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A Systematic Review on Challenges and Research Gap in Project-Based Learning Strategy

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Abstract

The 21st century learning requirements are different from the 20th century learning requirements. Now the critical thinking skills are the necessary requirements for the learning. So, to achieve the critical thinking skills various new learning techniques and strategies have been developed and applied. By applying new learning methods and strategies, various challenges have been faced by the researchers and instructors. The objectives of this study were to highlight the Project-Based learning strategy used in different educational levels, to discuss the challenges and their solutions and to present the research gap in the project-based learning strategy. This study will help the researchers and instructor to do more researches on the challenges and solutions of the Project-Based Learning.

Key Words: *Critical Thinking Skills, Learning Strategies, Instructors, Learners, Problems.*

Introduction

Learning is an important element for the development of a country. Various learning strategies are available for teaching- learning process (Hafeez et al., 2020). Project-Based Learning (PjBL) strategy is a constructivist learning-teaching strategy in which the students work together on a project to find the solution of a specific problem (Kokotsaki et al., 2016). This learning strategy allows the learners to actively participate in the learning process (Chen & Yang, 2019). Further, the learners become active in searching the solution of problem and decision-making ability by increasing their practical knowledge and critical thinking skills (Anazifa & Djukri, 2017). Sasson et al., (2018) stated that PjBL develops scientific knowledge of the learners by following the scientific process. The learners try to find the solution of the real-life problems by observations, questioning, discussion, experiments, data collection and analyzation and drawing results. Actually, in PjBL the learner takes the responsibilities and work together as a team member (Widyaningsih & Yusuf, 2018). In PjBL, there is a close relationship between the learning process and in the nature (Dimmitt, 2017). Moreover, PjBL increases the learner's metacognitive skills and they make useful plans and assess their solutions of the problems (Uziak, 2016). Finally, the learners achieve better academic grades by producing more learning environments (Gary, 2015). Helm & Katz, (2011)

proposed in a study that there is no solid lesson plan available for the Project- based learning. This allows the learners to think deeply and investigate thoroughly. In PjBL, the work is assigned to every member of a group individually or collectively. The topic is selected with the help of teacher. The topic of a project work consists of a real-life problem that have to solve by conducting an experiment on the project (Birgili, 2015).

PjBL brings opportunities for the learners to increase their cognitive skills and improve the academic achievements. Each member of a group works to find the information on a particular topic selected for the project. Thus, each learner or group of learners offer different solutions of a problem (Trisdiono et al., 2019; Hafeez, 2021). Then the information from each group members is collected and transferred in the form of document. This written document is used for the experiment to find the solution of the problem (Bell, 2010). The results of the project works are discussed with the teachers and other learners in classroom (Sada et al., 2016). Barak, (2012) suggested in a study that PjBL improves the self-learning abilities and promotes conceptual and motivational learning. The important characteristics of Project-Based learning are illustrated in figure 1.

Figure.1: Characteristics of Project-Based Learning Strategy (Robinson, 2013)

Han et al., (2015) concluded in a study that PjBL provides challenge and freedom to the learners to work collaboratively. This strategy develops high level of learner's engagement. The results of the project are presented in form of videos, Maps, Photographs, Models and sketches. PjBL strategy has a closed relation with the other pedagogical stratigies like Problem-Based learning (Bédard et al., 2012). In another study, (McGibbon & Van Belle, 2015) argued that the learners actively participate in the project-based learning process to share their ideas in the group and find the possible solutions of the problem.

Purpose of the Study

Many studies have been found in the literature about Project-Based Learning (Beier et al., 2019; Ngereja et al., 2020). The perception about the challenges and effectiveness of project-based learning in different level of educational studies is still to evaluate further. So, the objectives of this study are (i) to present the effectiveness of project-based learning strategy at different educational levels (ii) to highlight the challenges, their possible solutions and research gap for implementing Project-Based Learning strategy.

