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RESEARCH ARTICLE

The Effectiveness of PjBL in the Acquisition of Skills in Higher Vocational Education: A Qualitative Approach

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ARTICLE INFO	ABSTRACT
	This study aims to investigate the effectiveness of Project-Based Learning (PjBL) in acquisition of practical skills, increasing the engagement and motivation of students as well as fostering collaborative learning among peers in higher vocational education. On systematic review of 8 scholarly articles, following a qualitative approach using a thematic analysis to identify the commonness in the trend of data. The results reflect on significant development of 21st-century skills based on critical thinking, communication collaboration, and creativity while solving real-life problems. However, this study identifies some significant challenges such as a lack of resources and training for teachers, teacher unpreparedness, and lack of absence of institutional support in the implementation of PjBL. These findings indicate that PjBL is revolutionary in manifesting systemic changes in the existing vocational education domain. The existing literature offers insights into the nuances of PjBL while exploring the strengths and weaknesses of the same. Collaborations with local industry and specific teacher training programs on online platforms along with specific rubrics with formative assessments offer better alignment of PjBL in higher vocational education curricula.
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1. INTRODUCTION

1.1 Background

In recent times, Project-Based Learning (PjBL) reflects on the pedagogical approaches, which lays the foundation of experimental learning. This enables students to gain a mirrored insight into realised challenges in daily life (Žerovnik & Nančovska Šerbec, 2021). This suggests that success in these projects can be attributed to engagement in student-centred methodologies that develop some critical skills valued in the present-day workforce. In short, professional readiness in competitive environments is fostered by PjBL, which blurs the line between theoretical concepts and practical learning. Students participating in PjBL exhibit autonomous behavior and show engagement in deep learning, whereby the application of theoretical concepts solves real-life problems (Al-Busaidi & Al-Seyabi, 2021). However, these studies disregard the qualitative experiences of the people directly involved in the active learning process because they aim to scrutinize the performance of students from a pedagogical approach. Consequently, a pertinent research gap exists in the analysis of stakeholder experiences that modulate the acquisition of practical skills in higher vocational training. Thus, it is important to comprehend the perspectives of stakeholders -viz the students, teachers, and staff to perceive the impact of PjBL in higher vocational training.

A lack of in-depth assessment of the role of PjBL in higher vocational training has been observed despite the rising demand for the same. Almulla (2020) blames the huge workload and time-consuming nature of PjBL to be a major hindrance to its implementation. This implies that PjBL often becomes tiresome for some students, whereby they might lag in the development of personal skills in a fast-paced collaborative project. This results in a lack of confidence and unfriendly peers who might hinder individual development. However, these drawbacks can be reversed by careful administration and efficient training to foster multidimensional students in a uniform classroom setting in which the students themselves assume the role of teachers and educate the peer groups to post self-directed understanding. In this context, a sufficient number of scholarly articles and empirical evidence are present based on theoretical frameworks in general education, disregarding the importance of practical skill development in vocational training. Practical experiences of key stakeholders as students, teachers, and staff members are crucial to interpret the effectiveness of PjBL in inducing self-directedness in the participants (Mielikäinen,2022). This study uses a qualitative thematic analysis whereby the experiences of key stakeholders in PjBL , its impact on practical skills, and influence on student engagement and motivation is derived by identifying potential challenges in implementation in HVE classrooms.

1.2 Literature review

Higher Vocational education (HVE) is a field that aims to prepare learners for industrial trades and other occupations that require sufficient knowledge and practical skills to excel. This suggests that expertise in skills is prioritized over theoretical learning in vocational settings, ensuring the welfare of specific communities accompanied by the overall development of the country (Pambudi & Harjanto, 2020). Therefore, students choosing this career are required to be efficient in the hands-on methodology be it carpentry, healthcare, or computer-based industries. As the demand for skilled labor shifted drastically with the rise in globalization and technology, a re-evaluation of goals and methods encrypted for vocational education initiated the Project-Based Learning (PjBL). Initiated by John Dewey, the concept of Experimentalism forms the groundwork for PjBL with a greater focus on doing by practicing the tasks or skills so that the real experiences of learners shape their understanding of the activity (Guo et al., 2020). Here, constructivist ideas and constructionist ideas intertwine to form the philosophies in education where learners are thought to actively construct their knowledge via interaction and learn through tangible artifacts as well (Eckardt et al., 2020). This fortifies the idea that PjBL is a learner-centered method in education that encourages students to explore the problems they encounter in real life.

