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The Impact of Project-Based and Experiential Learning Integration on Pre-Service Teacher Achievement in Evaluation and Assessment

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Abstract. The present study aimed to explore the effectiveness of integrating project-based learning (PBL) and experiential learning in fostering the evaluation and assessment skills of pre-service teachers. To assess the impact of this integration, a self-efficacy assessment form and evaluation of teacher performance, learning achievement and mentality aspects were employed. The findings of the study indicated that the integration of PBL and experiential learning yielded positive outcomes, enhancing the evaluation and assessment skills of pre-service teachers. This research contributes to the existing body of literature by providing empirical evidence supporting the potential of integrating PBL and experiential learning as an effective approach to augment pre-service teachers' evaluation and assessment abilities. The study also underscores the significance of creating hands-on and collaborative learning environments within teacher education programmes. These results have significant implications for the design of future teaching strategies aimed at improving the evaluation and assessment skills of pre-service teachers. By incorporating PBL and experiential learning, teacher education programmes can create dynamic learning experiences that engage students in practical, real-world contexts. This approach encourages active participation, critical thinking and problem-solving skills, which are essential for effective evaluation and assessment practices. The study emphasises the importance of providing pre-service teachers with opportunities to apply their knowledge in authentic settings, fostering a deeper understanding of evaluation and assessment principles. By equipping pre-service teachers with these skills, they will be better prepared to meet the demands of the classroom and contribute to improved student learning outcomes.

Keywords: project-based learning; experiential learning; teacher education, evaluation and assessment; teaching skill development

1. Introduction

Project-based learning (PBL) has gained increasing attention in the field of teacher education as a beneficial tool for offering pre-service teachers active learning experiences. In the twenty-first century, with the rapid advancement of

technology and the changing demands of the workforce, there is a growing need for educational approaches that prepare pre-service teachers for real-world challenges and equip them with essential skills for lifelong learning and future career development. According to Thomas (2000), PBL is a form of learning that centres around students and is structured by projects that are oriented toward solving real-world problems. Throughout the processes, collaborative projects allow students to learn new content and develop new sets of skills via active learning, critical thinking, and collaboration among students (Boss & Larmer, 2018). By incorporating PBL into the curriculum, educators can create a more engaging and effective learning environment that prepares pre-service teachers for success in the twenty-first century.

According to Krajcik and Shin (2014), PBL is based on four core ideas: active construction of understanding by the learners, collaboration among learners in authentic learning contexts, effective scaffolding provided by the teacher or other cognitive tools, and engagement in meaningful, real-world problems or challenges. This means that learners are encouraged to engage with the content by asking questions, seeking out information, making connections to their prior knowledge, and applying the concepts they are learning in real-world contexts. By actively constructing their understanding, learners develop a deeper and more meaningful understanding of the content (Chrestensen, 2007; Bruno et al., 2019). Moreover, learners work together in groups to solve real-world problems or complete authentic tasks that are relevant to their lives and interests. By working collaboratively, learners can share ideas, build on each other's strengths, and develop a more sophisticated understanding of the content (Xiaodan et al., 2019; Jayashree et al., 2021). Regarding teacher facilitation, learners are provided with the necessary guidance, support and resources to help them complete the task or solve the problem. Scaffolding may include explicit instruction, modelling, feedback, or other forms of support that help learners move towards greater independence and mastery of the content (Taber, 2018). Lastly, learners are presented with tasks or problems that are relevant to their lives and interests, and that require them to apply the concepts and skills they are learning in authentic and meaningful ways. By engaging in these types of tasks, learners are more likely to be motivated, engaged and invested in their learning, and are more likely to develop the skills and knowledge necessary for success in the real world (Alshare & Nitham, 2004; Mahmoud & Idris, 2021).

