



A Systematic Review of Project-Based Blended Learning as an Innovative Teaching Model

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Abstract. To meet the demand of 21st-century skills, an innovative teaching approach is currently used at several education levels. Lately, the recent interests have considered in project-based learning (PjBL) through blended learning as a new teaching strategy. This model has a lot of uncovered information to be explored along with its implementation. This present study serves as an overview of several works regarding the use of project-based blended learning (PjBBL): How do researchers implement this approach in the teaching-learning process? What are the impacts on teachers and students? What are the challenges found by those studies in this field? In order to give valid information due to these questions, this paper presents a systematic review of research publications of several databases in the recent decade. Inclusion and exclusion criteria are also adopted in selecting articles process. The review covers (1) the overview of the implementation of the PjBBL model in these studies, (2) the effect of this mode toward educators and learners, and (3) the barriers covered by the works in this field. Furthermore, a critical discussion on the synthesis of the current studies is also served in this paper.

Keywords: blended learning · project-based blended learning (PjBBL) · project-based learning (PjBL) · systematic review

1 Introduction

The changing of learning mode into blended learning platform has been a research topic over the years. Moreover, in the post pandemic of Covid-19, this mode becomes the most popular and effective learning method because it combines benefits of both conventional and online method in learning. Commonly, blended learning has several features in defining this mode based on the sequence of integrating process such as flipped learning, hybrid learning, inverted learning, and blended learning [1]. Basically, blended activities are carried out in the conventional face-to-face mode and also in online platform namely LMS Moodle system [2]. Moreover, blended learning is a combination of benefit teaching model of online method, traditional face-to-face mode, and also practice in order to get the effectiveness of education [3, 4]. Therefore, in this study, the blended learning covers the students' experiences in more than one teaching-learning method in which they learn in part of online platform and also have traditional learning activities.

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Literatures have proved that blended learning provides a lot of positive effect for examples: minimize uneasiness communication [5], improving autonomous learning motivation [6], adding more social interaction among students-students and students-teacher, flexibility of time and place [7], cost effectiveness, and also easy to modify [2].

The idea of combining blended mode with PjBL approach has gotten a big attention by researchers. Scholars have modified this teaching method with PjBL to fulfil the 21st century demand namely communication, collaboration, critical thinking, and creativity [8]. By applying this combination model, teachers have proper time to developing essential students' HOTS skills [9]. Other works have also revealed that this upgrade teaching model can improve students' writing skills [10], improving interesting learning attitude for students [2], improving students' creative thinking skills, improving students' HOTS ability [11], improving learners' self-learning ability and inquiry learning ability [12], increasing learning motivation [13], improving the students' achievement [9, 11] and also improving problem-solving ability [11].

In order to achieve the advantages above, there are some important aspect to be considered in implementing this learning model namely: making acquaintance, designing and testing, application, assessment, and evaluation and adjustment [2]. One of essential stage is designing PjBBL model. Designing learning model is not only crucial step in teaching process, but it should be the foundation of all the teaching-learning process. Therefore, by having well-design learning model, we can achieve the potential benefits of PjBBL.

Several works have reported the effectiveness of PjBBL in several field, for example in academic writing course [10], information technology in higher education [2], pre-service teacher [14], engineering students [15], undergraduate students [16], self-study capacity in high school student [3], students in photoelectric department [12], engineering students [11], ICT engineering education [17]. However, these studies are very limited in providing clear design of the learning process in PjBBL model. Some studies are only reporting a brief report of their implementation; the advantages, disadvantages, and also the its difficulties. For example, the work of [18] which examined the impact of PjBL using Edmodo in inquiry skills and academic achievement using pre-test post-test design did not present any specific information about the learning design of PjBBL and it specifically report about its advantages and barriers due to the implementation. Similarly, the research of [14] that report the implementation of PjBL in improving teacher candidates' skills in designing learning program is only limited to three components during the implementation without further explanation about the learning model design. Another studies of [10, 13] have different perspective of PjBBL approach in academic writing. They brought all the activities in online platform namely CANVAS, MOOC, SPOC, and Classroom Zoom. Therefore, the idea of PjBBL needs to be clear in order to getting the benefit of this new learning approach.

