7-8-2019

Promoting the Effectiveness of Problem-Based Learning

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June 24, 2019

Table of Contents

Abstract 4

Chapter One: Introduction 5

    Scope of Research 6

    Importance of the Study 7

    Research Questions 7

    Connection to Program Essential Question 7

    Definition of Terms 8

    Summary 8

Chapter Two: Literature Review 9

    Conditions that Promote the Effectiveness of Problem-Based Learning 10

        Design 10

        Environment 13

        Differentiation 15

        Professional Development 19

        Management 21

        Assessment 23

    Effects of Problem-Based Learning 24

        Positive 25

        Negative 27

    Conclusion 27

Chapter Three: Summary 28

    Review of the Proposed Problem 28

    Importance of the Topic 29

Abstract

As educators continue to promote student achievement in an ever-changing world, continual review and adjustment of teaching practices are necessary. Incorporating problem-based learning (PBL) can provide opportunities for students to develop 21st-century skills while engaging them in authentic learning experiences. In order to be effective, educators must thoughtfully consider and develop the conditions that best promote the success of PBL and understand the expected impacts on student achievement. Research in school settings suggests that certain conditions promote the effective implementation of PBL, and a variety of student impacts can be expected. PBL experiences can show success when the situation is open-ended, related to real-life, and includes multiple disciplines. Students that experience PBL can show improved attitudes, behaviors, satisfaction, creativity, collaboration skills, research abilities, vocabulary development, communication skills, and overall achievement. Some negative impacts can also occur with the use of PBL. Studies note difficulties accessing resources or information, confusing and noisy classrooms, difficulties transitioning away from direct instruction, and delays in results.

Keywords: authentic, facilitator, interdisciplinary, problem-based learning, 21st-century skills

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Chapter One: Introduction

Meeting high academic expectations is not an easy accomplishment in the diverse classrooms found across the United States. An abundance of readily available information drives a need to shift instructional approaches. Additionally, the advancement of technology removes the need for many jobs that require manual labor, and predictions are being made that the jobs of the future do not even exist today (Dole, Bloom, & Doss, 2017). Furthermore, a report by Johnson and Adams (2011) shares that the dropout rate of students in America is increasing and happening at earlier ages, mostly between grades nine and 10. The report goes on to explain that 30% of students, or one in three, leave school before graduating (Johnson & Adams, 2011). Students identify that school's lack of relevance to their lives is a major factor regarding their choice to leave (Johnson & Adams, 2011). To provide a quality education that best promotes student success, educators are beginning to incorporate teaching practices that involve students more actively in their learning (Bicer, Boedeker, Capraro, & Capraro, 2015). John Dewey's (1938) educational theories include the idea that people learn best when they are socially and actively involved in building knowledge through an inquiry process. The effective incorporation of problem-based learning (PBL) can be beneficial when addressing these factors.

The use of PBL provides students with authentic opportunities to build skills that enable them to efficiently navigate, question, and use available information (Dole et al., 2017; Erdogan, 2017; Firdaus, Wahyudin, & Herman, 2017; Ibrahim, 2018; Johnson & Adams, 2011). It also promotes the development of 21st-century skills (Dole et al., 2017; Johnson & Adams, 2011). These skills include, but are not limited to, creativity, innovation, problem-solving,

communication, collaboration, self-efficacy, critical thinking, and entrepreneurship (Dole et al., 2017).

PBL is implemented in a variety of ways, but it generally engages students in a process of questioning, investigating, and using information to find solutions to a problem (Erdogan, 2017). PBL lacks specific implementation methods and this creates roadblocks for teachers (Erdogan, 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017). Therefore, in order to promote the effective use of PBL, this paper examines conditions that promote its success and the effects that occur with its use.

Scope of Research

Early research of PBL shows the effectiveness and structures used with the education of various professionals (Erdogan, 2017). Using PBL in other situations may require the use of different frameworks than early research shows and may produce varied results. To provide guidance to educators about implementing PBL, this paper focuses on synthesizing and summarizing studies that examine the conditions that are effective for PBL implementation and the outcomes of its use.

The literature examined for this paper included a combination of qualitative and quantitative research that included single-case study, experimental control, meta-analysis, meta-synthesis, ex post facto, causal-comparative, and design and development methods. Studies ranged from 2009 to 2019, and the most recent studies were the focus. To illustrate diverse applications of PBL, studies from a variety of locations were included from across the United States and around the world. Students within the studies ranged from elementary grades through undergraduate courses.

Importance of the Study

Reflecting on teaching practices and making adjustments to best meet students' needs is a major responsibility for educators. The combination of high demands for achievement, diverse student needs, abundant information, future employment trends, and increasing dropout rates requires a shift in traditional classroom practices to provide the most effective impacts on student achievement for future success. If the use of PBL is a practice that can address these factors, educators must understand the conditions that are effective for PBL in order to justify and successfully implement its use. Educators must also understand the effects that occur when using PBL. With a solid understanding of these characteristics, more successful implementation of PBL is likely to occur along with improved student achievement.

Research Question

Research related to the effectiveness of PBL addresses two main questions. What conditions promote the effectiveness of PBL for children? What effects occur from the use of PBL? Educational leaders may effectively promote the use of PBL to guide student achievement with the information research provides for these questions.

Connection to Program Essential Question

The research questions provide a focus for examining the essential question of the program: In light of what is known about how children learn and educational policy and practice, how shall educators best lead in educational settings today in order to impact student learning? Equipped with an understanding of how to effectively use PBL and the expected outcomes, educational leaders can be more informed when making decisions to provide learning environments that promote the success of all students. Educational leaders can use the provided information as guidance on best practices for successful implementation of PBL in educational

settings and as a means to justify and advance its use. The following section defines terms found in the reviewed research to provide clarification and further understanding for educators interested in the exploration and implementation of PBL.

Definition of Terms

Authentic refers to learning experiences that engage learners in situations connected to real-life experiences. Learners involved in these experiences are often motivated by individualized options and take more ownership of their learning (Dole et al., 2017).

Facilitator is the role that educators fill while learners are actively engaged in PBL (Erdogan, 2017). A facilitator promotes student achievement by managing the learning process. Facilitators may guide students by providing resources, offering encouragement, questioning, and continually monitoring progress while students work towards a goal.

Interdisciplinary is a term that refers to incorporating more than one area of study while learning (Bicer et al., 2015). For example, PBL could combine reading, math, science, engineering, and art all within the same learning experience.

Problem-Based Learning (PBL) is a constructive approach to learning where students are engaged in solving a problem without one direct solution (Erdogan, 2017).

21st-Century Skills refers to a set of skills that have been identified as necessary for success in the 21st century. These skills include, but are not limited to, creativity, innovation, problem-solving, communication, collaboration, self-efficacy, critical thinking, and entrepreneurship (Dole et al., 2017).

