

## The value and use of project-based learning in teacher preparation programs

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### Abstract

The study investigated faculty's value and use of project-based learning (PBL) in preparing student teachers. A convergent mixed methods design was employed in collecting data. Although the participants addressed the need to support the PBL environment and highly reported the use of PBL in their current teaching practices, the ways they explained how to implement PBL do not reflect PBL in real applications. Participants thought that the other types of learner-centered approaches, such as problem-based learning, are the same as PBL, which led to a strong positive correlation between the value and use of PBL. Professional development sessions for faculty members, partnerships with local and international organizations, and continuous evaluation were found helpful in achieving successful implementation of PBL in teacher preparation programs.

Keywords: Teacher education, Project-Based Learning, Student teachers' preparation programs

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## Introduction

Project-based learning (PBL) is a teaching methodology engaging students in the learning process and encouraging their curiosity to investigate meaningful and relevant real-world questions or problems (Krajcik & Czerniak, 2018). PBL is an investigative approach that allows learners to develop deductive and inductive reasoning skills to decipher the best solution to the problem (Hibbard, 2017; Meier & Hendel, 2019). This methodology prepares students with academic competency enabling them to work in collaboration with others, thereby empowering them to be global citizens able of taking responsibility for their lives. The end result is the students are mold into individuals who are economically and socially successful in the current stage of globalization. Grossman et al. (2019) studied the effect of PBL by surveying and interviewing accomplished PBL practitioners. They found that the practitioners sought to promote deep multidisciplinary learning, engage learners in authentic work, enhance collaboration among learners, and build an iterative culture where learners always prototype, reflect, redesign, revise, and evaluate, which are considered the core practices of PBL. PBL has been used in higher education, specifically in science fields, such as engineering and medical colleges (Torres et al., 2019). Tsybulsky and Muchnik-Rozanov (2019) investigated student teachers' experience during their practicum course using PBL. They found that PBL helped in shaping student teachers' professional identity including self-confidence and professional growth and gaining meaningful experience in terms of overcoming challenges and collaborating with their peers. These skills play role in keeping student teachers motivated in their teaching practices. Zembat et al. (2020) found a significant positive relationship between the level of self-leadership skills student teachers have and their motivation to teach.

Torres et al. (2019) stated that using PBL with undergraduate students enhances the ownership of learning for students and motivates them to learn effectively and refine their research, management, and social skills. Mahasneh and Alwan (2018) found significant differences in self-efficacy and achievement scores of student teachers who experienced PBL compared with the control group who did not experience PBL. Based on this finding, the researchers suggested the adoption of PBL in teaching student teachers and confirmed the need to conduct additional research verifying the effect of PBL in Arab countries.

MacMath et al. (2017) recognized the effectiveness of professional development (PD) sessions through teachers' communication regarding PBL concepts. However, teachers' understanding of PBL did not reflect their implementations. Mayer et al. (2017) and Grossman et al. (2019) confirmed the importance of integration between theory and practice in teacher education. Mayer et al. (2017) reported that many faculties and students consider taking university-based courses and practicing teaching in a variety of schools through practicum courses that are theory-practice divided. Therefore, embedding the professional experience into university courses is needed so theory and practice can be fully incorporated. Tsybulsky et al. (2020) investigated the quality of experience that student teachers went through the PBL process and found that the experience was meaningful and valuable. Hence, they confirmed that connecting the theory and practice by implementing PBL supports student teachers' needs and develops their skills as they move from being a novice to expert teachers. New teachers need to be equipped with essential research-based skills that will allow them to design proper and relevant programs to make teaching easier (Vaughan et al., 2017). However, Morosan et al. (2017) suggested that although the combination of theory and practice is required in enhancing student teachers' learning and understanding capacity, teachers should be cautious to avoid laxity in teaching. Therefore, teachers who have been well trained can determine when to use theoretical concepts and when to use practical concepts in a way that would create balanced learning for the students (Casey & Childs, 2017).

However, many studies reported that teacher preparation programs teach student teachers how to use PBL through university lecture contexts, which influences their attitudes as they become full-

fledged teachers. Baysura et al. (2016) found that more than half of student teachers had learned PBL in theory but did not have a chance to practice it within their studies. Al-Saifi (2016) reported that many studies have confirmed the existence of obstacles that affect the implementation of PBL. One area of investigation has focused on the ability of student teachers to implement the PBL model within their own classroom instructional experiences despite demonstrating adequate knowledge about PBL in their university coursework.

This study aims to investigate the university faculty members' perceptions regarding the value and use of PBL in preparing student teachers to be K-12 teachers. Hence, the following research questions were developed: to what extent do university faculty members in teacher preparation programs value PBL approaches to prepare student teachers to apply it? To what extent do university faculty members in teacher preparation programs use PBL approaches in the teaching profession to prepare student teachers to apply it? What is the relationship between the value and use of PBL in teacher preparation programs? To what extent do qualitative data serve to contribute to a more comprehensive and nuanced understanding of the faculty members' value and use of PBL in teacher preparation programs, via integrative mixed methods analysis?

## Methods

A mixed methods methodology was utilized in this study. Mixed methods researchers can utilize inductive and deductive logic simultaneously in conducting studies focusing on research questions (Tashakkori & Teddlie, 1998). This type of reasoning is called abduction in which the researcher moves from side to side between theory and data using different approaches and triangulating results gained from quantitative and qualitative research (Feilzer, 2010). To answer the research questions of this study, quantitative and qualitative methods were used to provide a comprehensive understanding of the research problem and offset the weakness of each approach, which would be strengthened by combining them.