1.3 Integrating PjBL in the 21st century in higher vocational education (HVE)

The HVEs integrate PjBL to prepare students for the analytical demands of modern-day work. With an objective to acquire skills that help in the solution of real-world tasks, creativity, and problem-solving are essential skills to possess besides communication skills and critical thinking (Demir, 2020; Macleod & Veen, 2020). Hence, by including PjBL in the educational curriculums of HVEs, the 21st-century skills for gaining, maintaining, and enhancing key competencies are emphasized. PjBL expectedly prepares the students for the demands of future careers where technical knowledge and problems resolution skills will be applied in dynamic work environments (Abdulkadir et al., 2019). This is vital for a professional life where a number of skills need to be put to use for well-managed situations. Hence, the support systems for the development of 21st-century skills need are based on particular skills, knowledge, learning abilities, and expertise. Kennedy and Sundberg (2020) highlight other important 21st-century skills that educators should focus on to keep them at par with contemporary times. It includes cross-cultural skill development and student preparedness for the digital age which deliver the pedagogical outcomes in classroom settings.

To provide a comprehensive understanding of academic content to students, PjBL lends students the chance to be ready for job prospects upon the completion of graduation. It also highlights that PjBL instructors should be highly trained to adequately deal with students' learning needs within and outside the classroom (Abdulkadir et al., 2019). This suggests that providing opportunities for to students gain soft skills and technical attitudes is critical for building future careers in learning and education. To pursue a career after higher vocational training, students naturally expect promising job roles in reputed industries that require hands-on training rather than rote learning. Thus

creativity, autonomy, and critical thinking in PjBL learners increases their career readiness via a learner-centric approach. Furthermore, collaborations with industry can aid students in knowing the unseen difficulties emerging in real-life industrial workplaces. Developing qualities such as teamwork, adaptability, and communication through PjBL can help increase their value as potential employees, where collaborative environments are prioritized (Almulla, 2020). Thus, the implementation of projects in a learning process develops the cognitive as well as attention skills of learners involved in various higher vocational education programs related to IT, STEM, business, finance, and administration.

1.4 Significance of this study

This study is significant in highlighting the efficacy of PjBL in correlating theoretical knowledge and practical skill development in higher vocational education. This fosters active learning via a collaborative approach, underscoring the role of collaboration and cooperation in cognitive development. PjBL mimics the demands at the workplace which can be practiced inside the classroom to offer an insightful learning environment based on experiences, for long-term retention in vocational education. Moreover, this study addresses the gap between vocational training and industry demands, readily providing structured modules for teaching practice improvements and curriculum redesigning for students. Thus, educational policymakers, practitioners, and administrators can draw practical recommendations for systemic improvements in teaching methods and curriculum formulations in HVE.

1.5 Research objective and aim

This research aims to highlight the effectiveness of PjBL in career readiness by exploring the experiences of key stakeholders and analysing the impact of PjBL in acquisition of practical skills to highlight the potential challenges in higher vocational education.

1.6 Research question

The main research question for this study has been formulated as -

RQ: *"How is Project-Based Learning effective in improving skill acquisition in higher vocational education?*

However, for ease of evaluation and analysis, the main research question has been segregated into three sub-questions that address the contextual issue in pedagogy.