Summary

Continual review and adjustment of teaching practices can encourage ongoing achievement in an ever-changing world (Cervantes, Hemmer, & Kouzekanani, 2015). Providing

authentic learning and opportunities to develop 21st-century skills can be accomplished with the incorporation of PBL (Dole et al., 2017; Erdogan, 2017). To effectively promote the use of PBL, educators can thoughtfully consider and develop the conditions that best promote the success of PBL and understand the impacts that occur with its use. A literature review in the next chapter examines the related research.

Chapter Two: Literature Review

As educators continually strive to promote student success, PBL offers an approach for active rather than passive learning (Dole et al., 2017; Erdogan, 2017). Traditionally, education in the United States follows a guided instruction approach through which teachers share information and students passively acquire what is shared (Dole et al., 2017). Kirschner, Sweller, and Clark (2006) describe how this structure serves to improve student performance on standardized testing that requires basic recall of information.

Kirschner et al. (2006) based their conclusions on what was known about human cognitive structures and the interrelations of working memory and long-term memory to promote learning. The authors failed to consider several factors that cannot be ignored in the field of education, however. While Kirschner et al. (2006) addressed how guided instruction is an effective means to build recall skills, they failed to address the topics of concern regarding high academic demands, diverse needs, abundant information, future employment trends, and rising school dropout rates.

PBL can be used to engage students towards mastery learning while also addressing a combination of student needs that promotes overall success (Dole et al., 2017; Erdogan, 2017). However, to best promote its use, educators can work to understand the conditions that lead to the effectiveness of PBL while also understanding the range of impacts PBL provides. This

chapter seeks to explore the information research provides regarding the effective conditions for promoting PBL and the outcomes that occur with its use.

Conditions that Promote the Effectiveness of Problem-Based Learning

Implementing PBL has been done using a variety of methods. Studies were conducted that incorporated certain elements or conditions and showed evidence of providing benefits to students (Balim, Ekici, & Ozcan, 2016; Erdogan, 2017; Firdaus et al., 2017; Ibrahim, 2018; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Mergendoller & Thomas, 2016; Pease & Kuhn, 2010; Ravitz, Hixson, English, & Mergendoller, 2012; Saputra, Joyoatmojo, Wardani, & Sangka, 2019). The elements and conditions that were incorporated into PBL promoted its effectiveness (Balim et al., 2016; Erdogan, 2017; Firdaus et al., 2017; Ibrahim, 2018; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Mergendoller & Thomas, 2016; Pease & Kuhn, 2010; Ravitz et al., 2012; Saputra et al., 2019).

Design. Carpenters plan and build solid foundations before constructing new homes. In a similar fashion, educators must plan and build with solid instructional models before constructing new learning. Research reveals that utilizing certain elements in the design of PBL is successful (Erdogan, 2017; Firdaus et al., 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017).

For example, a quantitative study done by Firdaus et al. (2017) followed a PBL structure that showed significant benefits to learners. The study involved a sample of all fifth grade students in Bandung, Indonesia. It used a pre- and post-test design to evaluate the effect of PBL and direct instruction on students' mathematical literacy. The experimental group was taught with PBL while the control group was taught with direct instruction. The experimental group showed that students taught with PBL improved their mathematical literacy more than students

taught with direct instruction (DI) (Firdaus et al., 2017). The mean difference of all students' test

results was 0.19 for both PBL and DI groups, with PBL students scoring higher (Firdaus et al.,

2017). The mean difference between PBL and DI test results was 0.19 in the village (Firdaus et

al., 2017). In the city, it was 0.22, and in the transition area, it was 0.17 (Firdaus et al., 2017). In

all three areas, PBL students scored higher than the DI students (Firdaus et al., 2017). The

structure of PBL used in this study included a review or presentation of a problem, an

investigation and development of strategies to solve the problem, implementation of the strategy,

and a discussion and evaluation of the results (Firdaus et al., 2017). The use of these PBL design

elements seemed to have a positive influence on young learners.

Another study by Lokey-Vega and Bondeson (2017) used a design and development

process towards the formation of a project-based model for use in online learning settings.

Project-based learning can be correlated to PBL, as the model began with posing a challenging

problem that guided the development of the project. The phases of the developed model included

hook and driving question, introduction of the project, formative assessments, development of

content knowledge, tutorial-by-example, summative assessment, and sharing (Lokey-Vega &

Bondeson, 2017).

The proposed model was tested with ninth grade literature students at Gwinnett Online

Campus (GOC). On statewide mandated literature and composition assessments, Lokey-Vega

and Bondeson's study showed that ninth grade GOC students achieved higher in comparison to

statewide proficiency levels when 56% of GOC students were proficient, while only 39% of

students were proficient state-wide (2017). Additionally, when ninth grade GOC students were

involved in project-based learning the following year, they showed increased success on

statewide assessments when 70% of GOC students were proficient, while only 41% of students

were proficient statewide (Lokey-Vega & Bondeson, 2017). This showed that the incorporation

of project-based learning, similar to PBL, made a significant impact on student achievement. The

incorporated elements of the project-based design model used by GOC demonstrated promising

results.

       A study by Erdogan (2017) examined 101 dissertations from the Council of Higher

Education National Thesis Database in Turkey. The analysis revealed that PBL courses were

carefully designed to provide authentic learning experiences (Erdogan, 2017). Problems posed

through PBL instruction were ill-structured, relevant to real-life, provided choice, and involved

students in setting their learning goals (Erdogan, 2017).

       Another study by Johnson and Adams (2011) analyzed surveys and interviews from 65

teachers and 1,239 students that ranged from primary to graduate education and involved 19

institutions across the United States, Canada, and Australia. The participants were involved in

challenge-based learning (CBL) which was similar to PBL as students were involved in solving

problems. Over three-quarters of all CBL students showed that they cared deeply when they

reported working harder than they normally do and felt part of solving a big problem (Johnson &

Adams, 2011). This illustrated how student interests guided the learning experience in order to

maintain a high level of authenticity. Problems were also structured so that students were guided

into new learning with access to adequate resources (Johnson & Adams, 2011). Careful planning

of the presented problem was important for developing successful active learning experiences

(Johnson & Adams, 2011).

       Overall, the combination of these studies showed promise that following these structures

of design provided an effective foundation for PBL (Erdogan, 2017; Firdaus et al., 2017;

Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017). Successful incorporation of PBL

followed a design model that began with a relevant, ill-structured, challenging problem presented as a question that offered opportunities for students to choose their learning path (Erdogan, 2017; Firdaus et al., 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017). Next, the investigation and development of a solution began. To facilitate learning, formative assessments were used to activate prior knowledge and highlight students' areas of strengths and areas needing development (Lokey-Vega & Bondeson, 2017). Based on assessment results, educators worked to help students build content knowledge as needed. Tutorials and samples were sometimes included during this phase (Erdogan, 2017; Lokey-Veg & Bondeson, 2017). Once a solution was reached, students were encouraged and allowed to carry out their plans (Erdogan, 2017; Firdaus et al., 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017). Educators then brought closure to the PBL experience with reflective discussion, evaluation, and possible revisions before students shared their work publicly (Erdogan, 2017; Firdaus et al., 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017). While PBL offered a means for self-directed learning, planning with these explained structures in place promoted student achievement with intended learning goals and more (Erdogan, 2017; Firdaus et al., 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017).