It can be noted that PBL emphasises the importance of real-world practice and authentic, meaningful tasks that allow students to gain hands-on experience and develop essential skills. This makes it consistent with the tenets of experiential learning. Experiential learning is a pedagogical approach that emphasises the importance of learning through first-hand experience and reflection on those experiences (Kolb, 1984). It involves a cycle of concrete experience, reflective observation, abstract conceptualisation and active experimentation, which allows learners to engage with the material in a more active and meaningful way. The first step is concrete experience, which entails engaging in a hands-on experience, such as participating in an activity or interacting with an object or environment. The second step is reflective observation, which involves examining the experience, highlighting noteworthy observations or discoveries, and assessing its relevance to broader concepts or theories. The abstract conceptualisation step

focuses on creating new concepts or theories, connecting the experience to broader ideas or principles, or identifying patterns or links within the experience. Lastly, the active experimentation step entails applying new theories, methods or assumptions based on earlier steps. This cycle provides learners with an active, engaging, and reflective approach to learning, enabling them to gain a deeper understanding of the material through direct experience and reflection.

Assessment and evaluation are crucial components of teaching and learning, and pre-service teachers must develop the necessary skills to be successful in their future careers (Wright, 2008). Effective assessment and evaluation practices allow teachers to monitor student progress, identify areas of strength and weakness, and make informed decisions about instructional strategies and interventions (Amua-Sekyi, 2016). In addition, teachers with strong assessment and evaluation skills are better equipped to meet the diverse needs of their students, create a positive learning environment, and support student success. Furthermore, the ability to design and implement assessments and evaluations is essential for meeting the requirements of educational policies and standards, ensuring accountability, and maintaining quality in education (Drovnikov et al., 2018). Therefore, it is vital that pre-service teachers receive adequate training in assessment and evaluation practices and can develop and apply these skills in real-world settings through project-based and experiential learning opportunities.

Calkins et al. (2018) presented five elements for assessment design including providing accessible and actionable information, being understood and valued by students, aligning with curriculum and instruction, building strong identities and promoting equity. In detail, effective assessment should provide students with information that is easily accessible and actionable. This means that the information should be clear, concise and relevant and should provide students with specific feedback that they can use to improve their learning. Assessment should also be designed to be inclusive so that all students have access to the same information and opportunities to demonstrate their knowledge and skills (Banta et al., 2009; Anette, 2020). Moreover, students need to understand and value the assessment as an authentic and worthwhile learning experience. This means that assessment should be relevant to students' lives and interests and should be designed in a way that is engaging and meaningful to them (McTighe, 2021). In addition, assessment should align with the curriculum and instruction to support knowledge transfer as it should be designed to assess the specific learning objectives and outcomes that have been taught in class and integrated into the instructional process as a natural part of learning (Brennan, 2010). Furthermore, assessment should be designed to promote a growth mindset and to encourage students to see themselves as capable and successful learners who can achieve their goals. Lastly, assessment should be designed to promote equity by addressing the diverse needs and experiences of all students (Taras & Wong, 2022). Differences in learning styles, abilities and backgrounds should be taken into consideration to create opportunities for all students. Assessment should also be designed to promote social justice and challenge stereotypes and biases that can limit student achievement.

However, developing assessment and evaluation skills is not an easy task. It requires a significant amount of time, effort and practice to master the various

techniques and strategies involved. Pre-service teachers must be willing to engage in ongoing professional development and seek out opportunities to refine their skills (Lumadi, 2013). Moreover, assessment and evaluation practices are constantly evolving, and teachers must stay up to date with the latest research and best practices in the field. Despite these challenges, the development of assessment and evaluation skills is critical for pre-service teachers to succeed in their future careers and make a positive impact on their student's learning and development.

At a contextual level, teacher education in the Thai context also prioritises evaluation and assessment skills. The knowledge of assessment types and implementation, the use of multiple measures, the use of technology in assessment, data analysis and feedback methods are included in the curriculum. However, the literature showed that pre-service teachers face challenges in developing such skills (Buathong, 2018; Sirisiriwat et al., 2016; Sripranomthanakorn & Thanwadi, 2019). This includes a lack of practical experience, limited exposure to diverse assessment practices, and limited opportunities for feedback and collaboration with experienced teachers. In addition, there may be cultural barriers that impact the implementation of effective evaluation and assessment practices, such as a focus on rote memorisation and a reluctance to challenge traditional teaching methods (Buathong, 2018). To address these challenges, teacher education programmes in Thailand should prioritise hands-on, experiential learning opportunities that allow pre-service teachers to develop and apply effective evaluation and assessment skills in real-world settings. Furthermore, it is important to provide ongoing support and professional development opportunities to ensure that teachers have the skills and knowledge they need to promote student learning and success.