RQ1. *Why do key stakeholders i.e. teachers, students, and staff members become conscious of the implementation of PjBL in Higher Vocational education?*

RQ2. *What is the impact of PjBL on the acquisition and retention of practical skills in higher vocational education?*

RQ3: *How does PjBL influence the sustainable indulgence of students in higher vocational education?*

RQ4. *What are the major challenges faced by vocational institutes and organizations while implementing PjBL and what are the ways by which they can be mitigated*

2. METHODOLOGY

The effectiveness of Project-Based Learning in higher vocational education is explored in this study by using a qualitative approach using thematic analysis. This section deals with the explicit investigation of patterns and themes from major findings in scholarly articles, derived from secondary sources of information like peer-reviewed articles, relevant in the context of vocational education.

2.1 Research design

Thematic analysis is generally considered for identifying, reporting, and analysing themes of commonness within qualitative data. This helps in familiarisation of data and reviewing themes, defining and naming them to produce a final report (Braun and Clarke (2019). Therefore, this method is highly flexible and adaptable to suit a range of qualitative data to assess the impact of PjBL.

2.2 Data collection methods

The data concerned with this study is extracted from secondary sources and peer-reviewed articles. These articles were found in electronic databases which include Google Scholar, Science Direct, Scopus, and JSTOR. Some of the keywords used during search refinement were based on Project-Based Learning, "Practical Skill Acquisition", " Higher Vocational Education", " Learning Models" and "Carrer readiness", "Critical and Technical Education". To make the search more specific and scrutinize articles based on these keywords, Boolean Operators AND/OR were employed, which gave search results filtered and focused on the topic of research.

2.3 Selection criteria: inclusion and exclusion techniques.

A set of inclusion and exclusion criteria was employed in the literature selection process. According to Connelly (2024), exclusion-inclusion criteria involve the essential components required to design research of high quality. Scholarly articles only published in the English language were selected to have a better outreach among diverse readers (Kraus *et al.*, 2022). In addition, articles that were particularly published in the last 5 years related to Higher Vocational Education components and its constitutive elements were included to maintain the timeliness and relevance of the study. Articles published before 5 years published in languages other than English, and texts with only abstracts were excluded. Finally 30 articles were selected as shown in Figure 1.
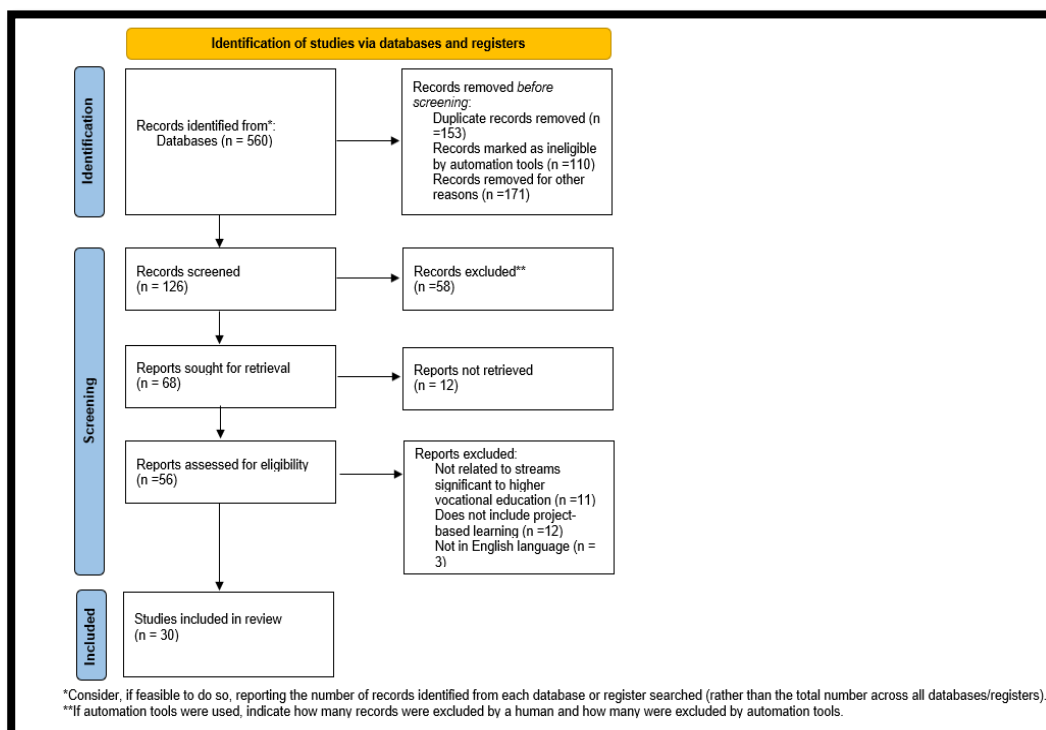