Environment. The environment of a classroom, school, and community refers to more than just the physical space where learning occurs. It also includes the social, emotional, and intellectual aspects that affect student achievement. The combined factors of a learning environment play a role in student achievement. To promote achievement, educators can work to develop positive environmental attributes that best serve the students. PBL may require a shift from traditional educational environments. When planning to implement PBL, educators can consider and develop the following aspects of the learning environment.

The teacher's role in PBL was significantly different than in a traditional classroom. A single case study by Ibrahim (2018) indicated successful results with PBL when the instructor assumed the role of a facilitator. When teachers served as facilitators, they continually and closely monitored students. As problems arose, facilitators coached and encouraged learners to find solutions on their own (Ibrahim, 2018). A sense of mutual responsibility was developed as facilitators selectively probed and guided learners to help ensure a comfortable learning environment that progressively strived to succeed (Ibrahim, 2018).

Another aspect that was considered when developing the environment for successful PBL was a culture of collaboration (Dole et al., 2017; Erdogan, 2017). When teachers modeled their role as a facilitator, this naturally led to the need for students to work together and help one another. Learning to work together with others provided various avenues of support and was identified as a skill students can apply throughout their lives. To further promote collaboration and willingness for students to take risks, mistakes were valued and seen as opportunities for growth (Johnson & Adams, 2011). A level of respect for one another was maintained while working together and sharing ideas. This was another major role of the teacher as facilitator. Celebrating success also built upon collaborative efforts (Johnson & Adams, 2011). Finally, when educators formed collaborative groups, they tried to ensure mixed abilities among the members (Ibrahim, 2018). This provided more avenues for members to share and use their talents in ways that improved achievement and built awareness and acceptance of others' differences (Ibrahim, 2018). Consideration of these factors helped support the development of a collaborative culture and successful PBL (Dole et al, 2017; Erdogan, 2017; Ibrahim, 2018; Johnson & Adams, 2011).

The availability of resources and facilities understandably had an impact on student achievement. While limited resources may have led to ingenuity, ensuring readily available resources was something educators prioritized when implementing PBL (Erdogan, 2017; Johnson & Adams, 2011). Fortunately, access to digital media and tools provided abundant information and assets (Johnson & Adams, 2011). Schools that had one-to-one devices and reliable internet access for students had added advantages (Johnson & Adams, 2011).

A study by Mergendoller and Thomas (2016) identified themes from interviews with 12 teachers seen as experts at using project-based learning, similar to PBL. Experts outside of the school were seen as valuable resources, and carefully developed partnerships provided added support (Mergendoller & Thomas, 2016). School and public libraries were also utilized to help ensure students were equipped with the needed tools for success (Mergendoller & Thomas, 2016).

Research indicated that certain aspects of learning environments led to student success with PBL (Dole et al., 2017; Erdogan, 2017; Ibrahim, 2018; Johnson & Adams, 2011; Mergendoller & Thomas, 2016). Teachers that used PBL took the role of a facilitator, continually worked to develop collaboration, and strived to ensure access to adequate resources. The combination of these efforts led to learning environments conducive to PBL and improved student outcomes (Dole et al., 2017; Erdogan, 2017; Ibrahim, 2018; Johnson & Adams, 2011; Mergendoller & Thomas, 2016).

Differentiation. The diversity within any classroom calls for instructional approaches that are compatible with meeting a variety of needs. Educators adjust teaching practices to provide accommodations that develop personalized learning and improve student success. PBL

may be an effective practice for providing a differentiated approach to learning and may offer

multiple avenues for adjusting implementation in order to address diverse needs.

For example, the research reviewed for this paper showed that studies of PBL in Turkey,

Indonesia, Peru, Malaysia, Australia, and areas across the United States including, but not

limited to, New York, Texas, Florida, Nebraska, Ohio, and Minnesota indicated significant

participant success with the implemented PBL (Balim et al., 2016; Bicer et al., 2015; Cervantes

et al., 2015; Dole et al., 2017; Erdogan, 2017; Ergul, 2014; Firdaus et al., 2017; Ibrahim, 2018;

Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Meyer & Wurdinger, 2016; Pease &

Kuhn, 2010; Saputra et al., 2019; Strobel & Barneveld, 2009; Tasci, 2015; Wirkala & Kuhn,

2011). These studies investigated PBL across a diverse range of characteristics including age,

gender, ability, religion, ethnicity, economic background, location, public schools, private

schools, and parochial schools and showed success. A study by Firdaus et al. (2017) used a

quasi-experimental method to quantitatively analyze whether rural, city, or transition locations

affected the success of PBL. The findings of the study suggested that the location of the school

was not a factor in the students' success with PBL. Even online learning showed success with a

PBL approach, as seen in the study by Lokey-Vega and Bondeson (2017). Because these PBL

studies were successful across a variety of students and locations, differentiated situations

seemed to be a favorable condition for PBL.

PBL also seemed effective across multiple disciplines. Studies reviewed for this paper

included the successful use of PBL in reading, literature, science, math, social studies, physics,

and accounting (Balim et al., 2016; Bicer et al., 2015; Cervantes et al., 2015; Ergul & Kargin,

2014; Firdaus et al., 2017; Ibrahim, 2018; Lokey-Vega & Bondeson, 2017; Pease & Kuhn, 2010;

Saputra et al., 2019; Tasci, 2015). These studies illustrated the ability for PBL to be

differentiated and incorporated throughout the courses schools offer. Additionally, PBL was

effective with interdisciplinary approaches, seen in the study by Bicer et al. (2015). Eighth grade

students in the study showed significant gains with science and math vocabulary after a PBL

experience that focused on preventing an egg from breaking when dropped at various heights

(Bicer et al., 2015). Combining science and math through the PBL process showed significant

student gains. These studies demonstrated the ability to successfully implement PBL in a wide

variety of topics and incorporate multiple topics within one investigation. In these studies, PBL

provided a structure for educators to develop personal learning experiences that were

differentiated for student success.

PBL was also effective in combination with other instructional approaches. For example,

a study by Saputra et al. (2019) showed that using Jigsaw cooperative learning together with

PBL led to significant student gains. Once the problem was established, the Jigsaw approach

involved assigning a topic or focus to each member of a team who was responsible for becoming

an expert in that area and worked with other experts focused on the same topic. Each expert was

then responsible to help build the understanding of the rest of the members on the originally

assigned team (Saputra et al., 2019). The success of this study illustrated the flexibility PBL

provided for successful incorporation of additional teaching practices.