**Research Design:** For this descriptive correlational study, a convergent mixed methods design was employed. Leedy and Ormrod (2016) explained that integrating the quantitative and qualitative data helps to develop and expand the understanding of the data, reach conclusions, and provide descriptions in which the data complete each other. The data were gathered from college faculty teaching in teacher preparation programs in Imam Abdulrahman University through the PBL questionnaire (PBLQ) using closed- and open-ended questions. The quantitative approach in this study was dominant over the qualitative approach, and they were collected simultaneously. Then, during the interpretation phase, the data were integrated using a display joint.

**Research Population and Sample:** The population of the study included all male and female faculty members belonging to the teacher preparation programs at Imam Abdulrahman Bin Faisal University (IAU). All faculty members—target population—( $N = 103$ ) were asked to complete the PBLQ. The study sample was chosen by using nonprobability sampling: a volunteer sampling procedure. Given that each member of the sampling was self-selected of being voluntarily included and the study population in general is interested in the research topic and has a strong opinion toward it, volunteer sampling was most appropriate for this study (Elder, 2009). The sample size has been calculated by using Krejcie and Morgan formula (1970):  $S = X^2NP(1 - P) + d^2(N - 1) + X^2P(1 - P)$ .  $S = 81$ .

Exploring the non-responders and finding how they are different from those who responded are not possible. Hence, the researcher further examined the sample by comparing the means on the value and use of PBL dependent variables to determine if a difference exists between early and later responders and ensure that this volunteer sample is generalizable to the population. The finding revealed that no significant difference exists  $p > 0.05$ , which confirms that the findings of this study are generalizable to the research population (see Table 1).

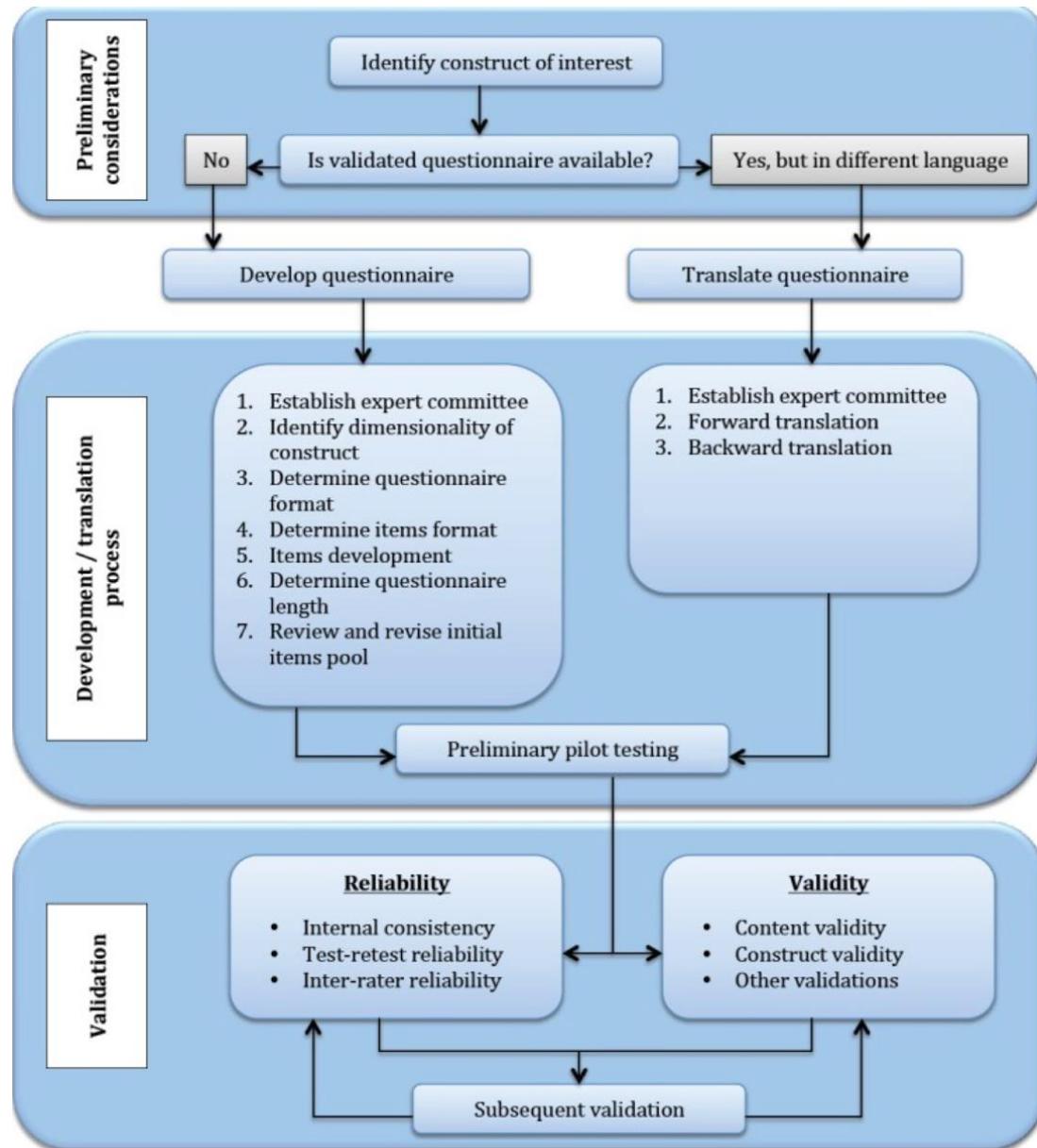
**Table 1 The Early and Later Responders Means Comparison**