Apparently, the PjBBL literature is needed to provide detailed information about the learning model/design as important component in this mode. As a blended learning principal is based on two instructional part namely conventional mode and online learning. This means that students have to experience more than one learning platform which a part of traditional learning and other part of online learning. Therefore, we aim to give

clear picture about the PjBBL model. We also look to the effect of this mode toward educators and learners and also the barriers. By attention of this objective of this study, we consider to education publication paper about PjBBL model. This paper is divided into four sections. The literature research process is explained in methodology section, followed by results finding and discussion. The last section is about limitation of the study and conclusion and recommendation in conclusion section.

2 Method

2.1 Research Design

A systematic review was implemented as a methodology of this study. To answer the problem formulation, a systematic review of the research results was carried out using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Protocol. The articles studied were articles obtained from two databases, namely Eric and Proquest, which were published in the last ten years, 2013 – 2022.

2.2 Inclusion and Exclusion Criteria

The inclusion criteria used were papers containing PjBL in a blended learning environment. PjBL referred to in this study is learning that uses projects as the main vehicle for students to learn, not just learning that produces projects/products. Meanwhile, blended learning is learning that combines face-to-face learning modes with online as a unit. Online activities are not just for enrichment for students, nor are they just for giving assignments. In blended learning, there is a portion of the material that is taught online, and another part through face-to-face.

The exclusion criteria set included non-research articles, such as book chapters and literature reviews, articles that only focused on one of the PjBL or blended learning, non-English-language articles, and articles that did not full text is available.

2.3 Literature Search

The keywords used for searching the articles were keywords that similar to PjBL and blended learning. The keywords include “project-based learning” AND “blended learning”, “project-based” AND “blended learning”, “project-based blended learning”, “blended project-based learning”, “project-based learning” AND “hybrid learning”, “project-based hybrid learning”, “hybrid project-based learning”, “project-based learning” AND “online learning” AND “face to face”, “project-based teaching” AND “blended learning”, “project-based” AND “blended instructions”.

The stages and results of searching the articles are given in Fig. 1. The first search on Proquest and Eric databases yielded 896 articles in total. By implementing exclusion criteria, the final number was only 14 articles.

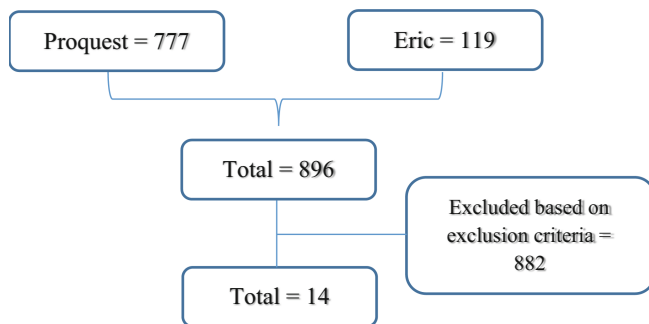


Fig. 1. Literature search overview

3 Result and Discussion

In this paper, general overview of the articles analyzed is presented as a result. This section has three main points namely: (a) general design of PjBBL implementation, (b) its effect toward teachers and learners, and (c) the barriers during the implementation.

Briefly, there are 14 articles analyzed in this work. Two third of articles were from various countries: China (2), New York (1), turkey (1), Indonesia (4), Brazil (1), Vietnam (1), Cyprus (1), Finland (1), Saudi Arabia (1), and Taiwan (1). The articles analyzed mainly conducted in higher education and university level with heterogenic major of disciplines for examples: English department, science, education department, and engineering. All the works tried to examine the effectiveness of PjBBL in their place by conducting several studies for example, R&D, experiment class, and survey test.

3.1 The Overview of the Implementation of the PjBBL

PjBL in a blended learning environment is a new learning mode as an upgrade to both conventional learning and fully online learning mode. Today, this learning mode is looked as the most effective and efficient learning model adopted by educators because of its advantages of both face-to-face learning and online learning. Since the higher attention in adopting this instruction, the detail design of PjBBL application is needed to achieve the benefit itself. This section answers the first research question of this work by reporting the learning model/design used in implementing PjBBL model in class. The detail information about the various model used by scholars in applying this new mode is shown in Table 1.