Another study showed success incorporating concept cartoons with PBL (Balim et al.,

2016). Experimental groups of students included PBL with and without integrated concept

cartoons. The PBL group that used concept cartoons studied an illustration of characters that

expressed various viewpoints about a scenario related to science and heat transfer. Students then

used inquiry skills to solve the problems presented in the scenario. The PBL group without

concept cartoons investigated the scenarios without the illustration. The control group followed a

traditional approach to learning using textbooks and activities. Both experimental groups achieved more than the control group with no significant difference between the two PBL groups (Balim et al., 2016). This suggested that the concept cartoons were a supportive tool but did not have an additional impact over PBL (Balim et al., 2016). PBL was the main factor of added success when comparisons of student success were made across the three groups involved in the experiment (Balim et al., 2016). This study illustrated that additional teaching practices can be incorporated during PBL to provide differentiated engagement or support without hindering the benefits of PBL.

Interestingly, studies by Pease and Kuhn (2010) and Wirkala and Kuhn (2011) demonstrated that there was no significance in collaborative PBL over individualized PBL. The benefit of PBL appeared to be correlated to the engagement with the problem, PBL's core principle (Pease & Kuhn, 2010; Wirkala & Kuhn, 2011). However, the authors explained that there was significant evidence in the literature that collaborative learning provided benefits to students, but those outcomes were not examined in their study (Pease & Kuhn, 2010; Wirkala & Kuhn, 2011). The studies indicated that PBL can be effective when used with collaborative groups and with individualized approaches. Therefore, PBL allowed teachers to differentiate grouping practices to fit students' needs best.

In summary, it appeared that PBL had diverse applications for promoting student success through differentiated conditions. Diversity across students, schools, locations, subjects, and integrated instructional approaches all showed significant gains with the differentiated implementation of PBL. The successful use of PBL in a variety of settings highlighted the flexibility PBL provided for meeting a variety of needs (Balim et al., 2016; Bicer et al., 2015; Cervantes et al., 2015; Dole et al., 2017; Erdogan, 2017; Ergul, 2014; Firdaus et al., 2017;

Ibrahim, 2018; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Meyer & Wurdinger, 2016; Pease & Kuhn, 2010; Saputra et al., 2019; Strobel & Barneveld, 2009; Tasci, 2015; Wirkala & Kuhn, 2011).

Professional Development. It is common for educational leaders in the United States to support the development of teachers' pedagogy and the implementation of practices shown to promote student success. Educators can encourage student success when they expand their knowledge of teaching practices and can effectively implement them with students. Several factors are considered regarding professional development and PBL. The promotion of PBL requires adequate training in constructivist learning, PBL principles, and a variety of other essential skills (Cervantes et al., 2015; Erdogan, 2017; Johnson & Adams, 2011; Ravitz et al., 2012).

Cervantes et al. (2015) completed a study in a South Texas school district with 461 seventh and eighth grade students. Through the study, PBL's implications for school redesign were generated (Cervantes et al., 2015). The study highlighted the need for instructional support with PBL training and continuous coaching because educators who were accustomed to traditional teaching methods may have experienced overwhelming challenges (Cervantes et al., 2015). Erdogan's (2017) study suggested that inadequate undergraduate and in-service training in constructivist applications resulted in more traditional teaching. Successful implementation of PBL benefited from adequate and ongoing training in constructivist and PBL methodologies (Erdogan, 2017).

Extended professional development provided multiple benefits in the study by Ravitz et al. (2012). Teachers who received extended professional development reported more PBL implementation than teachers with limited professional development (Ravitz et al., 2012).

Additionally, teachers with extended professional development also reported guiding other teachers more than teachers with limited professional development (Ravitz et al., 2012). Professional development opportunities were increased when teachers provided support to other teachers, and the overall success of PBL improved (Ravitz et al., 2012). Online communities were another avenue of support for teachers (Johnson & Adams, 2011). Of the teachers surveyed, 75% felt that online communities were critical to effective implementation of CBL, similar to PBL (Johnson & Adams, 2011). These studies suggested that extended professional development opportunities related to PBL promoted its use (Johnson & Adams, 2011; Ravtiz et al., 2012).

Studies also highlighted the importance of the decisions school administrators made (Cervantes et al., 2015; Erdogan, 2017). Cervantes et al. (2015) discussed how the decisions of school leaders impacted the learning environment and affected the implementation of PBL. Administrators' development was not ignored (Cervantes et al., 2015; Erdogan, 2017). School leaders helped adjust funding allocations, hiring practices, school policies, curriculum adoptions, and school operations in order to provide a learning environment conducive to PBL (Cervantes et al., 2015). Having a solid understanding of PBL and its needs helped administrators make decisions that supported its effectiveness (Cervantes et al, 2015). Some administrators needed additional training regarding PBL when they had a more traditional background of educational practice (Erdogan, 2017).

When educators implemented CBL, similar to PBL, they needed skills beyond understanding its principles and design (Johnson & Adams, 2011). Five essential skill areas were universally identified by teachers including digital media skills, internet skills, subject knowledge, understanding CBL, and classroom management skills (Johnson & Adams, 2011). A

range of skills was important in order to maintain a comfortable atmosphere as students navigated the open process of inquiry-driven learning (Johnson & Adams, 2011).

In summary, the studies revealed multiple essential skills educators and educational leaders needed to ensure the success of PBL (Cervantes et al., 2015; Erdogan, 2017; Johnson & Adams, 2011; Ravitz et al., 2012). They highlighted the need to provide adequate training opportunities and systems of support (Cervantes et al., 2015; Erdogan, 2017; Johnson & Adams, 2011; Ravitz et al., 2012). Studies also illustrated that various networks of support provided the needed professional development for successful implementation of PBL (Johnson & Adams, 2011; Ravitz et al., 2012). Direct training, guidance from colleagues, and online communities were all leveraged to support the professional development of teachers and administration (Johnson & Adams, 2011; Ravitz et al., 2012).

Management. Effective management provided structures that enriched student learning with PBL (Mergendoller & Thomas, 2016). Classrooms that incorporated PBL needed management practices different than traditional instruction required in order to be successful. Research revealed implications for shifts in time allocations for teacher preparation and student learning, as well as adjustments to instructor and student responsibilities with the use of PBL (Erdogan, 2017; Johnson & Adams, 2011; Mergendoller & Thomas, 2016).

When PBL was implemented, teachers clearly conveyed the phases of the process to students and the expected outcomes of the experience (Johnson & Adams, 2011; Mergendoller & Thomas 2016). Educators clarified proficiency standards for student learning, provided exemplars, incorporated external resources and experts, structured natural and logical consequences for failure or lack of participation, provided regular conferences, planned continuous peer feedback, and incorporated public sharing or action during PBL (Johnson &

Adams, 2011; Mergendoller & Thomas, 2016). Being prepared for all of these factors required additional time for educators. Educational leaders that supported PBL were aware of these implications and strived to provide adequate time for teacher planning and preparation.