Review of Literature

The PjBL is a constructivism learning strategy involving construction and transformation of new information to the learners (Oguz-Unver & Arabacioglu, 2014). In PjBL, student give the solution of the problem by indicating the problem, discussing about the problem, designing procedure to solve the problem, collecting data and analyzation of data and sharing the results with their learners (Stefanou et al., 2013). According to the study conducted by Chiang & Lee, (2016) PjBL is a systematic teaching-learning process which enables the learners to solve the complex real-life problems, present their results before the audience for implications. This teaching strategy also increases the life-enhancing and knowledge acquisition skills of the learners.

Factors Effecting on Implementation of PjBL Strategy

The study conducted by Al-Balushi & Al-Aamri, (2014) concluded that PjBL instructional strategy can be implemented with little available resources like traditional lecture strategy within the time allocated for learning in the classroom on a particular topic. The 21st century is an age of information and technology-based learning. The modern sources of technology are the major helpers for the learners to easily understand the design and development of a project and digitally document their whole learning process (Patton, 2012). Now the information technology has become an effective and necessary part of all the learning process especially for the constructing knowledge building process in project-based learning (Wekesa & Ongunya, 2016). However, Aldabbus, (2018) pointed that the learners need to be supported and guided in applying information technology effectively and safely to create the effective and critical thinking learning environment. So, the application of information technology is an important factor for the implementation of PjBL strategy.

According to the study of Lestari et al., (2019) the effective implementation of PjBL in the educational learning process lies on the instructor's abilities to successfully incorporate the information technology in PjBL and continuously motivate and guide the learners during the whole project. The effective and dynamic instructions with quality experiences from the instructor will assist the learners to build their knowledge in the learning process and reduce the cognitive load of the learners (Woods, 2014). The important factors for implementing Project-Based Learning Strategy are illustrated in figure 2.

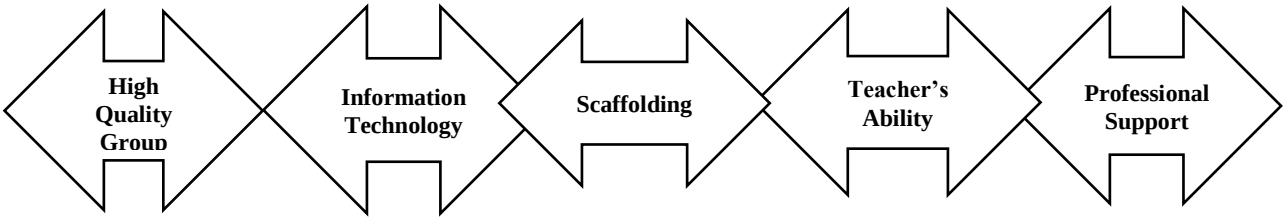

Figure.2: Factors for Implementing Project-Based Learning Strategy

Teacher's Motivation in Using PjBL

The application of PjBL in the classroom also increases the motivation of the instructors. By implementing PjBL, the teachers explore their abilities by using the various technological tools. The teacher's motivation increases when they explore new knowledge and implement this knowledge for social and industrial applications (Revelle, 2019). By conducting PjBL learning in classroom, the teaching strategies of the instructors also changed according to the learner's abilities and project requirement (Rahardjanto, 2019).

Habók & Nagy, (2016) conducted a research to evaluate the effectiveness of PjBL learning on the student's and teacher's confidence and motivation. The study concluded that after working on the project, motivation of teachers and students improved significantly for learning process. In another study Gómez-Pablos et al., (2017) indicated that the motivation and involvement of teachers and learners increased during the project-based learning. The study conducted by Wongdaeng & Hajihama, (2018) also improved the learning process and motivation of the teachers and learners.

Table.1: Stages for Implementation of PjBL

No	Stages	Description
1	Decision	The decision is made by the administration, managers and instructors of Higher Education Institutions.
2	Preparation	Some institutional and organizational changes can be made during the preparation of the project according the industry and business demands.
3	Incorporation of PjBL into course curriculum	To integrate the Project-Based learning into course curriculum, the curriculum committee reviews the existing course content.
4	Business and Industry sector involvement	It is one of the difficult stages. The incorporation of PjBL needs a lot of efforts to make it commercial.
5	Preparation of instructors for PjBL	The instructor's trainings are conducted at this stage to make the project useful for commercial purposes.