Figure 1: PRISMA flowchart (Source: Self-Generated)

2.4 Data extraction

On identification of relevant scholarly articles, the required qualitative data on PjBL was extracted by thematic analysis, substantiating its effect on vocational education learners. This data was extracted manually, and organised into a tabular form with information regarding authors, study title, study design, participants, key findings, and relevance with this research. The commonness in the identified and colour-coded for the sake of ease in analysis. The data extraction was majorly navigated by the major research questions. The extracted qualitative data was classified under some major themes which were linked to skill acquisition, instructional methods, student engagement, and learning outcomes.

2.5 Scientific evaluation

To ensure the credibility and quality of the selected literature, Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Guidelines were implemented. According to Costa *et al.* (2024), PRISMA Guidelines act as an essential framework to maintain transparency in the

literature and improve the trustworthiness of the key findings on which the study is based. Additionally, the Critical Appraisal Skills Programme (CASP) was implemented to examine the credibility of secondary data utilized for investigating the research questions formulated for this study. (Costa et al., 2024). The adopted strategies imply towards better understanding of the heterogeneity of research findings that maintain the consistency of expected outcomes.

2.6 Ethical considerations and expected outcomes.

The research study adheres to appropriate ethical standards for proper citation of preceding research and ensures acknowledgment of proprietary data. No compromise has been made on employed clarity in data selection and disclosure. The precision of the citations has been protected by safeguarding the accuracy of the reported data. Additionally, all the ethical guidelines concerning the validity of secondary data have been confirmed in this study.

2.7 Theoretical framework

Constructivist theory by Vygotsky guides the collaborative approach, tangible outputs, and learner experience in PjBL. Vygotsky's constructivist theory highlights that learners build their understanding via active engagement with the help of new information and learning contexts (Siregar et al., 2024). This helps them solidify their learning experiences and instils confidence in using their skills and abilities to contribute to professional fields.

3. RESULTS

This research reveals 30 relevant articles that were identified to find answers to the formulated research questions. Table 1 represents the aim of the study, research design, sample size, key findings, and research implications. Based on the detailed insights, four emerging themes have been identified in Table 2 namely: Enhanced practical skill acquisition, Student Engagement and Motivation, Collaborative Learning, and Challenges and Barriers to Implementation respectively.

Table 1: Summary of the identified patterns based on this study

Author and year	Study Aim	Study Design	Sample Size	Key findings	Research Implications	Emerging themes
Nilsook et al. (2021)	To prove the consistency of PjBL in vocational and technical education	Systematic review	Sample size is different for each of the several articles that were used in this review	Management of PjBL requires preparation, topic definition, creation and test, presentation, and evaluation.	PjBL is effective in development of 21st century skills such as critical thinking, collaboration, communication and creativity	Enhanced practical skill acquisition
Ahmad et al. (2023)	To highlight the research trends reflecting on Project-Based Learning in vocational education	Bibliometric Analysis	N= 60 articles	PjBL proves to be a significant teaching technique in the constantly evolving field of vocational education	PjBL students are efficient in development of problem solving, teamwork skills and critical thinking	Collaborative Learning