Allocated time for student learning was another management consideration for educators when implementing PBL. Enough time had to be allowed for students to work through the problem and come to a reasonable solution (Johnson & Adams, 2011). In the beginning stages of PBL implementation, it took additional time for students to adjust to an active role in their learning (Erdogan, 2017). Students needed guidance on the skills related to time management, as that responsibility was turned over to them (Mergendoller & Thomas, 2016). Teachers reported that the use of defined expectations for each work session and public forms of peer feedback at regular intervals throughout the process were also beneficial (Mergendoller & Thomas, 2016). Teachers felt that this built effective communication between teachers and students and helped hold students accountable for expected progress (Mergendoller & Thomas, 2016). Although inquiry learning required large quantities of time in educational settings, 93% of teachers from Johnson and Adam's (2011) study reported that CBL was a worthy and wise use of time and resources.

Studies also showed that it was important for educators to consider how to prevent and resolve conflict when managing PBL. As stated earlier, PBL was successful in either collaborative or individual settings (Pease & Kuhn, 2010; Wirkala & Kuhn, 2011). When educators developed PBL through a collaborative process, they made careful decisions when forming student groups in order to set them up for success (Johnson & Adams, 2011; Mergendoller & Thomas, 2016). Planning groups that were conducive to student learning incorporated heterogeneous combinations aligned to the context and task requirements

(Mergendoller & Thomas, 2016). While older students were prepared to form groups aligned for success, lower grades benefited more from pre-set groups (Johnson & Adams, 2011). Conflict was inevitable but was beneficial when groups were able to work through it (Johnson & Adams, 2011). The experience of working out problems with others helped guide students to more success in future interactions (Johnson & Adams, 2011). During PBL, educators were prepared to continually monitor student groups and intervene as necessary (Mergendoller & Thomas, 2016). However, teachers avoided making decisions for students and instead encouraged students to solve problems on their own (Mergendoller & Thomas, 2016).

Overall, it appeared that the implementation of PBL required consideration of time allocations for teacher planning and preparation, time allocations for student learning, and conflict prevention and resolution strategies. Educational leaders were aware of the extra time needed for successful PBL and the structures and practices that helped maintain effective classroom management. Making the needed adjustments for these factors enriched student learning during PBL (Erdogan, 2017; Johnson & Adams, 2011; Mergendoller & Thomas, 2016).

Assessment. Assessment serves to evaluate or make a judgment about something. Traditional educational settings typically use tests to determine the level or amount of knowledge students have acquired. PBL calls for a variety of assessment practices that guide students' learning and allows them to showcase achievements (Cervantes et al., 2015; Johnson & Adams, 2011; Mergendoller & Thomas, 2016).

The use of PBL did not require educators to abandon quizzes or tests (Mergendoller & Thomas, 2016). However, it did involve a shift in how educators used the data that these assessments provided (Mergendoller & Thomas, 2016). During PBL, tests and quizzes helped students and teachers identify what content knowledge still needed to be developed to lead to

successful completion of the PBL experience (Mergendoller & Thomas, 2016). Since PBL developed deep levels of understanding rather than recall knowledge, assessments of students showed more success when they allowed for elaboration and application of knowledge (Strobel & Barneveld, 2009). It was also important for students to act on their solutions (Johnson & Adams, 2011). This allowed students to witness the impact they were able to make.

Because PBL involved students solving real-life problems, students ultimately were assessed on what was produced or demonstrated (Mergendoller & Thomas, 2016). Pre-determined rubrics and group and individual evaluations were incorporated (Mergendoller & Thomas, 2016). Reflective thinking throughout the learning process was also valued (Erdogan, 2017). This allowed students to process their learning as they considered what went well and what could be improved (Erdogan, 2017).

The purpose of assessment during PBL served to guide as well as evaluate student learning. Educators that implemented PBL, utilized these roles of assessment in order to develop successful PBL experiences (Johnson & Adams, 2011; Mergendoller & Thomas, 2016). Assessment during PBL incorporated tests and quizzes for formative purposes, but summative assessments were used to evaluate the application of learning the solutions illustrated (Johnson & Adams, 2011; Mergendoller & Thomas, 2016).

Effects of Problem-Based Learning

Learning methods can provide various impacts on student learning. Successful implementation of any learning strategy requires educators to understand the effects it can have on students. The incorporation of PBL revealed both positive and negative impacts (Bicer et al., 2015; Dole et al., 2017; Erdogan, 2017; Firdaus et al. 2017; Ibrahim, 2017; Johnson & Adams, 2011; Meyer & Wurdinger, 2016; Strobel & Barneveld, 2009).

Positive. The use of PBL showed a variety of positive effects on students. A qualitative study by Dole et al. (2017) provided a categorical summary of the positive impacts PBL had on students. Learning attitudes, learning behaviors, and learning preferences were identified as areas of student impact. Dole et al. (2017) found that learning attitudes were impacted in two main ways: increased positive attitudes towards learning and improved academic mindset. Students involved in PBL were so inspired to learn that they spent additional time outside of class discussing and researching their topics (Dole et al., 2017; Johnson & Adams, 2011). Students naturally made connections to the real world. Students involved in PBL also exhibited a focus on mastery learning and a commitment to formulating a solution, and as a result, they developed a variety of skills mentioned earlier as 21st-century skills (Dole et al., 2017; Johnson & Adams, 2011).

The study by Dole et al. (2017) also revealed positive impacts on a range of learning behaviors, including motivation, engagement, creativity, perseverance, and divergent thinking. Students of PBL showed eagerness to learn and took ownership of their involvement (Dole et al., 2017). Teachers also saw that the less structured design of PBL, compared to that of direct instruction, fostered creativity (Dole et al., 2017). The open-ended format of PBL allowed students the time and space they needed to work through the struggles they faced, which built perseverance, and collaboration skills (Dole et al., 2017; Johnson & Adams, 2011).

The impact of PBL on learning preferences was also revealed in the study by Dole et al. (2017). Students appreciated and excelled with the autonomy PBL provided. They also valued the sense of community and teamwork that developed through the collaborative environment of PBL (Dole et al., 2017; Johnson & Adams, 2011). These studies illustrated how PBL experiences provided unique situations that developed significant benefits.

Meyer and Wurdinger (2016) completed a study that investigated students' perceptions of skill development when involved in project-based learning, similar to PBL. They surveyed 275 students from 6-12th grade at two charter schools in Minnesota (Meyer & Wurdinger, 2016). Qualitative data identified the most improved skills that students reported were time management, collaboration, communication, and self-directedness (Meyer & Wurdinger, 2016). Additional data was gathered quantitatively and showed improved responsibility, problem-solving, self-directedness, and work ethic (Meyer & Wurdinger, 2016).