Project-Based Learning Strategy in Different Educational Studies

Many studies have been conducted to prove the effectiveness of PjBL in various subjects and in different levels of education (Rosyida et al., 2019; Ulya et al., 2020). Most of these researches work were based on pre and post-test quasi-experimental design in different subjects and at different educational levels.

PjBL in K-12 Education

Project-Based learning is an instructional strategy in which the instructors and students work in a group to find the solution of a problem in real-life. Many researchers conducted the research to evaluate the effectiveness of PjBL in K-12 studies (Chen & Yang, 2019; Saleh et al., 2020). The previous studies have extensively reported positive effects of PjBL in K-12 studies. Angelle, (2018) conducted a review to evaluate the effectiveness of project and problem-based learning on different levels of education especially on K-12 class. The results of the review indicted that PjBL is more effective than the problem-based learning. The students' academic and critical thinking performances improve in project-based learning. The students thinking behavior and mental ability also increase in project-based learning process. Jacques, (2017) conducted a study to examine the effectiveness of PjBL in K-12 class in mathematics subject. Two groups were made to evaluate the PjBL. One group studied with traditional lecture method and other as PjBL. The results of the study indicated that the academic achievements of students were better in PjBL. The learners also achieved better creative and critical thinking abilities by PjBL process. Togou et al., (2020) concluded in a study that the PjBL improves the cognitive skills of the learners by increasing their critical thinking skills. Moreover, they also concluded that the learner's ability to deal with the business and social community also improved by project-based learning.

PjBL in Engineering Education

A lot of studies have been done on the effectiveness of PjBL in Engineering and technology education (Hellany et al., 2019; Pérez & Rubio, 2020). The PjBL in engineering education is conducted to clear the concepts and principles of scientific process. Aqlan & Nwokeji, (2018) conducted a research to evaluate the effectiveness of PjBL in industrial engineering. The outcomes of the study indicated that PjBL improves the students learning and confidence level. The students worked collaborately and performed well in the learning. Christie & Graaff, (2017) proposed in a study that PjBL is an important instructional and learning strategy in engineering education. The students that work on the projects have better command on the subject matter. The students that worked on the projects in their degrees performed well in the industry

and social matters. Naji et al., (2020) conducted a research to evaluate the effectiveness of problem-based and project-based learning in Civil Engineering course. The study conclusded that the learners who worked on the project performed well in their studies.

PjBL in Social Science Education

The social science education is related with the studies of the social behavior. Many researchers have done the researches on the application of PjBL in social science curriculum including (Arantes et al., 2018; López et al., 2020). Oh et al., (2020) conducted a research to evaluate the effectiveness of PjBL in sociology. The study concluded that students performed better during the work on the project. Indahwati et al., (2019) conducted a research to examine the project-based learning in Physical education. The study concluded that the learners achieved better academic achievements in the subject matter. Moreover, the students critical thinking skills also improved.

Challenges in Implementation of Project-Based Learning

Various challenges have been indicated by the researchers in their researches (Lewis et al., 2019; Wilson, 2020). Some important challenges are stated in this study.

(i) Collaborately work

As Project-Based Learning is a group-based learning activity, Shpeizer, (2019) stated that both the instructors and the students consider the group work a challenge. Although, they know its benefits for future but they face a great challenge during its incorporation. The leaners attitudes towards collaborately work is uncertain. Some learners don't want to work collaborately with the other students.

(ii) Lack of Technical and Labor Skills

Technical and labor skills are necessary requirements for the implementation of PjBL. Nwokeji et al., (2018) suggested in a study that technical and labor skills are great hurdles for the implementation of PjBL in any country. The people in under-developing countries are less skilled so, it becomes very difficult to implement the project-based learning in under-developing countries.

(iii) Information Technology Problems

In the 21st century, the information technology is playing an important role in all the educational and instructional strategies. The information technology knowledge is also very important for the implementation of the PjBL. Vasilienė-Vasiliauskienė et al., (2016) conducted in a research that knowledge of information technology plays a vital role in Project-Based learning. Most of the Projects need the application of Technology in their execution. The developed countries have better sources of information technology, so they can easily incorporate the information technology in their projects while, the under-developing countries have limited information technology sources so, it is very difficult to implement the Project-Based learning in under-developing countries.