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	(2-tailed)	Mean Diff.
Value	Equal variances assumed	5.080	.027	.54	80	.587	.587	.083
	Equal variances not assumed							
USE	Equal variances assumed	1.559	.215	1.06	80	.292	.292	.194
	Equal variances not assumed							

**PBLQ Development:** The researcher designed a questionnaire using a mixed methods approach to collect the data from the faculty members who were the participants in this study. This questionnaire was constructed from thematic elements emerging from the literature review.

The questionnaire with a six-point Likert scale response consisted of three components. The first one determined employment information. The second component measured the faculty beliefs toward PBL under a PBL value dimension consisting of 14 items, followed with an open-ended question about their thinking about preparing student teachers by modeling PBL teaching methodology. The third component measured the faculty implementations of PBL under a PBL use dimension consisted of 11 items and followed with open-ended questions asking about how they would implement PBL in their teaching practices. However, if they are unlikely to implement PBL, then they would be asked to justify and provide kinds of support. These open-ended questions were developed to gain a deeper understanding and comprehensive explanation regarding the value of PBL to the faculty to be adopted in teacher preparation programs and what its reflections on their teaching practices, which would lead to explain the quantitative data during the integration phase.

**Validity and Reliability Procedures:** The researcher identifies an expert panel in the education field to validate the questionnaire's items in terms of clarity and affiliation to ensure the external validity of the PBLQ. Considering that the questionnaire was sent to the participants in Arabic, two Arabic-English proficient people were invited to translate the questionnaire into Arabic and do back translation into English to ensure the validity of the questionnaire and the content validity of the questionnaire. The researcher conducted a pilot study to measure internal consistency by utilizing Cronbach's alpha to assure the questionnaire stability and feasibility. Pallant (2016) stated that values above 0.7 are acceptable. In this study, a reliability analysis was carried out on the value and use of PBL scales comprising 25 items. Each scale was tested separately to maintain the unidimensionality. Cronbach's alpha showed the reliability of value scale,  $\alpha = 0.84$  and reliability of use scale,  $\alpha = 0.86$  indicating good reliability. The following framework visually clarifies the questionnaire development, translation, and validation procedures (Figure 1).



**Figure 1 Questionnaire Development, Translation and Validation Processes**

*Note.* Adapted from Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine (Tsang et al., 2017, p.81).

**Data Collection and Analysis Procedures:** After obtaining the approval from IAU (Appendix), the PBLQ was used to collect the data from all faculty members who are teaching in the teacher preparation programs at IAU. This questionnaire was disseminated electronically through the faculty's emails. Four follow-up contacts were used to increase response rates. Following up with participants by sending multiple reminders has increased the response rate to 37% compared with a survey sent with no follow-ups (Dillman et al., 2014). Given that the homogeneity of variance is violated due to unequal group size, Kruskal-Wallis tests and Spearman correlation were used in data analysis (Table 2).

**Table 2 Test of Homogeneity of Variances**

	Levene Statistic	df1	df2	Sig.
Based on Mean	4.876	2	79	.010
Based on Median	4.429	2	79	.015
Based on Median and with adjusted df	4.429	2	73.44	.015
Based on trimmed mean	4.735	2	79	.011

For the open-ended questions, a thematic analysis method was applied. Moreover, meta-inferences were used to ensure the quality and validity of the inferences from both results and to complete the integration phase. Tashakkori and Teddlie (2008) described a meta inference as “an overall conclusion, explanation or understanding developed through and integration of the inferences obtained from the qualitative and quantitative strands of a mixed method study” (p. 101). Meta-inferences help in identifying the contradictory and confirmatory elements of the evidence and lead to new interpretations of the phenomenon being studied, which clarify the contribution of the mixed methods approach in addressing the research questions (Klassen et al., 2012). Table 3 clarifies the variables and techniques that were used to answer the research questions.

**Table 3 Alignment of Research Questions, Variables, and Techniques**

Research Question	Dependent Variables (DV)	Independent Variables (IV)	Technique
RQ1: To what extent do university faculty members in teacher preparation programs value project-based learning (PBL) approaches to prepare student teachers to apply it?	The total scores of value of PBL.  Continuous variable: Range from 1 to 6. 1 indicates strongly disagree 6 indicates strongly agree.	Employment information.  Categorical variables: 1.Position, 2.Experience 3.Department.	Kuskal-Wallis  Thematic Analysis  For relevant open-ended questions
RQ2: To what extent do university faculty members in teacher preparation programs use project-based learning (PBL) approaches in the teaching profession to prepare student teachers to apply it?	The total scores of use of PBL.  Continuous variable: Range from 1 to 6 1 indicates strongly disagree 6 indicates strongly agree.	Employment information.  Categorical variables: 1.Position, 2.Experience 3.Department.	Kuskal-Wallis  Thematic Analysis  For relevant open-ended questions
RQ3: What is the relationship between the value and use of project-based learning (PBL) in teacher preparation programs?	- Total scores of the value of PBL.  - Total scores of the use of PBL.		Spearman correlation