Other studies showed a variety of benefits of PBL. The study by Erdogan (2017) showed that PBL improved research skills, factual and conceptual knowledge, skill application or transfer, and student dispositions. Firdaus et al. (2017) found PBL to improve math literacy. Basic math knowledge and skills, computational ability, logical reasoning, and spatial concepts improved. Vocabulary development was also improved with PBL in the study by Bicer et al. (2015), who explained that PBL provided valuable opportunities for students to interact, communicate, and get involved in hands-on activities that helped build the mental images needed for vocabulary development. It seemed evident through these studies that the beneficial effects of PBL were multi-faceted.

Satisfaction was perhaps an unexpected but worthy impact of PBL seen in more than one study (Erdogan, 2017; Ibrahim, 2017; Johnson & Adams, 2011; Strobel & Barneveld, 2009). Students demonstrated that PBL gave them an improved sense of accomplishment and offered fulfilling opportunities to make a difference (Erdogan, 2017; Ibrahim, 2017; Johnson & Adams, 2011; Strobel & Barneveld, 2009). The relevancy to real-life motivated students to be actively engaged (Johnson & Adams, 2011). Additionally, instructors that implemented PBL noted their

own improved satisfaction and learning development (Ibrahim, 2017; Johnson & Adams, 2011; Strobel & Barneveld, 2009).

      Negative. The use of PBL did not come without what some perceived as less beneficial or even negative effects. Erdogan's (2017) study showed that when implementing PBL, some educators and students experienced difficulties accessing needed resources or information. Also, more confusion and noise was evident in some classrooms, especially during the early stages of implementation (Erdogan, 2017). In addition, students who had prior experience with direct instruction struggled with the transition to becoming more actively involved in their own learning and also with accepting results that were not immediate (Erdogan, 2017). Ibrahim (2018) discussed the same concern and noted that students felt disturbed or insecure when they were not certain how to proceed. Understandably, these were not the only challenges that students and educators faced with PBL. However, the positive impacts of PBL outweighed the negative impacts (Ibrahim, 2018).

Conclusion

      The review of literature for the second chapter of this paper provided an exploration of the conditions that effectively promoted the use of PBL and the observed impacts of its use. The reviewed research suggested that successful implementation of PBL carefully considered design, environment, diversity, professional development, management, and assessment throughout the learning experience. When these conditions were developed as described, the use of PBL produced both positive and negative outcomes. The positive effects highlighted a range of benefits that included improved attitudes, behaviors, satisfaction, creativity, collaboration skills, research abilities, vocabulary development, communication skills, and overall achievement. Negative effects were also noted that included difficulty accessing information, confusing and

noisy classrooms, struggle transitioning away from direct instruction, and delayed results. It should be noted, however, that the positive impacts were greater than the negative impacts. The next chapter encapsulates the purpose of the research and the relevant themes identified in the literature review.

Chapter Three: Summary

The previous chapter reviews the literature on the conditions that promote the effectiveness of PBL and the effects that occur when PBL is implemented. This chapter provides an incisive summary and conclusion of the first two chapters. Therefore, this chapter reviews the identified problem, the importance of the topic, and provides a summary of the main points of the literature review.

Review of the Proposed Problem

This paper examines the use of PBL in attempt to answer the question: In light of what is known about how children learn and educational policy and practice, how shall educators best lead in educational settings today in order to impact student learning? The educational settings educators face encourage the use of active learning. This practice is supported by John Dewey's (1938) theories that the inquiry process allows people to learn best because of their involvement in building knowledge.

PBL is an open-ended instructional method that engages students in authentic learning as they question, investigate, and use resources to formulate solutions to problems. It also aids the development of 21st-century skills. Successful implementation of PBL has been observed at the professional level, but implementation for younger learners may require different structures. The lack of specific implementation structures for PBL may cause resistance in its use. Furthermore, it is common for teachers in the United States to use traditional instructional approaches, so the

transition to PBL's active learning approach may be overwhelming. To support and promote the use of PBL to guide student achievement, this paper focuses on two main concerns, conditions that promote the effectiveness of PBL for children, and effects that occur from the use of PBL.

Importance of the Topic

One responsibility of educators is to provide quality education that promotes the success of all students. High academic expectations, diverse needs, abundant information, future employment trends, and increasing dropout rates may require a shift in teaching practices to provide the most effective impacts on student achievement for future success. Using PBL to engage students in more active learning can address these factors.

Understanding the conditions that promote the effectiveness of PBL and the expected effects with its use can help educators make informed decisions when making adjustments to teaching practices. If PBL is implemented, educational leaders need to be able to provide guidance on best practices and justification for PBL's use. More successful implementation of PBL and improved student achievement is likely to occur with a solid understanding of these characteristics.

Summary of the Main Points of the Literature Review

The literature review in the previous chapter explored the conditions that promoted the effectiveness of PBL and the effects PBL provided. Themes regarding design, environment, differentiation, professional development, management, and assessment were correlated to the success of PBL. Research also showed both positive and negative effects of PBL. The key findings were summarized in the next section.

Following PBL design provided an effective foundation for student success (Erdogan, 2017; Firdaus et al., 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Meyer &

Wurdinger, 2016). The structure of the problem was essential. It needed to be relevant to students, ill-structured, appropriately challenging, and provide choice (Erdogan, 2017; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Meyer & Wurdinger, 2016). As students investigated resources and formulated a solution, formative assessments were used to guide learning and build content knowledge as needed (Lokey-Vega & Bondeson, 2017). Students followed through with the developed solution and participated in reflection, revisions, and evaluation (Firdaus et al., 2017).

The development of an environment conducive for PBL was another condition that correlated to PBL's effectiveness. Instructors assumed the role of facilitator by selectively probing and guiding learners toward success (Ibrahim, 2018). A culture of collaboration was also developed, and access to adequate resources was ensured (Erdogan, 2017; Johnson & Adams, 2011).

PBL also offered flexibility for meeting a variety of needs. Diverse students, locations, and delivery showed significant success with PBL (Balim et al., 2016; Bicer et al., 2015; Cervantes et al., 2015; Dole et al., 2017; Erdogan, 2017; Ergul, 2014; Firdaus et al., 2017; Ibrahim, 2018; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Meyer & Wurdinger, 2016; Pease & Kuhn, 2010; Saputra et al., 2019; Strobel & Barneveld, 2009; Tasci, 2015; Wirkala & Kuhn, 2011). Incorporating multiple disciplines, instructional approaches, and collaborative or individualized methods were effective with PBL (Balim et al., 2016; Bicer et al., 2015; Cervantes et al., 2015; Ergul & Kargin, 2014; Firdaus et al., 2017; Ibrahim, 2018; Lokey-Vega & Bondeson, 2017; Pease & Kuhn, 2010; Saputra et al., 2019; Tasci, 2015; Wirkala & Kuhn, 2011). The research suggested that PBL offered diverse applications for promoting student success since it was effective with differentiated approaches.

