Studies in Interdisciplinary Horizons
https://sih-journal.com | eISSN: 3082-5792
Volume 2 Issue No. 3 | 2026
Received: March 10, 2026 | Accepted: June 30, 2026 | Published: August 30, 2026

Article

Project-Based Learning in Technical Education: Teachers' Experiences in Developing Grade 10 Students' Technical Skills

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Abstract

Project-Based Learning (PBL) has emerged as an effective learner-centered pedagogical approach that promotes authentic learning, problem-solving, collaboration, and technical skill development in technical education. By engaging learners in meaningful projects that simulate real-world workplace situations, PBL enables students to apply theoretical knowledge while developing practical competencies essential for lifelong learning and employability. This study explored the experiences of technical education teachers in implementing Project-Based Learning to develop the technical skills of Grade 10 students. A qualitative phenomenological research design was employed involving ten Grade 10 technical education teachers selected through purposive sampling. Data were gathered through semi-structured interviews, classroom observations, and document analysis and were analyzed using Braun and Clarke's six-phase thematic analysis. The findings revealed that teachers utilized authentic project tasks, collaborative learning, industry-based applications, reflective assessment, and continuous coaching to strengthen students' technical competencies. Despite challenges related to limited resources, varying learner abilities, project time requirements, and assessment demands, teachers demonstrated creativity, adaptability, and strong instructional commitment in implementing Project-Based Learning. The study highlights the importance of teacher competence, adequate learning resources, school-industry collaboration, and continuous professional development in strengthening Project-Based Learning implementation. The findings provide valuable insights for technical education teachers, school administrators, curriculum developers, and policymakers in improving technical skills development through authentic and learner-centered instruction.

Keywords: *Project-Based Learning, technical education, technical skills, teachers' experiences, Grade 10 students, phenomenology, qualitative research*

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1. Introduction

Technical education plays a vital role in preparing learners with practical knowledge, technical competencies, and workplace skills necessary for employment, entrepreneurship, and lifelong learning. In the Grade 10 curriculum, technical education equips learners with hands-on experiences that enable them to develop industry-relevant competencies while applying theoretical concepts in authentic learning situations. As industries continue to demand graduates who possess technical expertise, critical thinking, collaboration, and problem-solving skills, schools are challenged to adopt instructional approaches that promote meaningful and experiential learning.

Project-Based Learning (PBL) has become one of the most effective learner-centered pedagogical approaches in technical education. Unlike traditional teacher-centered instruction, PBL actively engages learners in designing, creating, and completing authentic projects that address real-world problems and workplace scenarios. Through project implementation, learners develop technical competencies, creativity, communication skills, teamwork, self-management, and reflective thinking while applying classroom knowledge to practical situations.

Teachers play a crucial role in the successful implementation of Project-Based Learning. They facilitate learning by designing authentic projects, guiding learners throughout project development, monitoring progress, providing constructive feedback, and encouraging reflection on learning experiences. Rather than serving solely as knowledge providers, teachers become facilitators, mentors, and coaches who support learners in acquiring technical skills through active participation, inquiry, collaboration, and continuous improvement.

Despite its educational benefits, implementing Project-Based Learning presents several instructional challenges. Teachers frequently encounter limited workshop facilities, inadequate instructional materials, insufficient equipment, varying learner readiness, time constraints, and difficulties in assessing project outcomes. These realities require teachers to become innovative, resourceful, and flexible in designing meaningful learning experiences that remain aligned with curriculum competencies while responding to available resources and learners' needs.

Although numerous studies have examined the effectiveness of Project-Based Learning in improving learner achievement and technical competencies, much of the existing literature has focused on quantitative outcomes. Limited qualitative research has explored the lived experiences of technical education teachers in implementing Project-Based Learning within authentic classroom settings. Understanding these experiences provides valuable insights

into teachers' instructional practices, implementation challenges, professional decision-making, and strategies for developing learners' technical skills.