RQ4: To what extent do qualitative data serve to contribute to a more comprehensive and nuanced understanding of the faculty members' value and use of PBL in teacher preparation programs, via integrative mixed methods analysis?	Integrating both Quan & Qual using a joint display to demonstrate the mixed methods meta-inferences.
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## Results

Out of 103 faculty members, 82 responded to the questionnaire with large response rate= 79.61%. Because there is no way to explore the non-responders and figure out how they are different from those who responded; and to ensure this volunteer sample is generalizable to the population, the researcher further examined the sample by comparing the means on the Value and Use of PBL dependent variables to determine if there was a difference between early and later responders. The finding revealed that there was no significant difference  $p > 0.05$  which confirms that the findings of this study are generalizable to the population. Three independent variables were used to examine the value of PBL. The independent variables are academic positions, experience years and academic major.

**The value of PBL:** a Kruskal-Wallis test revealed a statistically significant difference in the value of PBL across four different academic positions,  $H(3)= 12.03$ ,  $p=.007$ . Group 1 (Professor position,  $n=9$ ) recorded the highest median score ( $MD= 5.50$ ), while Group 4 (Lecturer position,  $n=30$ ) recorded the lowest median score ( $MD= 4.79$ ). Bonferroni-adjusted alpha level of .008 ( $0.05/6$ ) was used to compare all pairs of groups to avoid Type1 error (Pallant, 2016). However, none of all comparisons were significant after Bonferroni adjustment (all  $ps > .008$ ).

A Kruskal-Wallis Test revealed a statistically significant difference in the value of PBL across three different years of teaching experience groups,  $H(2)= 6.07$ ,  $p=.048$ . Group 3 (20+ years,  $n=12$ ) recorded the highest median score ( $MD = 5.46$ ) while Group 1 (1-5 years,  $n=17$ ) recorded the lowest median score ( $MD = 4.79$ ). Bonferroni-adjusted alpha level of .017 ( $0.05/3$ ) was used to compare all pairs of groups. However, none of all comparisons were significant after Bonferroni adjustment (all  $ps > .017$ ).

A Kruskal-Wallis Test revealed no statistically significant difference in the value of PBL across seven different academic major groups,  $H(6)= 9.32$ ,  $p=.156$ . There is no difference in the value of PBL based on academic major of faculty. All groups recorded similar median scores.

Two themes emerged from the open-ended question related to the value of PBL. These themes were: (1) The importance of PBL and (2) The need for reform. Multiple sub-themes are categorized under each theme (see Table 4).

**Table 4 Description of Emerging Themes**

<b>Theme 1</b>	<b>Description</b>	
<b>The importance of PBL</b>	Explaining the positive effects of PBL on students' academic abilities and learning environment and showing the necessity of implementing PBL.	
<i>Subthemes</i>	<i>Description</i>	<i>Example quotes</i>
Support country's policy in Education	Emphasizing Saudi's new vision, the adoption of a teaching style that depends on learners and helps to develop their skills and improve the overall performance.	<p>"PBL is consistent with the Kingdom's approach for improving learning outcomes and relying on effective learning methods and strategies."</p> <p>"PBL is helpful in improving learning environments which lead to achieve Saudi's goals in Education."</p> <p>"PBL has become a necessity in teacher preparation programs to raise the level of teacher performance in teaching skills efficiently which the Ministry of Education seeks for."</p>
Learning for life	Enabling students to be independent learners by maximizing their skills that meet the 21st century demands.	<p>"Learning through PBL has become a concept and reality in advanced educational systems. Therefore, the training process for it is not a luxury, but one of the basic premises that should be taken for teacher preparation."</p> <p>"Very important in creating meaningful learning in the souls of students."</p> <p>"one of its most important advantages is the responsibility students take in their learning, collaboration, connecting the theory with practice and their connection to the reality."</p>
Meeting students' needs	PBL promotion for learning differentiation and understanding students' needs and desires	<p>"In PBL, students have different intellectual and comprehension levels."</p>

Theme 2	Description	
<b>The need for reform</b>	The need to improve and change some aspects of teachers' preparation programs	
Subthemes	Description	Example quotes
Curriculum development	The need to revise the courses' content and requirements considering the appropriateness of topics to PBL.	<p>"People in charge of education colleges should include PBL during the development and preparation of various programs."</p> <p>"PBL should be well planned to ensure its success."</p> <p>"PBL is not suitable for all topics."</p> <p>"PBL is applicable in specific majors such as science."</p> <p>"The nature of the subject does not allow this."</p> <p>"The nature of the course determines if PBL is applicable."</p>
Professors' skills	Professors' abilities in conducting and implementing PBL properly.	"I see that it largely depends on the effectiveness of the role of the professor in directing and raising the value of projects implemented by students. Letting the students do their projects and then providing a summative evaluation to them eliminates the feature of this methodology."
Authentic Projects	The need for projects that are realistic and meaningful to students' lives.	<p>"PBL should be appropriate, comprehensive, detailed and realistic so that it touches the students' needs and interests."</p> <p>"Feature of PBL is that considering the presentation of realistic projects for students."</p>

**The use of PBL:** a Kruskal-Wallis Test revealed a statistically significant difference in the use of PBL across four different academic position groups,  $H (3) = 8.27, p=.04$ . Group 1 (Professor position) recorded the highest median score ( $MD= 5.45$ ), while Group 4 (Lecturer position) recorded the lowest median score ( $MD= 4.82$ ). Bonferroni-adjusted alpha level of .008 (0.05/6) was used to compare all pairs of groups. However, none of all comparisons were significant after Bonferroni adjustment (all  $p > .008$ ).