Project-based learning and experiential learning are both educational approaches that prioritise active, student-centred learning experiences that emphasise the practical application of knowledge and skills in real-world contexts. By integrating experiential learning principles into PBL, students are provided with opportunities to engage in meaningful and authentic tasks that encourage active learning, critical thinking and collaboration – the skills needed to develop teachers' evaluation and assessment abilities. Previous studies also indicated the benefits of both instructional approaches in teacher education (Alrajeh, 2020; Biasutti & EL-Deghaidy, 2015; Eckardt et al., 2020; Ernst, 2013; Gao, 2015; Goldstein, 2016; Howard, 2002; Legge & Smith, 2014.; Miller et al., 2021; Roessingh & Chambers, 2011; Williams & Sembiante, 2022). The preceding studies provide evidence that PBL is an instructional approach that can be seamlessly integrated with technology, as demonstrated by the works of Alrajeh (2020), Biasutti and EL-Deghaidy (2015), and Howard (2002). Furthermore, earlier research advocates for the integration of PBL with other instructional principles to further enhance its effectiveness. Additionally, integrating experiential learning into teacher education programmes can help address the challenges faced by pre-service teachers in developing assessment and evaluation skills in the Thai context. Thus, this study seeks to apply these two principles, project-based and experiential learning, to the development of pre-service teachers' evaluation and assessment abilities. Two objectives are proposed: 1) to investigate the effects of project-based

and experiential learning integration on pre-service teacher achievement of evaluation and assessment and 2) to investigate pre-service teacher self-efficacy of evaluation and assessment after learning with project-based and experiential learning integration.

2. Methods

The study used a one-group pre-post-test design. The detail of research methodology can be seen below.

2.1 Participants

The study involved 32 pre-service teachers who were enrolled in a university in Thailand, a context that has faced challenges in the quality of its teachers, particularly regarding evaluation and assessment skills (Buathong, 2018; Sirisiriwat et al., 2016; Sripranomthanakorn & Thanwadi, 2019). The researchers used a cluster random sampling method to ensure a representative sample. In detail, one out of two groups of social studies major students enrolling in the Measurement and Evaluation Design in Social Studies course was selected. The study was conducted following human research ethics, and ethical considerations were taken into account to ensure the safety and well-being of the participants. Prior to the study, participants were provided with a clear and detailed explanation of the research project, its objectives and the expected outcomes. Informed consent was obtained from each participant, ensuring that they fully understood the purpose of the study and agreed to participate voluntarily. The participants were informed that their involvement in the study was entirely voluntary and that they had the right to withdraw from the study at any time without penalty or consequence. Confidentiality was also maintained throughout the study, with all data being stored securely and anonymously to ensure the privacy and anonymity of the participants. These measures were put in place to ensure that the rights and welfare of the participants were protected, and to maintain the integrity and credibility of the research findings.

2.2 Instrumentation/Data Collection

2.2.1 The Integrated PBL and Experiential Learning Circle

The current study used a set of learning activities that were carefully designed to incorporate the principles of project-based learning and experiential learning. Project-based learning emphasises a problem-based and student-centred approach to learning, while experiential learning emphasises the importance of learning through direct experience and reflection on that experience. By integrating these two principles, the following activities were used in the class.

Firstly, students participated in brainstorming sessions to identify and select a real-world problem or challenge regarding evaluation and assessment. Once a problem had been selected, students engaged in research and gathered relevant information related to the problem or challenge. They were assigned to search various sources of information, including online resources, surveys and interviews, to gain a deeper understanding of the issue.

After gathering information, students collaborated with their peers to develop a project plan and timeline. They were separated into groups of four and instructed to develop a plan that indicates the tasks and responsibilities of members as well

as a working schedule to ensure that the project is completed within a specific timeframe. Throughout the project, students designed and implemented their ideas using a variety of resources and tools, such as technology, art materials or physical resources.

As the project progressed, students were encouraged to engage in the first-hand learning experience, for example, conducting interviews or surveys with professional teachers, administrators, students and parents to gather information related to evaluation and assessment, visiting schools and communities and engaging in other hands-on activities related to the project. Students were instructed to use various reflection methods, such as journals, group discussions or individual assessments, to deepen their understanding of the project and their learning experience.

