learning allows students to gain a more attractive, broad, and relevant learning experience with the skills they need, thereby directing them to be more creative [27] [38].

Project-based learning can change the learning paradigm from teacher-centered learning (TCL) to student-centered learning (SCL). In implementing PjBL, students are required to be more actively involved in the learning process. The findings in this study indicated that the application of the PjBL model has been able to improve teamwork skills and creativity of students majoring in architecture in completing project assignments in the Environmental Knowledge course.

4. Conclusions

Based on the results and discussion above, the conclusions were drawn as follows, through the PjBL model student teamwork skills were better, where students could communicate ideas and discuss among group members in solving problems and achieving project goals. The application of PjBL to environmental knowledge learning can also help students increase their creativity in producing products. This can be seen from the various forms of project miniature or final product concepts that they produce by utilizing used goods in the surrounding environment. Thus, the application of the PjBL method in learning can train and improve teamwork skills and also student creativity in producing a product.

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