Themes also emerged from the literature review regarding professional development. Both teachers and administrators needed adequate training on constructivist learning and PBL (Cervantes et al., 2015; Erdogan, 2017). Ongoing development was also important and was effective in personal coaching or online formats (Johnson & Adams, 2011; Ravitz et al., 2012). Finally, educators utilized a wide range of abilities when implementing PBL, which also needed to be developed (Johnson & Adams, 2011). These abilities included digital media skills, internet skills, subject knowledge, understanding of CBL, and classroom management skills (Johnson & Adams, 2011).

Management was another condition found to affect the success of PBL. Adequate time for extra teacher preparation and student learning was a prevalent factor (Erdogan, 2017; Johnson & Adams, 2011; Mergendoller & Thomas, 2016). Another important factor was preventing and resolving conflict (Johnson & Adams, 2011; Mergendoller & Thomas, 2016). Teachers needed to carefully form and align student groups, as well as continually monitor students and intervene as needed (Johnson & Adams, 2011; Mergendoller & Thomas, 2016).

The use of assessment was another condition that promoted the effectiveness of PBL. While tests and quizzes were useful in developing background knowledge, evaluations that allowed for elaboration and application of knowledge led to the revelation of deeper understanding during PBL (Mergendoller & Thomas, 2016; Strobel & Barneveld, 2009). Incorporating the use of rubrics and reflective thinking was also beneficial (Erdogan, 2017; Mergendoller & Thomas, 2016).

The literature review also revealed positive and negative effects of PBL. Improved learning attitudes, learning behaviors, and learning preferences for students were positive effects (Dole et al., 2017; Johnson & Adams, 2011). Several additional skills were also noted, including

improved research skills, factual and conceptual knowledge, skill application or transfer, and the development of 21st-century skills (Dole et al., 2017; Erdogan, 2017; Johnson & Adams, 2011). Increased satisfaction among students and teachers was another important positive effect (Erdogan, 2017; Ibrahim, 2017; Johnson & Adams, 2011; Strobel & Barneveld, 2009). Negative effects that were identified included, difficulty accessing resources, confusion, noisy classrooms, struggle in the transition to active learning, and delayed results (Erdogan, 2017).

The research examined for this paper found a correlation among a variety of conditions and the success of PBL. The conditions included design, environment, differentiation, professional development, management, and assessment. Positive and negative effects of PBL were revealed. Individuals involved with PBL showed improved attitudes, behaviors, satisfaction, 21st-century skills, and overall achievement. Difficulties accessing resources, managing classrooms, transitioning from traditional instruction, and delayed results were noted as negative effects. The next chapter draws from the literature review to provide insights, applications, and recommendations for future research regarding the use of PBL in educational settings.

Chapter Four: Discussion and Application

According to the studies in the literature review, PBL can significantly improve student success when consideration is given to the identified conditions (Balim et al., 2016; Bicer et al., 2016; Cervantes et al., 2015; Dole et al., 2017; Erdogan, 2017; Ergul & Kargin, 2014; Firdaus, 2017; Ibrahim, 2018; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Mergendoller & Thomas, 2016; Meyer & Wurdinger, 2016; Pease & Kuhn, 2010; Ravitz et al., 2012; Saputra et al., 2019; Strobel & Barneveld, 2009; Tasci, 2015; Wirkala & Kuhn, 2011). Additionally, a variety of positive effects can be expected with its use. The positive effects of PBL outweighed

the negative effects (Ibrahim, 2018). This chapter discusses insights gained from the research

that leads to improved instructional practice, examples of how the research applies to

professional practice, and suggestions for possible future studies.

Insights Gained from the Research

The first insight gained from this research is that the development and use of PBL require

significant adjustments for educators familiar with guided instruction practices. There is a range

of conditions to meet in order to develop successful PBL experiences. Successful

implementation of PBL follows its design, develops collaboration, allows for differentiation, is

supported with continual professional development, provides adequate time for preparation and

learning, facilitates prevention and resolution of conflict, utilizes formative and summative

assessments, and incorporates the process of reflection. A transition to this method of learning

can take time, continual guidance, patience, and perseverance.

The second insight gained from this research is that PBL offers impacts beyond

knowledge acquisition for students. This is perhaps the most significant finding. The concerns of

high academic expectations, diverse needs, abundant information, future employment trends, and

increasing school dropout rates can weigh heavily on the minds of educators (Johnson & Adams,

2011). It is encouraging to learn that PBL improves student achievement as well as a

combination of other skills, attitudes, and behaviors (Balim et al., 2016; Bicer et al., 2016;

Cervantes et al., 2015; Dole et al., 2017; Erdogan, 2017; Ergul & Kargin, 2014; Firdaus, 2017;

Ibrahim, 2018; Johnson & Adams, 2011; Lokey-Vega & Bondeson, 2017; Meyer & Wurdinger,

2016; Pease & Kuhn, 2010; Saputra et al., 2019; Strobel & Barneveld, 2009; Tasci, 2015;

Wirkala & Kuhn, 2011). This can build hope for future success. Further, improved satisfaction

among students and educators is motivating (Dole et al., 2017; Ibrahim, 2018; Johnson &

Adams, 2011). The positive and negative effects observed with the use of PBL can help

educators understand the outcomes of implementing PBL.

The third insight gained from this research is that, although PBL provides a wealth of

positive effects, there are some negative effects to be considered. Ensuring access to resources

and learning to manage classrooms with open-ended learning may seem reasonably attainable.

Research discusses the valuable resources available online and management practices for

successful PBL (Johnson & Adams, 2011; Mergendoller & Thomas, 2016). However, accepting

delayed results and supporting students that struggle in the transition from direct instruction can

prove to be difficult barriers to overcome. Methods of addressing these challenges were not

revealed in the examined research.

Application

The first example of how this research can apply to improved educational practice

involves identifying the shifts needed to transition from passive learning methods of traditional

practices to active learning methods of PBL. Teachers implementing PBL need to develop

learning experiences with a new structure in mind. The first task at the start of planning for PBL

involves a carefully structured problem. Teachers then need to develop their role as facilitator

while they form the learning environment and provide differentiated learning. Adequate and

ongoing professional development is important for leadership to secure. Both instructors and

administrators need to be encouraged to participate in professional development opportunities.

Finally, educators must adapt to the management and assessment practices that PBL calls for.

Addressing time allocation, developing conflict resolution skills, and engaging in reflective

thinking can promote the success of PBL.

The second example of how this research can apply to improved educational practice involves the range of benefits PBL provides. Educational leaders can more successfully advance and justify the use of PBL when they can explain and demonstrate these impacts to others. PBL can improve factual knowledge, conceptual knowledge, learning behaviors, learning attitudes, learning preferences, and a variety of 21st-century skills. Furthermore, when others realize that PBL can increase teacher and student satisfaction, while also successfully addressing the concerns of high academic expectations, diverse needs, abundant information, future employment trends, and increasing school dropout rates, they may be more likely to become involved with its use.