Finally, students presented their projects to their peers. An exhibition was held to give students an opportunity for students to showcase their learning and communicate the importance of their project. In terms of assessment, students were assessed on a variety of criteria regarding their ability to identify and solve real-world problems, collaborate with peers, use technology and resources effectively, and communicate their ideas clearly and effectively through presentations.

Overall, the learning circle emphasises concrete experience, reflective observation, abstract conceptualisation and active experimentation to let learners develop their assessment skills through experiential learning experiences gained while doing hands-on activities. The learning circle was used after the pre-test session, and it was evaluated to be appropriate ($\bar{x}$ = 4.80, SD = 0.44) before the implementation by five experts including scholars in evaluation and assessment, learning management and teacher education.

2.2.2 Evaluation and Assessment evaluation form (Rubric Scoring)

The study used a form to assess the pre-service teachers' evaluation and assessment skills, comprising two main parts: the ability to develop an assessment and to evaluate students' attributes. The assessment form consisted of 11 issues related to the ability to develop an assessment and seven issues related to the ability to evaluate students' attributes. The form was administered only after the treatment and was used by the researcher to evaluate the participants' skills after learning with the PBL and experiential learning integration. The evaluation criteria were based on a 4-point rating scale. The scale ranged from 0 (no ability) to 3 (advanced ability) for each evaluating issue, allowing for a comprehensive evaluation of the participants' assessment and evaluation skills development. The content validity of each evaluation item was at 0.67-1.00. The rubric scale was tested using a Rater Agreement Index and was found to be 0.99.

2.2.3 Self-efficacy evaluation form (Rating Scale)

The study used a self-efficacy form to assess the participant's level of confidence in their own evaluation and assessment skills. The form contained content that was similar to the previously used skill assessment form; however, it allowed students to rate their skills on a scale from 1 to 5. This form aimed to provide insight into the participants' perceived abilities concerning evaluation and assessment and to track any changes or improvements in self-efficacy throughout

the learning programme. The self-efficacy form was considered an important measure in evaluating the effectiveness of the learning programme, as it allowed for a deeper understanding of the participants' confidence in their skills, and how this may impact their future teaching practices. The form was employed before and after the treatment to investigate the extent to which the participants believed they could develop their evaluation and assessment skills. The content validity of each evaluation item was at 0.67-1.00. The discrimination of each evaluation item was 0.55-0.87, and the reliability was 0.96 as tested by Cronbach's alpha coefficient.

2.2.4 Learning achievement test

To assess the participants' knowledge of evaluation and assessment issues, a learning achievement test was employed. The test was designed to evaluate the participants' ability to develop learning achievement assessments, evaluate students' attributes, develop psychomotor assessments, manage tests, ensure the quality of written and multiple-choice tests, and assess the quality of students' attributes and psychomotor assessments. The test was employed after the treatment. The content validity of each item was found to be at an acceptable level (IOC = 0.67-1.00), ensuring that the test accurately measured the participants' knowledge of evaluation and assessment issues in the course description. The test consisted of 50 items, each with four choices, with appropriate levels of difficulty (P = 0.38-0.75) and discrimination (D = 0.25-0.88). The reliability was 0.89 as tested by Kuder - Richardson Method (KR-20).

2.3 Data Analysis

In summary, a one-group pre-post-test design was used. Prior to the intervention, a self-efficacy assessment was administered. Participants then engaged in learning activities that were designed using the principles of project-based learning and experiential learning, with a duration of one semester. After the intervention, participants' evaluation and assessment skills were assessed, and they were asked to self-evaluate their skills once more. In addition, a learning achievement test was administered. The collected data were analysed using various statistical methods such as percentage, mean score, standard deviation, paired sample test and one-sample t-test.

3. Results

3.1 Test Normality

The results show that all the data sets gathered in the current study were in a normal distribution. Both Kolmogorov-Smirnova and Shapiro-Wilk indicated no significant abnormality in data distribution in Table 1. Therefore, parametric statistics were used to identify the results of the study.

