Advances in Social Science, Education and Humanities Research, volume 609
Proceedings of the International Conference on Information Technology and Education (ICITE 2021)

Project-Based Learning Integrated with Design Thinking Approach to Improve Students' Critical Thinking Skill

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ABSTRACT
21st century learning requires students to be able to think critically and be able to solve about the problems around them. The skills required by these 21st century students are referred to as 21st century skills. To be able to practice critical thinking skills and problem solving in learning, lecturers or learning facilitators can use certain learning methods that can accommodate these skills. One of the appropriate learning methods to apply in this regard is the project-based learning method. Besides, there is also a thinking approach that can be involved to the project-based learning method. It is design thinking approach. Design thinking approach can help students to be able to think structured from the preparation until the project done. It can be happened by integrating the design thinking framework to the project-based learning syntax. Project-based learning methods integrated with design thinking approach make a holistic and detailed learning method for students in achieving learning goals. Then, it is also predicted to improve students' critical thinking skills, as project-based learning methods work.

Keywords: *project based learning, design thinking, critical thinking.*

1. INTRODUCTION

The 21st century is an era of significant challenges. This can happen because in the 21st century there are fundamental changes, one of which is technological change. Therefore, this era is also referred to as the era of globalization. Fundamental changes that occur in the 21st century certainly affect various aspects of life, not least aspects of education and learning. 21st century learning requires students to more actively play a role in learning.

The learning revolution certainly has an effect on the learning model that will be applied to students. Ideal learning is student-oriented learning, students will seek to construct their own knowledge and be actively involved in finding information [1]. One of the learnings that are expected to be able to overcome these problems is through the Project Based Learning (PJBL) approach. The focus of PJBL lies in the core concepts and principles of a discipline of study, engaging students in problem-solving investigations and other meaningful task activities, giving students the opportunity to work autonomously to construct their own knowledge, and culminating it in tangible products.

PBL is an innovative learning that emphasizes contextual learning through complex activities. Project Based Learning (PBL) is a learning designed for complex problems that students investigate to understand, emphasizing learning with long activities, tasks given to students are multi-disciplinary, product-oriented. PBL is a systematic method of learning, involving students in learning knowledge and skills through a long and structured process of inquiry into authentic and complex questions and carefully designed tasks and products [2], [3].

The project-based learning approach is supported by constructivist learning theory. Constructivism is a learning theory that has broad support that rests on the idea that students build their own knowledge within the context of their own experiences. The opportunity to convey ideas, listen to other people's ideas, and reflect on one's own ideas on the ideas of others, is a form of individual empowerment experience.

2. LITERATURE REVIEW

2.1 Project Based Learning

As the name implies, Project Based Learning is a learning that makes the project the core of the learning process. Project Based Learning is a learning that links technology with problems in everyday life in a project [4]. In the project-based learning process, there are problems that become the foundation in the work of the project. Students are guided to feel the problem, formulate / identify the problem, then realize the idea of a solution in the form of a project. The results of students' work are called artifacts.

Project-based learning is meaningful learning because it is directly related to real life. Problems solved in a learning using project-based learning should be problems from around students. Thus, this learning can support students' concern for the surrounding environment. John Dewey in [5] explain that students' personal investment can be developed if students engaged to the real and meaningful tasks and problems.

Learning needs to have an element of challenge for students, this is because students should be people who can create something useful, not just as recipients of knowledge. In addition, students in learning should upgrade themselves scientifically and soft skills. Through project-based learning, students can hone their social skills by learning in groups. Projects resulting from project-based learning can also be a proof of student self-development. This is because the work or artifacts produced from this project-based learning are authentic and original, which is the original work of the student [6].

Project based learning proofed as the method which can increase students' critical thinking skill. As Djukri said that by applying project-based learning, it can affect students' creativity and critical thinking skill [7], [8]. This can happen because during the learning process, students will find problems to solve. Thus, the student's thought process can grow and develop according to his needs.