A Kruskal-Wallis Test revealed no statistically significant difference in the use of PBL across three different years of teaching experience groups,  $H (2) = 5.487, p=.06$ . Group 3 (20+ years) recorded the highest median score ( $MD = 5.41$ ) while Group 1 (1-5 years) recorded the lowest median score ( $MD = 4.73$ ). A Kruskal-Wallis Test revealed no statistically significant difference in the use of PBL across seven different academic major groups,  $H (6)= 7.62, p=.26$ . All groups recorded similar median scores.

Three themes emerged from the open-ended questions related to the use of PBL. These themes were: (1) Implementing PBL, (2) Barriers, and (3) Support needed. Several sub-themes are categorized under each theme as shown in Table 5.

**Table 5 Description of Emerging Themes**

Theme 1	Description	
Subthemes	Description	Example quotes
<b>Implementing PBL</b>	The steps taken to implement PBL in teacher preparation programs.	
Activity	Implementing PBL as an activity or discussion in the classroom.	"I implement PBL through explaining its importance from the beginning of the semester." "I apply PBL through conducting activities during lectures, investigating a realistic problem from the field, and letting students collectively think about how to deal with that problem to make a decision about it." "I use PBL within the practical portion of the course for some tasks or exercises."
Problem-solving	Implementing PBL through identifying a related problem then providing solutions.	"Gathering some problems and questions about a topic in society, working on projects and researching in various fields to solve them." "By working as groups in the classroom to solve proposed educational problems." "Introduce a topic that needs a solution, then through it an innovative and appropriate solution must be produced."
Doing a project	Implementing PBL by focusing on achieving the project itself.	"Indeed, this was implemented in my courses throughout the semester, the idea of the project was presented and after that students prepare to implement the project with the necessity of having the raw materials." "Ask students to select, work on and submit a practical project at the end of the semester."
Project process	and Implementing PBL by focusing on achieving the project itself and providing formative evaluation during project construction.	"It is already applied by choosing a topic—creating work groups and dividing tasks by the work team—the continuous meetings between the work team could be remotely—the ongoing and continuous feedback from the supervisor—preparing the project—applying it—evaluating it—presenting the final report in a creative way and celebrating the end of the project."

<b>Theme 2</b>		<b>Description</b>
<b>Barriers</b>		Obstacles preventing implementing PBL in teachers' preparation programs.
<b>Subthemes</b>	<i>Description</i>	<i>Example quotes</i>
Funding	The financial requirements to implement PBL.	<p>"I believe that PBL needs tremendous efforts from all stakeholders, as well as generous financial support and users who are aware of its importance as an effective teaching method."</p> <p>"Financial capabilities are needed to implement projects."</p> <p>"PBL requires a significant financial cost to create multiple projects."</p> <p>"Doing projects requires specific materials and tools which usually cost a lot of money."</p>
Syllabus	A course plan showing its content and requirements that limit implementing PBL.	<p>"Course syllabus and evaluation system do not support the strategy"</p> <p>"Course descriptions should include the use of PBL to train teachers before practicing in the classroom."</p> <p>"Course description needs to be reconstructed to be align with PBL and engaging students in this matter is important."</p>
Time	The availability of the time for implementing PBL.	<p>"Limited time and wide content are challenging, so giving time to faculty to devote themselves to carry out this type of learning is important."</p> <p>"Reducing administrative burdens, breaking out of time constraints and old routine planning."</p> <p>"Assigning a faculty member in administrative tasks wastes the member's time and limits their creativity."</p> <p>"Reducing the number of students, so we can have sufficient time to use PBL."</p>

<b>Theme 3</b>		<b>Description</b>

<b>Support needed</b>	The assistance faculty needs to enable them to implement PBL.	
<i>Subthemes</i>	<i>Description</i>	<i>Example quotes</i>
PD		<p>Training programs for “Raising the awareness toward the importance of student-centered teaching methods including PBL and conducting faculty members in the training sessions about the use of PBL in teaching.”</p> <p>teacher preparation “Training colleagues on contemporary teaching strategies and on how to develop ideas related to real problems rather than the repeated traditional ideas.”</p> <p>understanding and “Workshops representing PBL at the university stage are needed.”</p> <p>implementing PBL.</p>
Policy		<p>The academic instructions of the teacher preparation courses that should be obeyed need revision.</p> <p>“Professors should have the freedom in making the evaluation process up to them because PBL has a different and unconventional evaluation method.”</p> <p>“A change in policies for developing course content and its references, simply giving more space to choose cognitive content.”</p> <p>“I believe that we need to have more freedom and be more flexible with the course content and requirements.”</p>
Infrastructure support		<p>The necessary items or equipment during implementing PBL.</p> <p>“Providing scientific materials and devices to implement the strategy.”</p> <p>“The capabilities, resources and laboratories equipped for students so that they can complete their work.”</p> <p>“The appropriate classroom environment, such as preparing rooms for workshops and group work with the necessary technologies.”</p> <p>“Technology support including internet service. Sometimes it is difficult to subscribe to software programs that a faculty member needs to undertake a project with their students.”</p>

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**The relationship between the value and use of PBL:** Spearman's rho correlation was used to explore the relationship between the value and the use of PBL across faculty members in teacher preparation programs. There was a strong positive correlation between the value and use of PBL, which was statistically significant,  $rs = .663$ ,  $p = .000$ . Both the value and use variables recorded a similar median, the value ( $MD = 5.10$ ,  $SD = .61$ ), the use ( $MD = 5.00$ ,  $SD = .74$ ).