Arwizet & Satpura (2019)	To examine how learning outcomes in students involved in vocational training is influenced by teaching with collaborative-think pair share Project-Based Learning model	Quasi-experimental study	N=41, (n = 21 in the experimental group and n =20 in control group)	PjBL has substantial influence in improving the collaborative skills in higher vocational education learners	Collaboration is a key skill in vocational education trainees which can enhance their learning experiences on engagement with PjBL	Student Engagement and Motivation
Ibrahim & Rashid (2022)	To examine the effectiveness of PjBL as a teaching method in enhancement of collaborative skills in Design and Technology Subject	Quasi-experimental study	N= 66 individuals in two groups, 34 in the control group and 32 in the treatment group	PjBL treatment groups exhibit high level of collaborative skills than the ones placed in control groups	PjBL acts as a crucial teaching method in vocational courses that improves collaborative skills by explicit planning	Enhanced Practical skill acquisition
Viswambaran & Shafeek (2019)	To analyse the impact of PjBL in improving student engagement and	Mixed method	N= 70 students from two subjects in Higher National Diploma in Engineering.	Confidence levels and self-efficacy was highly boosted in students trained under PjBL in vocational course	PjBL has a positive correlation with enhancement of student engagement and motivation in students placed in higher vocational settings	Student Engagement and Motivation
Deep et al. (2020)	Impact of PjBL in Technical and Vocational Educational al	Systematic Review	N= 32 full text papers	Soft skill development is enhanced in vocational trainings by employing PjBL in the curriculum	Communication skills, leadership qualities and problem-solving abilities are improved by	Enhanced practical skill acquisition

	Training (TVET)				following PjBL.	
Sudjimat et al. (2021)	To examine the role of PjBL in 21st century workforce character development	Mixed method	N= 11 public and private vocational high schools	PjBL helps in significant improvement of student involvement and motivation under a student centric and collaborative approach	PjBL models are successfully implemented on full-fledged student involvement which enhances their motivation in problem solving ability	Challenges and Barriers to Implementation of PjBL
Liu (2019)	To identify the major barriers faced by teachers in implementation of PjBL in successful outcomes in higher vocational education	Systematic review	N= 15 papers	Lack of adequate knowledge and unskilled taskforce is the leading cause of hinderance to implementation of PjBL in higher vocational education.	Practical recommendations can be drawn on existing drawbacks of PjBL which can result in wholehearted implementation of PjBL in higher vocational education	Challenges and Barriers to Implementation
Megayanti et al. (2020)	To establish a correlation between PjBL and 21st century cognitive skill framework	Systematic review	Each literature has its own individual sample size	Implementation of PjBL faces several factors such as lack of focus in teachers and absence of self-management in students which hinders collaborative approach in students pursuing higher vocational education	Implementation of PjBL is limited to two-way communication, self-directed learning skills, patience and sufficient number of resources to meet industry demands in 21st century	Collaborative Learning
Wulansari et al. (2022)	To identify the role of PjBL in development of 4C skills	Quasi-experimental	N= 61 students	Region specific projects result in higher scores for 4C skill development in students of	A major improvement in soft skills and core competencies via PjBL	Enhanced practical skill acquisition

				vocational training		
Masdarini et al. (2024)	To assess the role of PjBL in development of entrepreneurial skills in students of higher vocational schools	Quantitative research study	N= 76 eleventh grade students	Entrepreneurial skills were highly boosted by application of PjBL in the vocational training	PjBL assists higher vocational education students in development of skills required by the industry	Enhanced practical skill acquisition
Nurtanto et al. (2020)	To improve the learning quality in students by using PjBL in the gasoline engine curriculum	Quantitative study	N = 34 students	Collaborative skill is enhanced by PjBL, especially in improving professional competency.	Students can readily master collaborative skills through PjBL in vocational education	Collaborative Learning
Samsudin et al. (2020)	To study the effect of PjBL in improving problems of physics mechanics	Quasi experimental research	N = 100 high school students	PjBL improves problem solving ability in STEM	Higher engagement and low levels of dropouts are observed in students undergoing PjBL training	Student engagement and motivation
Beier et al. (2019)	To study the impact of PjBL on attitude of students and their career aspirations	Quasi-experimental study	N = 492 students	The perception of students towards acceptance of STEM skills is enhanced via PjBL	PjBL helps in engaging students for longer durations in vocational education	Student engagement and motivation
Sumarni & Kadarwati (2020)	To study the effectiveness of STEM-PjBL for high school students	Quasi experimental study	N =230 students	Creative and critical thinking skills are upgraded after participation in PjBL	Enhancement of 21st century skills via PjBL is observed in crucial components of vocational education	Enhanced practical skill acquisition
Duc et al. (2022)	To assess the impact of Project-Based	Review	N= 61	Project-Based learning proves effective in students	Despite the effectiveness of PjBL in higher education, it	Challenges and Barriers to Impleme