Therefore, this study explored the experiences of technical education teachers in implementing Project-Based Learning to develop the technical skills of Grade 10 students. The findings are expected to contribute to strengthening instructional practices, enhancing teacher professional development, improving curriculum implementation, and promoting learner-centered technical education that responds to the evolving demands of industry and society.

2. Objectives of the Study

This study aimed to explore the experiences of technical education teachers in implementing Project-Based Learning (PBL) to develop the technical skills of Grade 10 students.

Specifically, it sought to:

1. describe the pedagogical practices employed by technical education teachers in implementing Project-Based Learning;
2. explore the experiences of teachers in developing Grade 10 students' technical skills through Project-Based Learning;
3. identify the challenges encountered by teachers in implementing Project-Based Learning in technical education;
4. examine the strategies employed by teachers to address implementation challenges and strengthen students' technical competencies; and
5. provide implications for improving Project-Based Learning implementation, technical education instruction, and teacher professional development.

3. Review of Related Literature

Project-Based Learning (PBL) has gained widespread recognition as an effective learner-centered instructional approach that promotes authentic learning, critical thinking, collaboration, and technical skill development. Unlike traditional teacher-centered methods, PBL engages learners in investigating real-world problems, designing practical solutions, and producing meaningful outputs that demonstrate their understanding and competencies. Through authentic project experiences, learners develop technical expertise while strengthening communication, teamwork, creativity, and problem-solving skills essential for the twenty-first-century workplace.

In technical education, Project-Based Learning provides learners with opportunities to integrate theoretical knowledge with practical application. By completing industry-related projects, learners acquire technical competencies that closely resemble workplace tasks and professional standards. Research has shown that project-based instruction enhances learners' confidence, independence, and ability to apply technical concepts in authentic settings. It also promotes deeper understanding by allowing learners to learn through active participation, experimentation, and reflection.

The role of teachers is central to the successful implementation of Project-Based Learning. Teachers design authentic project tasks, facilitate inquiry, monitor learner progress, provide timely feedback, and guide learners in solving practical problems. Rather than functioning as the primary source of information, teachers become facilitators who encourage collaboration, self-directed learning, and reflective practice. Effective teacher facilitation creates supportive learning environments where learners actively construct knowledge and develop technical competence through meaningful experiences.

Assessment in Project-Based Learning extends beyond traditional written examinations by emphasizing authentic evaluation of learners' performance and technical competence. Teachers employ project rubrics, performance-based assessments, reflective journals, demonstrations, peer assessment, and portfolio evaluation to assess learners' knowledge, practical skills, collaboration, and problem-solving abilities. Authentic assessment enables teachers to evaluate learners' application of knowledge while promoting continuous improvement and self-reflection.

Despite the advantages of Project-Based Learning, technical education teachers continue to encounter implementation challenges. Limited workshop facilities, inadequate tools and equipment, insufficient instructional materials, large class sizes, varying learner abilities, and limited instructional time often affect project implementation. Consequently, teachers become innovative by utilizing locally available materials, modifying project designs, strengthening collaborative learning, and maximizing available resources to ensure meaningful technical learning experiences.

Although previous studies have examined the effectiveness of Project-Based Learning in improving learner achievement and technical competence, relatively few qualitative investigations have explored the lived experiences of technical education teachers implementing PBL in secondary schools. This study addresses this gap by examining teachers' pedagogical practices, classroom experiences, implementation challenges, and instructional strategies in developing Grade 10 students' technical skills through Project-Based Learning.

4. Theoretical Framework

This study is anchored on **Project-Based Learning Theory** by Thomas (2000), **Constructivist Learning Theory** by Jean Piaget, **Experiential Learning Theory** by David Kolb, and **Social Constructivism** by Lev Vygotsky. These theories provide the conceptual basis for understanding teachers' experiences and pedagogical practices in implementing Project-Based Learning (PBL) to develop the technical skills of Grade 10 students.

