Project-based learning efficacy in vocational education: Literature review

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Abstract. A shift in-demand skill in the workforce at the cognitive level and the need to adapt is a challenge for vocational graduates. Therefore a strategy is needed to enhance the 21st-century skills in vocational education. One of the strategies is implementing an active learning model such as Project-Based Learning. This article aim is to gather, summarize and integrate the quality of empirical evidence supporting links between Project-based Learning (PBL) and 21st-century competency framework. This study conducted with a systematic literature review. The data was collected from textbooks, journal articles, and internet searches. The result shows there are a lot of evidence of project Based Learning positive impact in fostering students skill in accordance to 21st-century competency framework including critical thinking, problem-solving, communication ability, collaboration ability, and creativity. The result also shows that several factors that could limit the effectiveness of PBL implementation including the teacher’s role, students’ roles, and other factors including equipment and the environment.

1. Introduction
Vocational graduates are now facing a challenge of 21st-century skills to survive in the industry. The importance of skilled and knowledgeable employees for the 21st-century workforce has led the vocational school to enhance the educational practices and methods which lead the students to gain the skills needed. The 21st-century competency framework focuses on some skills including critical thinking skills and problem-solving skills, communication, collaboration, creativity and innovation; media and technology literacy skills; and interpersonal skills in career development [1,2]. Introducing and enhancing those skills to vocational students is becoming more crucial to prepare them to adjust the fast-changing workforce life.

The learning environment should encourage students to engage in the process. Project-Based Learning (PBL) is one of the models that allow students to get more involved in the learning process. A lot of strategies critical for enhancing the 21st-century skills are taught in an innovative approach of PBL [3]. Project-based learning is an instructional model build based on learning activities and gives students various challenges through their assignment to solve [4]. John Dewey first proposed PBL in the 1890s, and since then, it has been elaborated and applied to various subject and learning situations [5]. PBL is usually done by dividing students into groups to achieve shared goals. In its implementation, students are asked to work on a project in a long time, from one week to one semester. Students are required to solve a real case or answer questions with high complexity [6].
The evidence of the relationship of PBL in enhancing the 21st-century competency framework among vocational students is examined in various researches. However, almost all of the researches that have been done only demonstrates a portion of the overall competency associated as a 21st-century competency. For instance, research only investigate how PBL could affect the student’s critical thinking or student motivation. The objective of this study is, therefore, to gather, summarize and integrate the quality of empirical evidence supporting links between PBL and 21st-century competency framework. The research questions were addressed including (a) What was the impact of Project-based learning on vocational education results, especially in terms of 21st-century skills? (b) What factors likely influenced the efficacy of project-based learning?

2. Methods
This study conducted a systematic literature review to investigate the efficacy of Project-based learning methods in vocational education. By reviewing relevant literature, we understand the breadth and depth of the existing body of work and identify gaps to explore [7]. The inclusion criteria of the literature included the implementation of a project-based learning model in a vocational school. The eligible article for this research could be either a learning practice report or a research report. The literature used in this study includes journal articles, book chapters, thesis results, and conference proceedings. The literature was set in the language both English and Indonesian.

The search was conducted using an online system to find relevant literature based on the research question. Thus, keywords for this research combine “project-based learning model” and “vocational education” The synonym terms also used, when appropriate, to reflect the inclusion criteria defined before. This search was conducted during November 2019 and the selection process involved three screening levels. The first level was identifying the titles matched the keywords that related the question research. The second screening level examined the abstract to meet the inclusion criteria. The last screening level was reading the full text to reassure the literature eligibility. The result will be reported descriptively with narrative content analysis approaches due to the heterogeneous data in terms of study design, populations involved, outcomes measured, etc.

3. Results and discussion
There are various researches regarding a project-based learning model implementation. However, there is only a small number of researches conducted a PBL model on vocational education. After conducting two steps of the screening system, there were forty-seven articles meets the criteria. The final screening in this research had led to fourteen articles that meet the inclusion criteria to answer the research questions.

The first area of 21st-century skills is critical thinking and problem-solving, communication and collaboration, also creativity and innovation. Regarding those skills framework, evidence show that PBL could enhance vocational students skills. PBL is then known to have a positive impact on improving various skills including critical thinking, cooperative skills, problem-solving abilities, creative thinking, communication abilities, students’ motivation, and also vocational skills. The limitations and the drawbacks of PBL’s implementation process found in various researches then become essential factors affecting the efficacy of PBL. The result details are written as follows.