Table 1: Normality of data

Data	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	p	Statistic	df	p
Participants' learning achievement	0.14	31	0.13	0.94	31	0.10
Ability to develop an assessment (Post-test)	0.12	31	0.20	0.95	31	0.16
Ability to evaluate students' attributes (Post-test)	0.10	31	0.20	0.94	31	0.07
Overall participants' Self-efficacy in evaluation and assessment (Pre-test)	0.13	31	1.23	0.13	31	0.11
Participants' Self-efficacy in the ability to develop an assessment (pre-test)	0.11	31	1.35	0.11	31	0.09
Participants' Self-efficacy in the ability to evaluate students' attributes (pre-test)	0.14	31	0.98	0.14	31	0.08
Overall participants' Self-efficacy in evaluation and assessment (Post-test)	0.09	31	0.78	0.09	31	0.67
Participants' Self-efficacy in the ability to develop an assessment (post-test)	0.12	31	0.87	0.12	31	1.05
Participants' Self-efficacy in the ability to evaluate students' attributes (post-test)	0.11	31	0.69	0.10	31	0.58

3.2 Evaluation and Assessment Skills Assessed by Teachers

The findings suggest that pre-service teachers who participated in the learning activities designed by integrating PBL and experiential learning exhibited a high level of evaluation and assessment skills ($\bar{x}$ = 43.16). When the evaluation and assessment skills were examined in detail, it was revealed that the participants possessed a very high level of ability to develop an assessment ($\bar{x}$ = 27.32), while their ability to evaluate students' attributes was rated at a high level ($\bar{x}$ = 15.84). The results indicated that the participants excelled in classifying learning objectives according to Bloom's taxonomy, developing multiple-choice assessments, selecting supervisors for test quality, analysing the quality of multiple-choice assessments, analysing the quality of open-ended assessments, writing reports on assessment quality, selecting supervisors for attribute assessment quality, publishing attribute assessments and writing reports on students' attribute assessments. They were able to identify the test structure, develop an assessment according to the planned structure and learning objectives, develop an open-ended assessment and provide clear instructions. They also demonstrated a satisfactory level of ability to scope the structure of an attribute assessment, set questions following operational definitions, and select supervisors for attribute assessment quality. However, they faced difficulties in identifying the operational definitions of subject matters (Table 2).

Table 2: Participants' evaluation and assessment skills after the treatment

Evaluation issues	Min	Max	$\bar{x}$	SD	%	Interpretation
1. The ability to develop an assessment	22	33	27.32	4.13	82.80	Very High
1) Be able to classify learning objectives following Bloom's taxonomy	2	3	2.84	0.37	94.62	Very High
2) Be able to scope test structure	2	3	2.29	0.46	76.34	High
3) Be able to develop an assessment following the planned structure and learning objectives	2	3	2.29	0.46	76.34	High
4) Be able to develop a multiple-choice assessment	2	3	2.84	0.37	94.62	Very High
5) Be able to develop an open-ended assessment and provide a clear instruction	2	3	2.29	0.46	76.34	High
6) Be able to select supervisors for test quality	2	3	2.65	0.49	88.17	Very High
7) Be able to publish the assessment	2	3	2.29	0.46	76.34	High
8) Be able to manage an assessment	2	3	2.29	0.46	76.34	High
9) Be able to analyse the quality of multiple-choice assessment	2	3	2.45	0.51	81.72	Very High
10) Be able to analyse the quality of open-ended assessment	2	3	2.65	0.49	88.17	Very High
11) Be able to write a report on assessment quality	2	3	2.45	0.51	81.72	Very High
2. The ability to evaluate students' attributes	11	21	15.84	3.80	75.42	High
1) Be able to identify the operational definitions of subject matters	1	3	1.74	0.89	58.06	Limited
2) Be able to scope the structure of an attribute assessment	1	3	2.13	0.67	70.97	Average
3) Be able to set questions following the operational definitions	1	3	2.13	0.67	70.97	Average

Evaluation issues	Min	Max	$\bar{x}$	SD	%	Interpretation
4) Be able to select supervisors for the attribute assessment quality	2	3	2.65	0.49	88.17	Very High
5) Be able to analyse the quality of an attribute assessment	2	3	2.29	0.46	76.34	High
6) Be able to publish an attribute assessment	2	3	2.45	0.51	81.72	Very High
7) Be able to write a report on students' attribute assessment	2	3	2.45	0.51	81.72	Very High
Average	33	54	43.16	7.91	79.93	High