**Integration:** after analyzing the quantitative and qualitative data obtained from PBL questionnaire using the same sample size, the researcher compared both quantitative and qualitative results side by side by merging the both results to draw meta-inferences. Convergence, divergence, and expansion areas among both quantitative and qualitative results were identified using a joint display (see Table 6).

**Table 6** Joint Display of Quantitative, Qualitative and Mixed Methods Meta-Inference

<b>Mixed Methods Meta-Inferences</b>	
<p>1. Convergence: The high value of PBL found in the qualitative data by expressing its importance confirms the high median scores among most groups. Some lecturers had different opinions and mentioned the deficiency when being asked about the value of PBL which may emphasize the lowest medians in the value of PBL among lecturer position and 1–5-year groups.</p> <p>2. Divergence: Although the participants addressed the need for actions to support the PBL environment and highly reported the use of PBL in their current teaching practices, the ways they explain how to implement PBL do not reflect PBL in real applications.</p> <p>3. Expansion: Participants thought that the other types of learner-centered approaches, such as problem-based learning, are the same as PBL which led to a strong positive correlation between the value and use of PBL.</p>	
<b>Quantitative results</b>	 <b>Qualitative findings</b>
<p>1. No significant difference exists in the value of PBL across academic major groups, academic position groups, and years of teaching experience groups.</p> <p>2. No significant difference exists in the use of PBL across academic major groups, academic position groups, and years of teaching experience groups.</p> <p>3. A strong positive correlation exists between the value and use of PBL.</p>	<ul style="list-style-type: none"> <li>- Adopting PBL as a teaching methodology in preparing student teachers is valuable due to its role in supporting Saudi's policy in Education, developing students' life skills, and considering students' needs and desires.</li> <li>- Mentioning to the deficiency when being asked about the value of PBL in regard to the need of reforming the curriculum, refining professors' skills, and producing authentic projects.</li> <li>- PBL is implemented through various forms: activity, problem solving, doing a project, and project and process.</li> <li>- The restriction of the syllabus, financial burdens, and lack of the time is the dilemma that limits implementing PBL.</li> <li>- PD, courses' revision, and infrastructure reform are essential elements needed in supporting the PBL environment.</li> <li>- PBL is valued but its applications are widely different among participants.</li> </ul>

## Discussion

The study revealed that adopting PBL as a teaching methodology in preparing student teachers is valuable among faculty. However, some lecturers had different opinions and mentioned some deficiencies, such as the need of reforming the curriculum, refining professors' skills, and scarcity of authentic projects, when being asked about the value of PBL which could emphasize the lowest medians in the value of PBL among those groups composed of lecturers and those with one to five years of experience. This difficulty could be attributed to faculty members' lack of experience in teaching PBL, especially for those who have been taught by a traditional teaching approach, which most teacher preparation programs still apply (Morgan et al., 2013). The findings showed that all participants' groups indicated the likelihood to use PBL in teaching practices and confirmed PBL implementation through various forms: activity, problem solving, doing a project, and project and process. However, restrictions of the syllabus, financial burdens, and lack of time were highlighted as dilemmas that limit PBL implementation. The essence of the syllabus review was discussed by Morgan et al. (2013), Harris (2015), Vaughan et al. (2017) and Whitford et al. (2018). They confirmed that restructuring the educational syllabus in a way which helps students could address the inherent social challenges they may face in the future.

The findings revealed the areas that need support for creating a proper PBL environment. Professional development, courses' revision, and infrastructure reform were considered essential elements needed in supporting a successful PBL environment. Han, Yalvac, and Capraro (2015) discussed the elements related to the improvement of learning environment and used to support PBL implementation. From a theoretical perspective, Henschke (2013) reached a modern concept based on adult learning theories for andragogy theory that seeks to assist adults to engage actively and interactively in the learning process by providing an appropriate environment that meets their needs and goals. Although professional development (PD) was essential in supporting PBL implementation, tracking the outcomes of PD sessions and reforming other relevant challenges should also be considered critical according to Han, Yalvac, and Capraro (2015). They found after conducting PD sessions that teachers' understanding of PBL do not necessarily reflect their implementations. Teachers reported students' willingness, subject, time, and available technologies as their perceived challenges hindering PBL implementation.