From 14 articles that review in this study, only a few of them give detail information about the learning design. The study of [10] has different implementation of PjBBL model. They brought all the activities in online setting without reducing the interaction activities on all the learning stages. In implementing this model, they designed the class into three stages namely; before class: MOOC/SPOC learning, in class: zoom conference, after class: canvas management and WeChat interaction. Before the synchronous learning via zoom, the learners were required to learn independently on MOOC/SPOC. They watched three videos and had post-test to check their understanding about the materials given. In online class, the teacher and students virtually met to have discussion or sharing

Table 1. Learning Stages Applied in PJBBL

Learning Stages	Articles
Pre-Class, In-Class, After-Class	[10]
Offline Learning, Online Learning	[2]
Lecturing, On-Line Learning, Class Experience	[14]
Online Learning, Conventional learning	[15]
Online Learning, face-to-face meetings	[13]
Classroom, Online Learning	[3]
Before Class, In-Class, After Class	[12]
Online Learning, Classroom activities	[11]

about their thought related to the topic. In the last stage, learners were required to do project-based writing assisted by canvas management. The students did the project in group of three, and also had interactive discussion by WeChat.

On the other work done by [2], the implementation of the PjBBL was in 15 weeks including conventional face-to-face learning in class and online learning. Firstly, the students joining classroom activities in group divided by the teacher. After that, they continue learning by online mode. In the online learning activities, the students had several tasks such as individual task, group assignment, mid-test, and final exam. This study focused in exploring the form of assessment in the implementation. The finding revealed that the peer assessment done for group task give more positive and transparent evaluation, stimulate students' engagement and promote independent learning.

The other work in exploring this effect of this model was done by [15]. The experiment class using a PjBL approach in blended mode in 12 weeks. The videos and learning materials were posted in Moodle before class. The teachers gave post-test to ensure the students understanding. To support the learning process, the intra-group and inter-group discussions both in class and online were provided. The other research of [14] applied PjBBL model by combining formal class and online learning in three components namely mentoring, virtual learning, and developing skills in the class experience. They found that by applying this new model, the learners' creative thinking skills can be developed well. In line with this study, Alberto [16] tried to implement PjBBL in multi-campus. Before class meeting, the researchers gave the information about schedule through blog website. The online class came first along with project and discussion in blog. After that, there were four conventional class which had conducted in three hours long. Each meeting has their own purposes for example, the first week is giving course information. The second one is for giving detail information about the group and the initial task. The last is for giving feedback about the project.

Ref. [12] had developed PBBL Teaching model such as before class, in class, and after class. As shown in flowchart, students had to watch the project micro video and do the task, after that in group network communication, they did report preparation. In class, they did the project and intergroup evaluation. Simulation experiment and innovation activities had done after class. The students had also make group project summary and

had problem feedback through network. The newest study of [11] proposed blended PjBL model that took eight weeks of treatments. In the first week, the learners had creative thinking test to determine their ability level. The experimental group had done PjBL model in which meeting 1–3 had done in classroom, and meeting 4–8 were through Edmodo. The last stage was conducting an assessment of learning process.

3.2 The Effect of This Mode Toward Educators and Learners

In this section, we tried to look at the articles in which explored the impact of PjBL on both teachers and students. The influence of this new learning model is stated in Table 2.

The majority of the studies in this way reported on the effect of PjBL implementation on learners. It includes, for examples, the impact on students' literacy (4), Learning Outcomes (3), Emotional Dimension (Self-efficacy, motivation, and attitude) (4), Problem-Solving Skills (4), and Collaboration and interaction, thinking skills (4). The finding of these studies reported that learners have positive impact toward the implementation of PjBL, for examples,

Students' literacy. Ozdamli and Turan [15] reports the effect of TS-PBL approach on 130 engineering students. The finding stated that the skills gained during the learning process significantly affect their future careers. Another article by [14] reported the finding of research with 32 teacher candidates in PjBBL model in 2021. The majority of sample had positive impact on their pedagogical knowledge since this mode provided various experiences both inside and outside the classroom. In line with this study, Dai et al. [3] also reported their work in 2021 including 125 students in the PjBL application. The results shown that the interaction provided in PjBL mode was fostering and developing learners' knowledge and skills including ICT skill. The students stated that by conducting PjBL mode as learning instruction, they were able to construct ideas together, plan the project, seek needed information, and solve the problems and doing various social interaction during the learning process. In the same year, Alamri [9] conducted a survey