(iv) Time Management

The time management is another challenge. The Project-Based learning is very time-consuming learning strategy. According to the study conducted by Keator et al., (2016), the PjBL strategy follows the scientific

procedure for its results. This scientific process requires times to produce the results. So, implementation of Project-Based learning strategy is a time-consuming process.

(v) Social Challenges

Some project works may harm the population partially or fully. If so, then it becomes difficult to implement the project-based learning. Kumar et al., (2020) conducted a study to view the effects of project-based works on the population and in social context. They concluded that it becomes very difficult to continue the project works in a region where it is affecting the population or other social culture.

(vi) Funding Problems

Funding is also an important requirement for the implementation of PjBL. Without availability of funds, it becomes difficult to incorporate the PjBL. According to Rice et al., (2016), if the funds made available for the implementation of PjBL approaches, then the industrial sector of a country progress and becomes a researcher country.

Solutions of the Challenges for Implementing PjBL Strategy

(i) Regular Trainings

The project-based learning requires skilled teaching faculty and labors. So, by conducting regular trainings of faculty members and labors the required skilled person can be prepared for the implementation of PjBL.

(ii) Free and Non-Stop Resources of Information and Technology

The implementation of PjBL requires information technology resources to execute the performance of project works. So, a free and non-stop information technology resources must be provided to the project works.

(iii) Funds for Project-Based Learning Strategy

The project-based learning need funds for the implementation. So, the Government and NGO'S must provide the funds for the project-based learning.

(iv) Interactions between Industry, Society and Institution

To conduct the Project-based learning, it is necessary that there is a close link between the society, industry and institutions.

(v) Time Management

By doing proper time management, this challenge can be resolved.

Research Gap in Project-Based Learning

The researchers and instructors have always been trying to find the right and useful learning strategy for human and industrial development. For this, several learning strategies have been developed and applied till today (Kendal et al., 2018, Chen et al., 2019, Biwer, et al., 2020). All these learning strategies have developed according to the local and international learning environment. There are very few studies found in the literature in which challenges and their solutions are present. So, to discuss the challenges and to present their solutions, more research is needed in the project-based learning Strategy.

Discussion

Project-Based Learning strategy is a highly skilled and Practical based learning in which a systematic process is followed to solve the real-life problems. According to (Terasawa, 2016), the implementation of PjBL requires high level of technical skills. In under-developing countries, the men power with high level of technical skills are not available. So, it becomes difficult to implement the Project-based learning strategy in the course curriculam. In the present study, project-based learning strategy in various educational fields and challenges for the implementation are reviewed. The review of literature showed that project-based learning strategy requires a proper planning and management for its implementation. It is a systematic and long-term procedure. In project-based learning, the scientific procedures and principles are followed to achieve the required results. The work is done collaboratively and then information's are shared to find the solution of the problem. The challenges highlighted in this review are in pipeline with the study conducted by (Brassler & Dettmers, 2017; Spikol et al., 2018). According to the study conducted by Mahasneh & Alwan, (2018), the implementation of Project-Based learning strategy improves students-instructors self-efficacy and academic achievements. They also concluded that this learning strategy builds the confidence level of the learners and instructors. In another study conducted by Munezero & Bekuta, (2016) suggested some solutions of the challenges in implementing project-based learning. These solutions include conduction of the trainings for instructors, provision of funds by government for project works and availability of accessibility of free and fast information technology resources.

Conclusion

A review study has been conducted to evaluate the effectiveness of Project-Based learning strategy in various educational fields. The challenges and their possible solutions are also discussed in this study. The of this study indicated that the Project-Based learning is an effective learning strategy for the development of creativity and critical thinking skills. There are also some challenges like lack of required skills and funds in implementing the Project-Based learning. The possible solutions of the challenges are regular conduction of trainings and involvement of Government sector and NGO'S to minimize the challenge of Funds.

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