3.3 Participants' Evaluation and Assessment Skills

The present study used a one-sample t-test, a parametric statistical analysis, as all collected data sets exhibited normal distribution. A determining score of 70 percent of the full marks was set, which indicated a significant difference between the participants' overall evaluation and assessment skills ($\bar{x}$ = 43.16) and the determining score (t = 3.77, p = 0.00). Additionally, there was a significant difference between the participant's ability to develop an assessment ($\bar{x}$ = 27.32) and the determining score (t = 5.70, p = 0.00), as well as a significant difference between the participants' ability to evaluate students' attributes ($\bar{x}$ = 15.84) and the determining score (t = 5.70, p = 0.00). It can be inferred that the integration of PBL and experiential learning was effective in developing pre-service teachers' evaluation and assessment skills, as all mean scores were higher than the determining scores. Therefore, it can be concluded that the learning programme was successful in developing pre-service teachers' evaluation and assessment skills to a desirable level (Table 3).

Table 3: One sample t-test for the participants' evaluation and assessment skills

Evaluation issues	Full mark	Determining mark	$\bar{x}$	SD	Mean Differences	t	p
The ability to develop an assessment	33	23.10	27.32	4.13	4.22	5.70	0.00*
The ability to evaluate students' attributes	21	14.70	15.84	3.80	1.67	1.14	0.06
Overall	54	37.80	43.16	7.91	5.36	3.77	0.00*

*p<0.05

3.4 Participants' Learning Achievement after the Treatment

The study found that the integration of PBL and experiential learning was effective in enhancing pre-service teachers' learning achievement of evaluation

and assessment. The results of a one-sample t-test revealed a statistically significant difference between the participants' average score on the learning achievement test ($\bar{x}$ = 38.06) and the determining criteria (t= 3.93, p = 0.00). The finding suggests that the designed learning activities using PBL and experiential learning were successful in improving the participants' learning achievement in evaluation and assessment to an expected extent.

Table 4: Participants' learning achievement of evaluation and assessment

	Full mark	Determining score	Min	Max	$\overline{X}$	SD	t	p
Learning achievement	50	35	27	45	38.06	4.34	3.93	0.00*

*p<0.05

3.5 The Participants' Self-Efficacy in Evaluation and Assessment Before and After the Treatment

The present study reports that pre-service teachers' self-efficacy in evaluation and assessment skills was at an average level before the intervention ($\bar{x}$ = 3.26), but significantly increased to a very high level after the treatment ($\bar{x}$ = 4.27), t = 6.12, p = 0.00. Notably, both the ability to develop assessments ($\bar{x}$ pre-test = 3.30; $\bar{x}$ post-test = 4.27), t = 5.88, p = 0.00 and the ability to evaluate students' attributes ($\bar{x}$ pre-test = 3.20; $\bar{x}$ post-test = 4.26), t = 6.10, p = 0.00 showed the same positive effect. These results suggest that the integration of project-based learning and experiential learning positively impacted pre-service teachers' self-efficacy in evaluation and assessment skills. It can be inferred that the intervention was effective in enhancing their perceived ability to evaluate and assess students, as reflected in their self-reported improvement.

Table 5: The participants' self-efficacy in evaluation and assessment before and after the treatment

Self-efficacy		$\bar{x}$	SD	Paired Differences		t-test	p
				$\bar{x}$	SD		
The ability to develop an assessment	Post	4.27	0.53	0.97	0.92	5.88	.000*
	Pre	3.30	0.93				
The ability to evaluate students' attributes	Post	4.26	0.55	1.06	0.97	6.10	.000*
	Pre	3.20	1.03				
Overall	Post	4.27	0.53	1.01	0.91	6.12	.000*
	Pre	3.26	0.95				

*p<0.5

4. Discussion

This study aimed to integrate PBL and experiential learning to develop pre-service teachers' evaluation and assessment skills. Additionally, we sought to address a gap in the literature by incorporating learners' aspects into the principles, which had been neglected in previous studies (e.g., Alrajeh, 2020; Eckardt et al., 2020; Miller et al., 2021; Williams & Sembiante, 2022). To investigate

the effectiveness of this approach, we assessed pre-service teachers' self-efficacy in evaluation and assessment skills before and after the intervention. Specifically, we employed a self-efficacy assessment form and found that the data gained from it contributed to the study by demonstrating that the principles of PBL and experiential learning are effective in promoting students' confidence in evaluation and assessment work.