Project-Based Learning Theory (Thomas, 2000) explains that meaningful learning occurs when learners actively investigate authentic problems and produce projects that demonstrate knowledge and skills. Project-Based Learning places learners at the center of the instructional process by engaging them in planning, designing, implementing, and evaluating projects that mirror real-world tasks. In technical education, this approach enables learners to develop practical competencies, critical thinking, collaboration, creativity, and problem-solving skills while applying theoretical concepts to authentic workplace situations.

Constructivist Learning Theory (Piaget, 1972) posits that learners actively construct knowledge by connecting new experiences with their prior understanding. In technical education, teachers facilitate learning by allowing learners to engage in hands-on activities, experimentation, inquiry, and problem-solving. Through active participation in project development, learners deepen their conceptual understanding and strengthen their technical competencies by learning through meaningful experiences.

Experiential Learning Theory (Kolb, 1984) emphasizes that learning occurs through a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Project-Based Learning provides learners with authentic experiences where they apply technical concepts, reflect on project outcomes, improve their performance, and transfer acquired skills to new situations. Reflection and continuous improvement are essential elements in strengthening learners' technical competence and workplace readiness.

Social Constructivism (Vygotsky, 1978) highlights the importance of social interaction, collaboration, and guided learning in knowledge construction. Within Project-Based Learning, learners work collaboratively, exchange ideas, solve problems collectively, and receive continuous guidance from teachers and peers. Teachers serve as facilitators who scaffold learning experiences and support learners in achieving increasingly complex technical tasks through cooperative learning.

Collectively, these theories explain how learner-centered, collaborative, and experiential instructional practices contribute to the successful implementation of Project-Based Learning and the development of Grade 10 students' technical skills.

5. Methodology

This study employed a qualitative phenomenological research design to explore the experiences of technical education teachers in implementing Project-Based Learning to develop the technical skills of Grade 10 students. The phenomenological approach was selected because it enables an in-depth understanding of teachers' lived experiences, instructional practices, and perspectives regarding the implementation of Project-Based Learning in authentic classroom settings.

The study was conducted in selected public secondary schools offering Grade 10 technical education programs. The participants consisted of ten (10) Grade 10 technical education teachers who had direct experience in implementing Project-Based Learning. Participants were selected through purposive sampling based on their teaching assignments, years of teaching experience, and active use of project-based instructional approaches in technical education.

Data were gathered using a researcher-developed semi-structured interview guide, complemented by classroom observations and document analysis. Project plans, lesson plans, learners' project outputs, assessment rubrics, instructional materials, and reflective journals were examined to validate and enrich the interview data. Prior to data collection, permission to conduct the study was obtained from the Schools Division Office and the respective school administrators. Written informed consent was secured from all participants before individual interviews were conducted. Interviews were audio-recorded with participants' permission, transcribed verbatim, and verified through member checking to ensure the accuracy and credibility of the collected data.

The collected data were analyzed using Braun and Clarke's (2006) six-phase thematic analysis, which involved familiarization with the data, coding, searching for themes, reviewing themes, defining and naming themes, and producing the final report. This systematic process enabled the identification of recurring themes that described teachers' pedagogical practices, experiences, implementation challenges, and strategies in developing learners' technical skills through Project-Based Learning.

To ensure the trustworthiness of the findings, the study employed the criteria of credibility, transferability, dependability, and confirmability. Credibility was established through member checking, prolonged engagement, and triangulation of interview, observation, and document analysis data. Dependability and confirmability were strengthened through peer debriefing and maintaining an audit trail, while transferability was enhanced by providing rich descriptions of the participants, research setting, and instructional context.

Ethical standards were strictly observed throughout the conduct of the study. Approval to conduct the research was obtained from the appropriate educational authorities before data gathering commenced. Participation was voluntary, and all participants signed informed

consent forms after receiving a clear explanation of the study's objectives, procedures, potential benefits, and possible risks. Confidentiality and anonymity were maintained through the use of pseudonyms, and all collected information was securely stored and used exclusively for academic and research purposes.