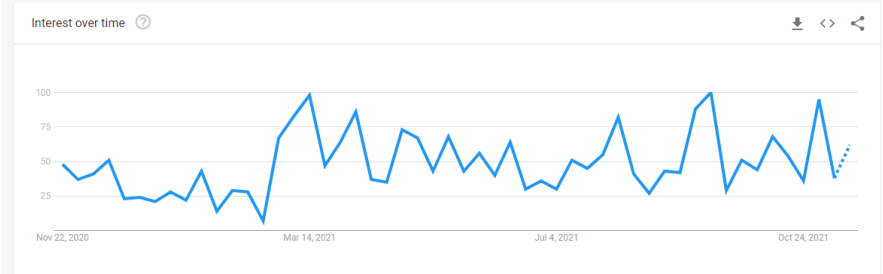

Figure 1 Project-based Learning Trend
(Sources: Google trend)

Project-based learning trend in Indonesia, based on the Google Trend Search, the number of it is still high nowadays with the up and down graphic. So, it can be defined that project based learning is relevant in learning today. As mentioned by Bell [9] that Project-Based Learning is an innovative learning method that teaches a multitude of strategies critical for success in this 21st century.

2.2 Design Thinking

Design thinking is a method of creative thinking in solving problems. This understanding is in accordance with the results of research that design thinking is a method to solve problems in innovative ways [10]. Design thinking methods are usually used also by researchers. The purpose of design thinking is to help find solutions to problems while creating them. Design thinking is also defined as an analytic and creative process that provides opportunities for a person to experiment, prototype, gather feedback, and redesign [11].

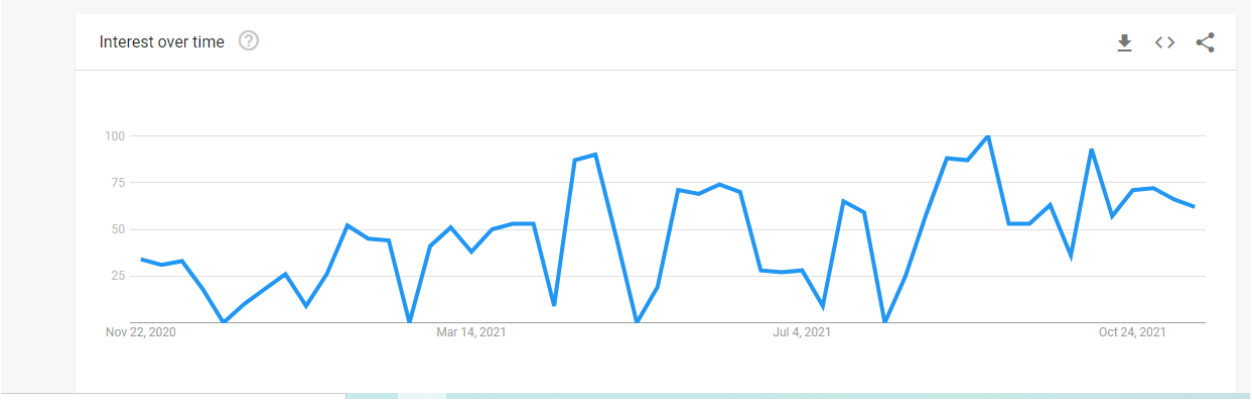

Figure 2 Design Thinking Trend

Design thinking trend based on the Google Trend Search has fluctuate graphic and the number of the trend is bit high. As also mentioned by Koh et al [12], design thinking is relevant to this era, 21st century learning, because design thinking will guide students to have their experiences of 21st century learning dimensions. There are five phases in design thinking: empathize, define, ideate, prototype, and test. The five steps are interconnected in sequence and no one should be left behind. The five stages are very necessary and become a complete process by continuing the next stage after one stage is completed [13]. This method of thinking design thinking is suitable for use in the 21st century era, seeing that in the 21st century students are required to have several skills, one of which is critical thinking skills and good problem solving. Design thinking can support a constructivist learning design. Constructivist learning is an approach of teaching and learning based on the cognitive construction [14]. Students will be able to construct their cognitive their selves. By the phases, design thinking approach guide students to find problems and understand it. After students find the problem that will be solved, they guided to define the problem they found. Students may find some resources to identify and define the problem. They may also find some topics related to the problem. After all, students may define clearly about the problem.

The third phase of design thinking approach is ideate. Here is the grassroot of the authentic masterpiece. In this phase, students should be able to think critically so that their idea will be the right problem solving. To be able to create an innovative problem solution. After students create their own idea or problem solution, students have to be able to make it real as the prototype of the solution. In this phase, the students' creativity skill is used. Students' must be able to be creative. When students have been able to make the prototype of their idea, it has already shown that students' have already develop their creativity skill [15].