The study's key findings reveal that the integration of PBL and experiential learning was beneficial in developing pre-service teachers' evaluation and assessment skills. This is demonstrated through the positive results in the teacher assessment aspect, as the researchers rated the participants' performance above the expected level. Additionally, the participants' knowledge aspect showed that their learning achievement score was above the expected criteria, and the mentality aspect indicated that the treatment made participants more confident in their evaluation and assessment skills.

These findings support previous studies (e.g., Alrajeh, 2020; Eckardt et al., 2020; Miller et al., 2021; Williams & Sembiante, 2022) have also identified PBL and experiential learning as beneficial principles in teacher education. These principles provide a hands-on and collaborative learning environment for students, allowing them to actively engage in the learning process by solving real-world problems, working in groups and applying their knowledge and skills to create a product or solution. Experiential learning emphasises the importance of learning through direct experiences, reflection and application. By integrating these principles, pre-service teachers can practise and develop their evaluation and assessment skills in a real-world context, enhancing their confidence and self-efficacy in these skills.

Furthermore, the study's use of self-efficacy assessments provides further evidence of the positive impact of PBL and experiential learning on pre-service teachers' efficacy in evaluation and assessment skills. Self-efficacy assessments allow participants to assess their confidence in their abilities, providing insight into the effectiveness of the intervention. Overall, the study's findings highlight the importance of PBL and experiential learning in developing pre-service teachers' evaluation and assessment skills, providing valuable insights for teacher education programmes seeking to enhance their students' learning outcomes.

Indeed, while prior research has demonstrated the efficacy of both PBL and experiential learning in enhancing pre-service teachers' evaluation and assessment skills, the current study is unique in that it highlights the benefits of integrating these two principles. This finding underscores the potential synergistic effects of combining different pedagogical approaches to create more effective learning environments. Furthermore, the use of a self-efficacy assessment form in the study allowed for a more nuanced understanding of the impact of PBL and experiential learning on pre-service teachers' confidence in their evaluation and assessment skills. Self-efficacy refers to an individual's belief in their ability to perform a specific task or achieve a particular outcome. In the context of education, self-efficacy is an important predictor of academic performance or performing actions at designated levels and achievement (Bandura, 1997; Dele & Maria, 2015). By measuring self-efficacy concerning evaluation and assessment skills, the current study provides evidence of the

positive impact of PBL and experiential learning on pre-service teachers' perceived competence in these areas.

5. Conclusion

This study aimed to integrate PBL and experiential learning to enhance pre-service teachers' evaluation and assessment skills. It also aimed to address a research gap by incorporating learners' perspectives, which had been overlooked in previous studies to include additional elements that can enhance PBL processes.

Given the promising results of this study, there is a need for further investigation into the effectiveness of integrating PBL and experiential learning in other aspects of teacher education, such as curriculum development or classroom management. Future research could explore the extent to which these principles can be applied across different settings and contexts, and how they might be modified to suit the needs of different learner populations. Additionally, as self-efficacy assessments are effective in measuring the impact of these principles, future studies could further refine and validate such assessments to ensure their reliability and validity in different educational settings. Moreover, studies that explore the long-term impact of integrating PBL and experiential learning on pre-service teachers' evaluation and assessment skills could provide insights into the sustainability of these approaches. Finally, it would be useful to investigate the impact of these approaches on pre-service teachers' attitudes toward evaluation and assessment, as well as their perceived value and relevance in their future teaching practice.

One limitation of this study is its heavy reliance on quantitative measures, which limits the depth of insights into pre-service teachers' experiences and perceptions. By not incorporating qualitative data, important nuances and contextual understanding may be missed, hindering a comprehensive understanding of the topic. Future research could benefit from incorporating qualitative methods to gain richer insights into the subjective experiences and perspectives of pre-service teachers involved in PBL and experiential learning.

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