6. Findings and Discussion

Theme 1: Developing Technical Competence through Authentic Project-Based Learning Experiences

The findings revealed that technical education teachers viewed authentic project tasks as the foundation of effective technical skills development. Participants explained that Project-Based Learning enabled learners to apply theoretical concepts to practical situations by engaging them in projects that closely resembled real workplace tasks. Through designing, constructing, assembling, troubleshooting, and evaluating project outputs, learners developed technical competence, confidence, and problem-solving abilities while experiencing the realities of technical work.

Participant 2 shared:

"Our projects simulate actual workplace situations. Learners do not simply memorize procedures—they perform the tasks, solve problems, and improve their skills through actual project work."

Participant 7 stated:

"Project-Based Learning allows learners to learn by doing. As they complete their projects, they become more confident in using tools, following procedures, and producing quality outputs."

These responses demonstrate that authentic project experiences provide meaningful opportunities for learners to develop practical technical competencies while strengthening critical thinking and workplace readiness. Teachers believed that engaging learners in real-world projects enhanced skill mastery because students actively applied classroom concepts in authentic situations. The findings support Project-Based Learning Theory, which emphasizes meaningful learning through authentic problem-solving and project completion (Thomas, 2000). Likewise, the findings align with Experiential Learning Theory, which explains that technical competence develops through concrete experiences, reflection, and active experimentation (Kolb, 1984).

Theme 2: Facilitating Collaboration and Learner Engagement through Project-Based Instruction

The participants emphasized that Project-Based Learning encouraged collaboration, communication, and active learner participation throughout project implementation.

Teachers organized learners into small groups where they shared responsibilities, exchanged ideas, solved technical problems collaboratively, and supported one another in completing project requirements. Participants explained that teamwork enabled learners to develop interpersonal skills while strengthening technical knowledge through peer interaction and cooperative learning.

Participant 3 explained:

"Group projects encourage learners to communicate and solve technical problems together. They learn from one another while completing the required project."

Participant 8 remarked:

"My role is to guide and monitor the learners while allowing them to make decisions and discover solutions independently. They become more responsible and confident when they work as a team."

These findings indicate that collaborative learning enhances learner engagement and strengthens both technical and interpersonal competencies. Through teamwork, learners develop communication, leadership, cooperation, and problem-solving skills that are essential in technical education and future workplaces. Teachers serve as facilitators who scaffold learning, provide guidance, and encourage reflective thinking rather than simply delivering information. These findings support Vygotsky's Social Constructivism, which emphasizes that learning occurs through meaningful social interaction, collaboration, and teacher guidance. Furthermore, learner-centered project implementation promotes active participation and deeper understanding by allowing learners to construct knowledge through shared experiences and collaborative inquiry.

Theme 3: Addressing Resource Constraints through Creativity and Instructional Innovation

The findings revealed that teachers encountered challenges related to limited tools, equipment, workshop facilities, instructional materials, and financial resources during the implementation of Project-Based Learning. Despite these limitations, participants demonstrated creativity by improvising instructional materials, maximizing locally available resources, modifying project designs, and encouraging learners to recycle or repurpose materials without compromising learning objectives. These adaptive practices enabled teachers to sustain authentic learning experiences while ensuring that learners continued to develop essential technical skills.

Participant 1 shared:

"We do not always have complete tools and materials, so I encourage learners to use locally available resources and recyclable materials. The important thing is that they still learn the correct technical process."

Participant 6 stated:

"Sometimes we modify the project according to the available equipment. Even if resources are limited, learners can still achieve the required competencies through proper guidance."

These responses indicate that teachers' resourcefulness and innovation play an important role in sustaining Project-Based Learning despite limited resources. By adapting project requirements to available facilities and materials, teachers maintained learner engagement while promoting creativity, problem-solving, and technical competence. These findings support Constructivist Learning Theory, which emphasizes meaningful learning through authentic experiences and active problem-solving.