2.3 21st Century Learning

21st century learning has a framework with some components included. In this 21st century, learning can be happened by different way with the previous era [16]. Some aspects are developed in this era. Such as the standards and assessments, curriculum and instruction, professional development, and learning environment. Besides, there are also some skills needed in this 21st century as mentioned in this picture below:

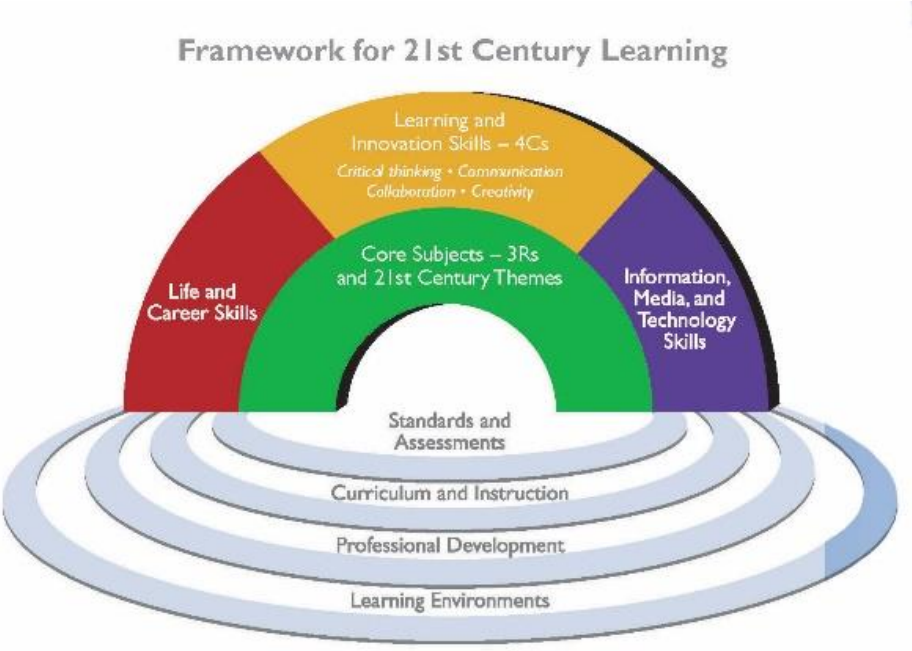

Figure 3 Framework for 21st Century Learning [16]

At 21st Century Learning Framework it is explained that there are several skills needed by every human being in the 21st century, especially students. These skills are called 21st century skills. 21st Century Skills are skills that need to be possessed by 21st century learners to support the optimization of learning and application in real life. 21st Century Skills are generally grouped into three, namely 4C Learning and Innovation Skills which consists of four skills (communication, creativity, critical thinking, and collaboration skills),

Life and Career Skills in the form of basic life skills and career support, and Information, Media, and Technology Skills in the form of skills that support learners as users and creators of technology and media that are closely related to the source of information (digital literacy). 4C Learning and Innovation Skills are directly related to learning, both in formal and non-formal education.

21st Century Skills are beneficial to learners in various aspects of life. The term 21st Century Skills includes the knowledge and skills necessary for a person to be able to face the world in the present and future [17]. Coaching or growing skills in the 21st century, especially to students, certainly requires assistance from teachers or facilitators of learning. 21st century skills can be integrated into learning by applying specific methods or frameworks. Methods or frameworks used in learning in order to cultivate 21st century skills should be synchronized with learning materials that will be given to learners. Thus, there is a good integration between learning materials, applied learning methods, and the purpose of 21st century skills coaching as one of the learning objectives.

2.4 PJBL Integrated To Design Thinking

Education today is not just about learning something new, but more than that, education is now about the way of thinking which involve problem solving and some decision making [18]. The problem solving and decision making itself are need some skills, they are creative and critical thinking.