The third example of how this research can apply to improved educational practice involves the negative effects observed with PBL. Educational leaders need to be aware of the barriers that may exist with PBL and work towards solutions. They may need to find innovative ways to access resources and manage learning. They may also need to determine the most effective means to provide additional support to learners that do not easily adapt to PBL and build support for the delayed but influential results. The needed support may involve policies and practices that need adjustments to support PBL and the success of students.

Recommendation for Future Research

The first recommendation for future research is to study teachers' transition from passive to active learning. Given the range of conditions needed to support successful PBL, studies identifying the most challenging aspects for teachers to address may offer insight to leaders. Research could reveal potential policy and practice adjustments needed at school, district, or national levels to support the use of PBL.

The second recommendation for future research is to study the effects of improved teacher and student satisfaction with the use of PBL. There may be added benefits from the improved satisfaction that addresses other concerns, including overall well-being, teacher retention, and ongoing development. Further research could reveal an even larger body of evidence to justify and promote the use of PBL.

The third recommendation for future research is to study the effects of the negative aspects of PBL. The negative aspects could discourage educators from implementing PBL. New research could be conducted to determine the best methods for overcoming the negative effects and to understand their full impact. Research could investigate whether the effects of overcoming the challenges of PBL provide added benefits for continued student achievement. Evidence that the perceived negative effects of PBL actually provide benefits could further promote its use. However, if evidence shows extended harm from the negative effects, further use of PBL may be cautioned until conditions can be improved.

The research for this paper shows that using a PBL approach to learning is not a simple endeavor, but with adequate conditions, its use with students can be effective in developing a variety of benefits. This research can help educational leaders positively impact student learning by offering guidance on the best practices for PBL and the outcomes of its use. Given the complexity of implementing PBL and the wealth of benefits shown for students, it is recommended that systematic support for PBL can be a valuable investment for educational systems and can support educational reforms needed to maximize student achievement.

References

Balim, A., Ekici, D., & Ozcan, E. (2016). Concept cartoons supported problem based learning

      method in middle school science classrooms. *Journal of Education and Learning*, *5*(2),

      272-284. doi: 10.5539/jel.v5n2p272

Bicer, A., Boedeker, P., Capraro, R.M., & Capraro, M.M. (2015). The effects of STEM PBL on

      students' mathematical and scientific vocabulary knowledge. *International Journal of*

      Contemporary Educational Research, 2(2), 69-75. Retrieved from

      http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED573146

Cervantes, B., Hemmer, L., & Kouzekanani, K. (2015). The impact of project-based learning on

      minority student achievement: Implications for school redesign. *National Council of*

      Professors of Educational Administration: Education Leadership Review of Doctoral

      Research, *2*(2). Retrieved from https://eric.ed.gov/?id=EJ1105713

Dewey, J. (1938). *Experience in education*. New York: The Macmillan Company.

Dole, S., Bloom, L., & Doss, K.K. (2017). Engaged learning: Impact of PBL and PjBL with

      elementary and middle grade students. *The Interdisciplinary Journal of Problem-based*

      Learning, 11(2). doi: 10.7771/1541-5015.1685

Erdogan, T. (2017). What does research tell us about trends in dissertations on PBL? *Universal*

      Journal of Educational Research, *5*(6), 972-988. Retrieved from

      http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1144094

Ergul, N., & Kargin, E. (2014). The effect of project based learning on students' science success.

      Procedia – Social and Behavioral Sciences, *136*(1). 537-541. doi:

      10.1016/j.sbspro.2014.05.371

Firdaus, F. M., Wahyudin, & Herman, T. (2017). Improving primary students' mathematical

literacy through problem based learning and direct instruction. *Educational Research and Reviews*, *12*(4), 212-219. Retrieved from

http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1132197

Ibrahim, E. (2018). Problem-based learning (PBL) in sociolinguistics as a way of encouraging active learning. *MATEC Web of Conferences*, *150*(05075). doi: 10.1051/matecconf/201815005075

Johnson, L. & Adams, S. (2011). *Challenge based learning: The report from the implementation project*. Austin, Texas: The New Media Consortium. Retrieved from https://www.learntechlib.org/p/49837/

Kirschner, P., Sweller, J., & Clark, R. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, *41*(2), 75-86. doi: 10.1207/s15326985ep4102_1

Lokey-Vega, A. & Bondeson, K. (2017). Innovation in design of project-based learning for the k-12 online context. In P. Resta & S. Smith (Eds.), *Proceedings of society for information technology and teacher education conference*, (pp. 677-684). Chesapeake, VA: Association for the Advancement of Computing in Education. Retrieved from https://www.learntechlib.org/p/177831/

Mergendoller, J. & Thomas, J. (2016). Managing project based learning: Principles from the field. Retrieved from https://newtechnetwork.org/resources/managing-project-based-learning-principles-field/

Meyer, K. & Wurdinger, S. (2016). Students' perceptions of life skill development in project-based learning schools. *Journal of Educational Issues, 2*(1), 91-114. Retrieved from

http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1127481

Pease, M. & Kuhn, D. (2010). Experimental analysis of the effective components of problem-

    based learning. *Science Education*, *95*(1), 57-86. Wiley Periodicals, Inc. Retrieved from

    https://onlinelibrary-wiley-com.ezproxy.csp.edu/doi/epdf/10.1002/sce.20412

Ravitz, J., Hixson, N., English, M., & Mergendoller, J. (2012). Using project based learning to

    teach 21st century skills: Findings from a statewide initiative. Vancouver, B.C.: American

    Educational Research Association. Retrieved from

    http://images.bie.org/uploads/general/21c5f7ef7e7ee3b98172602b29d8cb6a.pdf

Saputra, M., Joyoatmojo S., Wardani, D., & Sangka, K. (2019). Developing critical-thinking

    skills through the collaboration of jigsaw model with problem-based learning model.

    International Journal of Instruction, *12*(1), 1077-1094. Retrieved from

    https://files.eric.ed.gov/fulltext/EJ1201249.pdf

Strobel, J. & Barneveld, A. (2009). When is PBL more effective? A meta-synthesis of meta-

    analyses comparing PBL to conventional classrooms. *Interdisciplinary Journal of*

    Problem-Based Learning, *3*(1). doi: 10.7771/1541-5015.1046

Tasci, B. (2015). Project based learning from elementary school to college, tool: Architecture.

    Procedia – Social and Behavioral Sciences. *186*(1). 770-775. doi:

    10.1016/j.sbspro.2015.04.130

Wirkala, C. & Kuhn, D. (2011). Problem-based learning in k-12 education: Is it effective and

    how does it achieve its effects? *American Educational Research Journal*, *48*(5), 1157-

    1186. doi: 10.3102/0002831211419491