The findings revealed that PBL's applications were widely diverse among participants. These differences could be attributed to the knowledge of faculty members and the way they perceive PBL as a concept. This finding was in line with the studies of Hovey and Ferguson (2014), Lee et al. (2014) and Han et al. (2015) on faculty members from various disciplines, their definitions and implications of PBL, and the challenges they encounter. They found that the implementations of PBL were rooted to the understanding of faculty members. Some faculty believed that the purpose of PBL is to create projects. The handbook published by Buck Institute for Education demonstrated the differences between PBL and doing a project. Specifically, doing a project would come as an activity or a project alongside the unit or at the end of the course, whereas the project in PBL was integrated in the learning process. Learners do a project based on teacher' directions; however, they drive the project based on their inquiry in PBL. PBL is in line with academic standards unlike doing a project. PBL drives students to collaborate on organization of contents and building of a project that is applicable to real-world issues, then publicly share and present the results. However, doing a project can be completed alone and the end results of the project are presented in the classroom.

Further understanding was found in terms of the relationship nature between the value and the use of PBL after integrating the data. The findings showed that the participants thought that the other types of learner-centered approaches, such as PrBL, are similar with PBL, which could be attributed to the strong positive correlation between the value and use of PBL. Harris (2015); and Fromm (2018) identified the

differences between PBL and PrBL. PrBL would start with a problem in a scenario format or case study. Learners in PrBL would be given a problem, which must be solved through investigating previous knowledge and identifying areas that need more information. These similarities and differences could lead to the misunderstanding in distinguishing the two learner-centered approaches from each other.

Factors hindering the implementation of PBL found in this study are similar with those reported in the study of MacMath et al. (2017) which showed that students prefer to learn in a traditional way as it would be much easier for them than PBL. The challenges of implementing PBL found in this study are aligned with existing studies (e.g., Hovey & Ferguson, 2014; Lee et al., 2014; MacMath et al., 2017). Although PBL has many advantages, some of the challenges with the use of the PBL model are the lack of resource materials to use in the advancement of learning, difficulty in objective evaluation, and unqualified teachers to undertake guiding the teaching, and to structure the range of topics to be covered in the teaching process (Vaughan et al., 2017). Some educational systems are structured in the way they adopt conventional learning needs and deploy rote learning and paper-based learning (Vaughan et al., 2017).

Harris (2015) found that teachers agreed the most challenging barriers in implementing PBL are time, meeting state requirements, inclusion of the standards, designing PBL and implementing it within school timeframe. MacMath et al. (2017) reached that students prefer to learn in a traditional way because it easier to study the materials and then get the grade unlike PBL which requires the ownership learning and variety of responsibilities. Teachers expressed the difficulty of using PBL on their own and confirmed the importance of adopting PBL at the whole school level, allowing more time for them, and funding from school administration as a support for successful implementation. Such challenges were mainly related to four aspects: programs' policy, professional development, environment, and students' willingness.

Applications that are suitable for K-12 teachers are found helpful for college professors in terms of perception, implementation of PBL, challenges that limit the effective practices of PBL, and faculty members' need for support. In this study, the faculty highly value PBL, but they apply it differently. Some faculty members use PBL as a side activity or a project, whereas others consider it the same as PrBL. Only few have implemented PBL by achieving the project itself and providing formative evaluation during project construction. However, factors such as driving questions, interdisciplinary ideas, collaborations with other professors in delivering the courses, and the National Professional Standards for Teachers in Saudi Arabia have not been considered in teaching through PBL, even though they are essential steps in PBL. Faculty members define PBL differently which has influenced their PBL implementation. Therefore, PD sessions focusing on enhancing knowledge and skill levels of faculty members with regard to PBL are necessary. These PD sessions would promote and activate PBL culture in teacher preparation programs at IAU and develop faculty members' knowledge and performance by extending their understanding to other disciplines and diverse assessment ways. Faculty members can share their PBL experience by inviting colleagues to their classes for peer-evaluation as a way for performance development. PD sessions can be conducted by local experts and/or by making partnership with global certified organizations that are interested in PBL for training and mentoring.

PBL can also be activated through establishing partnerships at local and international levels, as indicated in the National Professional Standards for Teachers in Saudi Arabia. Disadvantaged schools in the university area, for example, can be used as a win-win partnership strategy. Student teachers may also investigate the needs of these schools and be creative in transforming these struggling schools to a better place for learning via building projects relevant to the course they are taking in the university. These projects can be offered as an elective or supplementary curriculum, enrichment clubs, workshops, and other extracurricular activities to those local schools. These practices will allow students to decide the area they want to work on and connect the theories they are currently learning in their university courses with practice, which most of the student teachers like to achieve via this dynamic way.

Teacher preparation programs can make partnerships with highly-ranked international institutions in the field of education that have successfully applied these types of learning, such as Bank Street College. This college is 99% characterized by a student-centered approach and is 95% committed to social justice and progressive education. The Bank Street College students spend over 720 hours in various teaching practices, which enable them to be mentored individually to gain rich teaching experience and receive constructive feedback from their supervisors. At the end of their long clinical experience, the Bank Street College students can relate various learning contents to the real world, develop curriculum based on students' interests, needs, and abilities, and create a diverse classroom environment that enhances social and emotional growth development (Horng et al., 2015). Previous study on the effectiveness and the influence of the Bank Street College teacher preparation programs on its graduates has revealed a significant difference between the Bank Street College graduates as professional teachers and those who graduated from other teacher preparation programs in New York (Horng et al., 2015).