3.1. The impact of project based learning on vocational education results

3.1.1. Students’ motivation. Vocational students have low learning motivation since the enrolment for new students does not require a high score. Thus, it is common for vocational students to have under average score [8]. PBL naturally encourages learners to play a key role in all stages of the project, which increases their motivation to learn [9]. The students who are educated by multiple intelligences supported with project-based learning methods are more successful and have a higher motivation level. The process encourages students to get more involved although they most likely have doubt at the beginning. Hence PBL Methods made students’ motivation continuously grow along the process [10].
3.1.2. Communication ability. The implementation of PBL has dealt with teamwork as stimulation for interactions and students could integrate their language skills, social skill and technological skills [11]. The PBL helps students develop positive communication skills through certain ways like deliver the presentation where they can try to explain and to convince audiences. Discussion among the groups also helps students to defend their ideas at the same time they learn to listen to the opinion of their peers. Students can deliver a more understandable presentation after getting the PBL treatment [12].

3.1.3. Critical thinking skills. Project-based learning is perceived as potentially more interesting for students and teachers and more successful than traditional approaches for developing high-order thinking skills. Proved by the research result that confirmed the effectiveness of the constructivist approach for developing students' ability to ask questions, to query information that does not include sufficient data and to take a reasoned stance [13,14]. Using the right media to help the PBL process could accommodate students to understand the material by providing direct learning experiences the increase their interest, activeness, and interaction to improve their critical thinking [15].

3.1.4. Students’ creativity. Students’ creativity enhances during the process of PBL. PBL is one example that could improve students’ creativity. PBL provides good conditions for creativity by integrating creativity training into the curriculum and Stimulate with project tasks that will motivate the emergence of individual creativity and group creativity [16]. The study also shows that the application of contextualized learning problems could improve the aspect of originality in creativity and problem understanding in problem-solving skills, which was usually difficult to improve [17].

3.1.5. Problem solving ability. PBL could facilitate the problem-solving ability of vocational high school students. It is not only enlightening the general education but also encouraging vocational education Through PBL activities, the student gains the problem-solving ability and might implementing the ability to the practical situations which they might face in the future [10]. The aim of PBL as active learning for students is to address different learning styles, adopting deeper approaches to subjects relevant for their professional or personal development, and advancing students to higher development levels including problem-solving ability and higher-order thinking skills [18].

3.1.6. Cooperation and collaboration ability. The PBL has several characteristics that make students dynamically active, also provides an opportunity for interdisciplinary study for completing the various stages of the project [19]. The strengths of PBL implementation deals with teamwork as stimulation for interactions and stimulate social skills [11]. Peer also gives a crucial function as a regulatory force that is often more powerful than the teacher’s requests, as social ties, peers have an important role in gaining student motivation and achievement [5,20]. PBL creates an environment that accommodates students to engage with their peers through several stages to finish their work together as a team. Furthermore, PBL also makes the student more confident to communicate and collaborate with a group of people that could be beneficial for their future.

Despite the 21st-century skills, PBL also has several effects on other aspects. PBL has a positive impact on improving the level of content knowledge among students [21] and improve vocational skills [22]. Implementation of PBL improves the productive competence of students [23]. Next, PBL approaches develop self-direct learning skills among learners [9].

3.2. factors influenced the efficacy of project based learning
Although there is a lot of evidence that shows that PBL has a positive impact on improving student skills regarding the 21st framework skills, it is not necessarily the same in every situation. According to the studies, various factors influenced the efficacy of PBL implementation. These various factors are grouped into factors originating from the teacher, students, and other factors besides the said factors.
In the implementation of PBL, teachers need to understand and master the stages of the implementation along with the expected results of each stage. To enhance students’ skills, the teacher needs to master those skills. The ability to solve problems and to improve the content knowledge and skills is a challenge, especially to deal with students with low ability, lack of motivation and lack of focus, the lecturers/teachers should be more patient [19]. Next, a teacher is obligated to ensure students remain focus and have a deep understanding of a concept and a teacher also has to give immediate feedback and evaluate on students’ work [24]. Mastery of the latest technology is also important for teachers to manage PBL classes.

However, students also have an important role in the successful adoption of PBL. The attitudes of students are essential to prepare students to face similar challenges in a professional life work environment [25]. Students also need to conduct student self-management in accordance to manage the time effectively. It is important to divide students in a more heterogeneous group consist of the various capability to ensure students who have a weakness in the process could be helped with their peers.

Other factors that influence the efficacy of PBL implementation are providing tools or media to complete the project. Accessible location is also preferable to save time and cost consuming, arrange sufficient time and set the time limit for a student to finish their project. Create an equal level of agency and participation of group work, using suitable assessment tools to monitor progress reports, and create a conducive learning environment that comfortable for both teachers and students. To implement effective PBL not only depends on the teachers’ interdisciplinary competency, practical knowledge, work experience, and employed approach and method but could also depend on the equipment involved, as well as the surrounding environment [26].

4. Conclusions

There are a lot of evidence of project Based Learning positive impact in fostering students skill in accordance with 21st-century competency framework based on the literature review of several studies. PBL is proven to improve student skills as the said system. However, several factors that affect the efficacy of PBL implementation. The factors then categorized as teachers’ roles, students’ roles, and other factors including equipment and the environment.

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