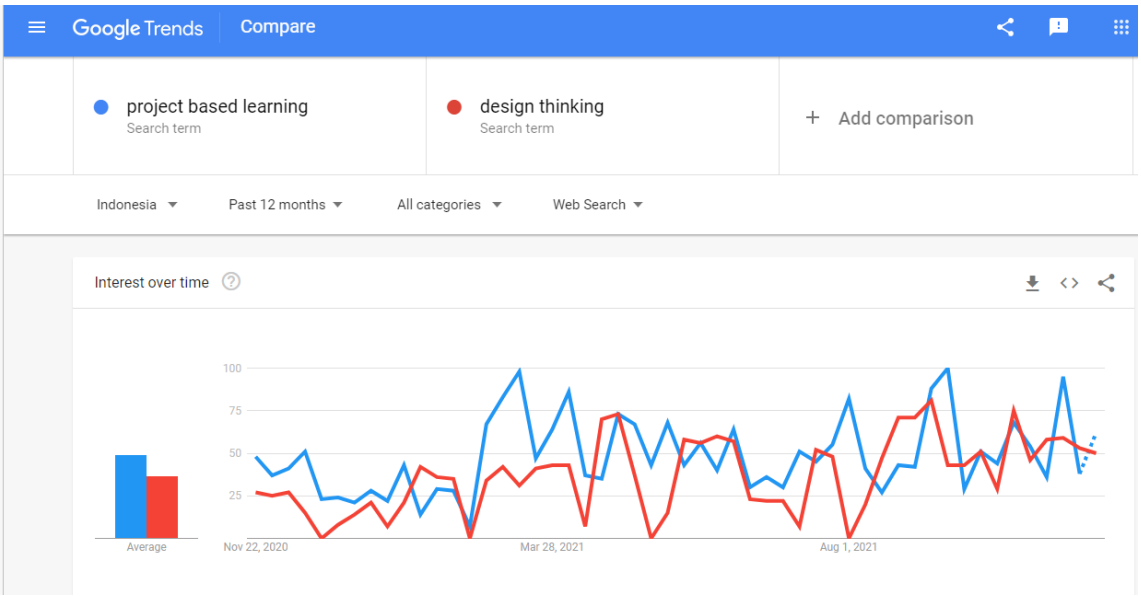

Figure 4 Comparation of PJBL and Design Thinking Trends

Based on the google trend search engine, the graphic trend of Project-Based Learning and Design Thinking are not much different. It can be decided that Project-Based Learning and Design Thinking are still have high trend number today.

Project based learning is a learning method that accommodate creative and critical thinking. the purpose of this method is to solve a problem by creating a prototype. Besides, design thinking is a thinking approach which has five steps that can be applied and integrated to project-based learning. Design thinking that integrated to project-based learning method can drive to some students' innovation. So, this approach could be formed as innovations and human-centred design approaches education [19].

The role of design thinking approach here is to help the learning design itself which use project-based learning method so that the syntax of this learning method can be more detail and the steps are more specific. By applying the project-based learning integrated with design thinking approach, students are expected to be helped in learning process. Project based learning integrated to design thinking approach can be used for learning with project as the main purpose.

Design thinking has the similar purposes with project based learning. They are guiding students to be able to solve the problem. Design thinking is a design of problem solving process which can be applied into multiple disciplines [20]. In learning discipline, design thinking might be applied by integrating it into a learning strategy or learning method or something else. By seeing the main purpose, design thinking might support a learning method which so applicable in this 21st century learning. It is project-based learning method.

Project-based learning can be integrated with design thinking approach to be applied in to a learning process. As Parmar mentioned that integration of design thinking to project-based learning can create a critical role in class [21]. So, the syntax of the project-based learning

could be combined with the design thinking phases the by the new framework for learning. It would help students to do the learning. Integration of design thinking to project-based learning could create a new learning approach which can increasing the students' innovation [19]. This integration focus on the steps of the learning process. Combination or integration of both phases will be mentioned in the table below.

Table 1. Integration Syntax of PJBL and Design Thinking

Project-Based Learning	Design Thinking
Choosing Topic	Empathize
Searching Resources	Define
Organizing	
Developing Thought	Ideate
Coordinating	Prototype
Reflection	Test
Follow Up	

3. CONCLUSION

Project based learning is a learning method which support students to increase their critical thinking skill by doing a project. Project is the main purpose in this method. Critical thinking skill might be increased by solving the problem as the step on this method. Besides, design thinking is a thinking method which has steps that might be helpful for students when they are solving problems. As a thinking method, design thinking can be integrated into learning method that has similar main purpose. That is project based learning.

Project based learning integrated with design thinking approach is a learning method which can be used in every subject which has problem solving matter and project as the main purpose. This learning method provides helpful syntax to guide students to construct their cognitive construction phase by phase. Project based learning integrated with design thinking may support the 21st century learning which has some challenges classified to some framework. The integration itself is about the combination of those two syntax.

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