Continuous evaluation of the current teacher preparation programs is needed. Topics worth investigating, diverse teaching strategies, dependence on variety formats of formative evaluation, increase in practicum hours throughout the program (which has currently eight hours taken in the last semester of bachelor's degrees and no practicum hours for graduate degrees), and meeting the National Professional Standards are essential elements that need to be considered for program evaluation. Decentralization of the mechanism of the program is essential to make it more flexible. In this way, faculty members can have the liberty to revise or develop some aspects during the program implementation phase and teach their handled courses with ease.

Due to the COVID-19 crisis and the sudden conversion of education to distance learning, PBL has shown its flexibility. PBL Works Organization certified by Buck Institute for Education (2020) has posted a variety of ways that can be used to assist educators to keep using PBL in an online learning environment and offered digital tools that facilitate the project planning, construction, evaluation, and public presentation phases. These practices in an unexpected situation show the possibility of overcoming the challenges hindering PBL implementation, such as lack of time.

Field (2020) has emphasized that connecting theories with current events is the best way to achieve authentic learning. She also suggested the identification of connection points for teachers to create driving questions, such as discussing the best ways for governments to respond to COVID-19, tracking the history of pandemics and their effects, comparing COVID-19 with other infections, utilizing mathematical tools to predict the spread of the pandemic, and identifying helpful ways in preventing misinformation regarding this pandemic through communication tools (Field, 2020). The same thing can be applied to teacher preparation programs. Faculty, for instance, can ask their students to discuss the most appropriate way for the Department of Education to respond to the current crises, identify the effective ways for delivering curriculum, develop a plan or unit fits to remote learning, think about ways to support social and emotional learning in the current situation, strategize against the barriers of remote learning, sympathize with students who do not have access to Internet, and find creative solutions. Subsequently, the student projects can be posted or presented in a public educational platform to widen its reach. The current circumstance has led to the removal of some challenges faced by faculty member when implementing PBL, such as lack of time. However, the current crisis has also created other technology-related challenges, thereby confirming that understanding the models of proper integration of technology in education is a necessity for all educators. Overall, multidisciplinary science is clearly emerging which demands educators to expand their major area and develop their skills upon that.

## **Conclusion and Recommendations**

This study revealed that no significant difference exists in the value and use of PBL across academic major, academic position, and years of teaching experience groups. However, further understanding of the relationship nature between the value and the use of PBL was found after data integration. The findings showed that the participants' ways of implementing PBL do not necessarily reflect PBL real applications. The participants thought that the other types of learner-centered approaches, such as PrBL, are the same as PBL. PD sessions for faculty members, partnerships with local and international organizations, and continuous evaluation were discussed and suggested as helpful strategies in achieving successful implementation of PBL in teacher preparation programs. It would be helpful for future research to hear from student teachers and other stakeholders to reach a more comprehensive understanding of PBL adoption in teacher preparation programs. Evaluating teacher preparation programs and redesigning the curriculum based on PBL are also helpful. Synchronous and asynchronous learning based on PBL might also be considered as major parts of the learning process which would help professors and students develop their technology-related skills. The applications of PBL through technology and distance learning are worthy of further investigation.

*\*Note: the manuscript is extracted from the author's PhD dissertation.*

## Appendix

Kingdom of Saudi Arabia Ministry of Education Imam Abdulrahman Bin Faisal University Office of the Vice President for Research & Higher Studies	 الجامعة الإسلامية جامعة الإمام عبد الرحمن بن فضيل وكالة الجامعة للدراسات العلية والبحث العلمي	الملكة العربية السعودية وزارة التعليم جامعة الإمام عبد الرحمن بن فضيل وكالة الجامعة للدراسات العلية والبحث العلمي
<b>اللجنة الدائمة لأخلاقيات البحث على المطلوبات الحية</b> <b>Institutional Review Board</b>		
IRB Number	IRB-PGS-2019-15-222	أرقم بروتوكول
Project Title	University Faculty Members Perceptions Regarding the Level of the Value and Use of Project Based Learning in Teacher Preparation Programs: A Mixed Methods Study	
Principal Investigator	Postgraduate Student / Tahani Alrajeh	
Supervisor	Dr. Yousef Saeed Alghamdi	
College / Center	Education	Department
Approval Date	Curricula and Instruction 9/5/2019	

The application was reviewed and approved at Imam Abdulrahman Bin Faisal University IRB through an Expedited Review on Thursday, May 9, 2019.

Approval is given for one year from the date of approval. Projects, which have not commenced within six months of the original approval, must be re-submitted to the University Institutional Review Board (IRB) Committee. If you are unable to complete your research within the validation period, you will be required to request an extension from the IRB Committee.

On completion of the research, the Principal Investigator is required to advise the Institutional Review Board if any changes are made to the protocol, a revised protocol must be submitted to the Institutional Review Board for reconsideration.

Approval is given on the understanding that the "Guidelines for Ethical Research Practice" are adhered to. Where required, a signed written consent form must be obtained from each participant in the study group.

Dean of Scientific Research  
Chairman of the Institutional Review Board



Dr. Naiif Nasser Almasoud

Stamp: 

CC: - Dean:  
- Deanship of Scientific Research  
- Director General:  
King Fahd Hospital of the University  
- Director:  
Center for Research and Medical Consultations  
- Supervisor General for Quality and Safety  
King Fahd Hospital of the University  
- Director:  
Monitoring Office for Research and Research Ethics  
- Director:  
Pharmacy @ KFHU

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