Table 2. The Impact of PjBBL on Educators and Learners

Effect Categories	Sub-Categories	Articles
Teacher	Technological literacy	[3]
	Attitude	[18]
Students	Students' literacy	[3, 9, 14, 15]
	Learning Outcomes	[9, 9, 10, 19]
	Emotional Dimension (Self-efficacy, motivation, and attitude)	[2, 3, 10, 15]
	Problem-Solving Skill	[3, 14]
	Collaboration and interaction, thinking skill	[3, 14, 15, 19]

research toward 80 students on BPBL implementation. The study revealed that this approach required sharing knowledge, information and discussion. Thus, by implementing BPBL can enrich students' learning experiences.

Learning Outcomes. Ref. [9, 10, 19] had reported the impact PjBL on student's learning outcomes. Zhang and Chen [10] present the finding based on the data from 90 undergraduate students through formative evaluation that the students' abilities were significantly improved so it generally stated that by using PjBL, the students' learning outcomes meet the learning goal. Bachri et al. [19] conducted an experiment with pre-test post-test design of 67 students. They found that the PBRL with online mode gave positive influence on students' thinking ability and also their learning outcomes. Moreover, Alamri [9] conducted a survey research toward 80 students on BPBL implementation. The study revealed that this approach can improve learners' academic outcome and also enrich their learning experiences.

Emotional Dimension (Self-efficacy, motivation, and attitude). Ref. [2, 3, 10, 15] report positive effect of PjBL implementation on students' emotional dimension. Zhang and Chen [10] stated that learners had positive attitude on this way of learning. In case study research, Nguyen [2], argued that majority of sample felt excited and satisfied toward the implementation. Ref. [15] report a research on effect of TS-PBL on engineering student. By implementing this method, students were motivated on learning process. Therefore, it can be stated that majority of sample had positive perception toward the use of TS-PBL. Another study [3], present positive finding based on observing the implementation process. They found that learners were very active, creative, and excited on the project.

Problem-solving skill. The findings notably in Table 2 from [3, 14] reported that PjBL implementation give effect on students' problem-solving skill. Ref. [14] argued that the PjBL mode required students to cooperate, listen, and being responsible to each other, and also settle arguments to understand how to finish the duties and solve the problems. This statement is supported by Dai [3] which conducted research in three high school in Vietnam. The finding revealed that the learning stages in PjBL model for example, selecting theme, problem-solving proposal, planning, implementation, presentation, and evaluation can improve students' problem-solving skill.

Collaboration and interaction, and thinking skill. The research in Table 2 [3, 14, 15, 19] have identified positive impact on students in the form of Collaboration and interaction, and thinking skill. For instance, ref. [14] provides a fact that after PjBL implementation, there are a significant effect on the students' thinking skill. This skills was recognized in very good category. Another ref. [15], had conducted study on 130 engineering student toward the effect of TS-PBL utilization in 2017. The finding revealed that students were motivated to work and finish the project collaboratively. Moreover, PjBL mode is significantly impact the learners' spatial thinking ability due to its learning activities [19]. This statement is also in line with the finding of [3] which found most of the students could develop their own ideas collaboratively, and have more interaction with each other in PjBL learning setting.

Besides, there are two articles that reported on the effect of PjBL implementation on educators in which covered, for example, the influence on Technological literacy and Attitude. Articles [3, 18] are reporting the impact of PjBL implementation on teachers. In

Table 3. The Challenges and Difficulties During the PJBL

Obstacles Categories	Sub-categories	Articles
Technological literacy and competency	Lack of technological competency	[2]
	Lack of confidence	[15]
Technological sufficiency Challenges	Lack of internet connection	[15, 18]
Technological operational problems	Time consuming in designing the course	[2]

this study [3], the PjBL model was developed in four steps covering classroom and online meeting for 125 students of grade 11 of three high schools in Vietnam during 2019–2020. By observing during the implementation, the finding show that the teachers give positive feedback toward it. It reflected that applying PjBL was effectively developed learners' self-study abilities. In line with this study, the article of [18] which is done in pre-test and posttest research model of 72 prospective teachers stated that applying PjBBL by Edmodo platform is effective to improve prospective teachers' learning outcomes concerning measuring and evaluating class.