Theme 4: Strengthening Technical Competence through Continuous Feedback and Authentic Assessment

The participants emphasized that continuous monitoring, coaching, and authentic assessment were essential in developing learners' technical skills throughout project implementation. Rather than evaluating only the finished product, teachers assessed learners' planning, technical processes, safety practices, collaboration, and problem-solving abilities at different stages of project completion. They provided immediate feedback that enabled learners to identify mistakes, improve technical performance, and refine their outputs before project completion.

Participant 4 explained:

"I observe learners while they are working on their projects because the process is just as important as the final product. I immediately provide feedback whenever improvements are needed."

Participant 9 remarked:

"Project rubrics allow learners to understand the standards they need to achieve. Continuous feedback motivates them to improve the quality of their work."

These findings demonstrate that authentic assessment promotes continuous improvement by evaluating both the learning process and the final project output. Ongoing teacher feedback strengthens learners' technical competence, confidence, and reflective thinking while encouraging responsibility for their own learning. The findings align with Experiential Learning Theory, which emphasizes learning through reflection and continuous refinement of practice.

Theme 5: Demonstrating Reflective Practice and Professional Commitment in Project-Based Learning

The findings revealed that teachers consistently reflected on their instructional practices to improve the implementation of Project-Based Learning. Participants regularly evaluated project outcomes, consulted colleagues, participated in Learning Action Cells (LACs), attended technical skills training, and updated their instructional strategies to respond to learners' needs and industry demands. They believed that continuous professional learning enabled them to design more meaningful projects and improve the quality of technical education.

Participant 2 shared:

"After every project, I evaluate what worked well and what should be improved. Reflection helps me design better projects for the next group of learners."

Participant 8 stated:

"Training and collaboration with fellow technical education teachers give me new ideas that I can immediately apply in my classes. Continuous learning helps me become a better facilitator of Project-Based Learning."

These responses suggest that reflective practice and professional development strengthen teachers' instructional competence and confidence in implementing Project-Based Learning. Through continuous reflection, collaboration, and lifelong learning, teachers improve project design, classroom facilitation, and learner support. The findings highlight that sustained professional growth is essential for maintaining high-quality technical education and preparing learners with the competencies required in modern workplaces.

7. Conclusion

This study explored the experiences of technical education teachers in implementing Project-Based Learning (PBL) to develop the technical skills of Grade 10 students. The findings revealed that teachers effectively utilized authentic project tasks, collaborative learning, continuous coaching, reflective practice, and authentic assessment to strengthen learners' technical competencies. By engaging students in real-world projects, teachers enabled them to apply theoretical knowledge, develop practical skills, enhance problem-solving abilities, and improve teamwork and communication. Although participants encountered challenges such as limited tools and equipment, inadequate instructional resources, time constraints, and differences in learners' abilities, they demonstrated creativity, adaptability, and strong professional commitment in sustaining meaningful project-based instruction. The study concludes that successful implementation of Project-Based Learning depends on teachers' pedagogical competence, reflective practice, resourcefulness, and commitment to providing

authentic learning experiences that prepare learners for technical careers and lifelong learning.

8. Implications

The findings of this study offer significant implications for technical-vocational education, instructional leadership, and teacher professional development. Schools should strengthen Project-Based Learning implementation by providing adequate workshop facilities, updated tools and equipment, instructional materials, and safe learning environments that support authentic technical training. School administrators should encourage continuous professional development through specialized training, Learning Action Cells (LACs), industry immersion, and professional learning communities that enhance teachers' competence in project design, authentic assessment, and learner-centered instruction. Partnerships between schools, local industries, technical experts, and community organizations should be expanded to provide learners with authentic project opportunities, current industry practices, and workplace exposure. Curriculum developers may further enrich technical education by integrating contextualized and industry-relevant project activities that strengthen learners' technical competencies, creativity, collaboration, and problem-solving skills. Future researchers may replicate this study in other technical-vocational institutions or employ mixed-methods and comparative research designs to further examine the implementation of Project-Based Learning across different technical specializations and its influence on learners' technical skill development, workplace readiness, and lifelong learning competencies.

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