3.3 The Barriers Covered

The challenges and difficulties during the implementation observed by scholars are varied. They mainly concern with three main categories for example, Technological literacy and competency, Technological sufficiency Challenges, Technological operational problems which have identified in Table 3.

There are several problems faced in the use of the learning model. For example, designing the learning activities, spending a lot of time and effort in doing assessment and controlling the learning activities, and students still unfamiliar with the new model [2]. The study of [15] stated the internet connections and communication made the challenge even more. In line with the finding, Hursen [18] found internet connection and insufficient of technological devices as the obstacles in the implementation.

3.4 Discussion

Implementing new learning model in class has to have a clear learning design in order to get its benefit effectively. Currently, many scholars have adopted PjBBL to teaching their students. The finding of this present study has identified several learning designs in implementing PjBL mode done by stakeholders. As briefly, the learning setting can be summarized in Fig. 2:

Overall, our review found that there are two main types of learning design used in the PjBL implementation. The first design is face-to-face learning followed by online class. This design has been reported used by [2, 3, 11, 15, 16]. The last design is online learning- in class- online learning. This mode is reported used in three study of PjBL implementation [10, 12, 14]. From our findings, we can suggest that face-to-face design consider as the most popular design used in PjBL implementation. Although, studies

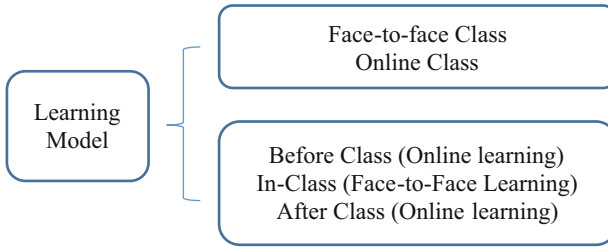


Fig. 2. Learning design in PjBL Implementation Done by Scholars

in PjBBL environment have propose various learning activity design, there is limited of them in which give detail description related to the implementation. The clear and unambiguous learning design in implementing new learning mode is very important due to receiving its benefit.

Secondly, our work has discovered the impact of PjBL mode implementation on both teacher and learner. Our review found that the effect of this new mode mostly influences on students. This is in line with the concept of PjBL concept in which requires student-centered learning. The effects include five sub-categories namely Students' literacy, Learning Outcomes, Emotional Dimension (Self-efficacy, motivation, and attitude), Problem-Solving Skill, and Collaboration and interaction, thinking skill. This finding is related with the literatures which reveals that blended learning with project based approach can increase students' creative thinking skills [20], students' HOTS ability [11], learners' self-learning ability and inquiry learning ability [12], improve learning motivation [13], the students' achievement [9, 11], and also problem-solving ability [11]. From our finding, we understood that scholars have tried to find the best teaching-learning approach which provided a lot of benefit for both teacher and students.

On the other hand, the challenges and problems faced in applying this model has been identified in this review. There are three main categories of barriers detected of PjBL implementation, for example, Technological literacy and competency, Technological sufficiency Challenges, and Technological operational problems. The result of this finding can be summarized that lack of internet connection become the most popular problem in implementing this new model. From the study, we can realize that the challenges, for example, lack of technological literacy and competency of both teacher and learners are related to lack of training given by school or institution. Likewise, lack of technological sufficiency namely lack of internet connection is as a mirror that institution has not effectively and optimally supported the teaching learning activity.

Several intentions on exploring the advantages of PjBL model as new learning mode, but few of them have actually addressed the best PjBL design for effective implementation. In order to get maximal benefit of learning mode, the detail information of the implementation is needed covering the learning design, assessment, and evaluation. Moreover, the challenges of PjBL implementation are combination of conventional and online learning problem which in different domain. Therefore, for providing accurate solution in blended learning used PjBL domain, further research is recommended to do so.

4 Conclusion

This paper presents a systematic review of literatures dealing with PjBL implementation. We discuss the learning design used in Problem-based blended environment learning, its impact on both educators and learners, and also discovering its barriers. From the review, we can conclude that face-to-face followed by online learning become the most popular learning design used in PjBL implementation. This learning mode is majorly influencing the learners since this model required student learning center in which give various learning experiences. However, in the utilization this learning approach, the lack of technological sufficiency for example of insufficient of internet connection is identified as the most problem faced during the implementation.

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