	Learning in different levels of education			pursuing higher vocational education	has certain limitations to implementation	ntation of PjBL
Martinez (2022)	To examine the effectiveness of PjBL teaching methods in propagating 21st century skills	Mixed method approach	N = 16 in service teachers	PjBL trained individuals are better exposed to work based learning opportunities.	PjBL curriculum implementation depends on collaborative skills of teachers	Challenges and Barriers to Implementation of PjBL
Yunita et al. (2021)	To study how PjBL helps in fostering mathematical ability	Systematic literature review	N = 26 studies	Optimal time utilisation, enhancement of mathematical skills and increased engagement in learning activities in PjBL trained students	Advanced mathematical skills increase data analytical abilities and problem-solving within stipulated deadline, essential in higher vocational education	Enhanced practical skill acquisition
Virtue & Hinnant-Crawford (2019)	To investigate the advancement of student outcomes due to implementation of PjBL	Qualitative study	N = 28 participants	Students are accustomed to hard work in practical world post application of PjBL	PjBL helps students develop career readiness skills crucial for vocational education	Enhanced practical skill acquisition
Chen et al. (2021)	To study the implemental challenges of PjBL	Systematic review	N = 108 articles	Participants from diverse cultures are differentially receptive to PjBL	Cultural differences are a barrier to implementation of PjBL in vocational trainings such as engineering	Challenges and Barriers to Implementation of PjBL
Evenddy et al. (2023)	To investigate the benefits and challenges of PjBL	Systematic Review	N = several studies incorporated	Collaborative skills can be nurtured in vocational education by administration of PjBL	Project-Based Learning inculcates collaborative approaches to incorporate career preparedness	Collaborative Learning

	in higher education				in teachers undergoing vocational training	
Aksela & Haatainen (2019)	To assess the benefits and challenges to implementation of PjBL amongst teachers	Qualitative study	N= 99 teachers	PjBL requires efficient collaborative skills, technical proficiency and ample time	Long term developmental models required for implementation of PjBL in teacher trainings as part of vocational education curriculum	Challenges and Barriers to Implementation of PjBL
Al Rasyid et al. (2019)	To determine the collaborative skills in students continuing PjBL	Quasi experimental study	N = 240 students	Students trained under PjBL showed interest in group projects and demonstrated active involvement	Collaborative learning is facilitated by PjBL which is an essential skill for problem solving in vocational education	Collaborative learning
Syahril et al. (2019)	To compare effectiveness of PjBL and cooperative PjBL	Quantitative Study	N= 20	Motivation of students decrease in PjBL as they cannot find solutions to problems	Cooperative PjBL is more effective than PjBl, which serves as a barrier in implementation of PjBL.	Challenges and Barriers to Implementation of PjBL
Rodríguez & Lieber (2020)	To correlate between entrepreneurial mindset and entrepreumerial skills	Quasi experimental study	N = 2 groups of undeserved communities	Entrepreneurial programs use PjBL to induce career readiness in students	PjBL develops collaborative learning, problem solving and critical thinking, which promotes career readiness in vocational education	Enhanced practical skill acquisition
Huysken et al. (2019)	To assess the effectiveness of collaborative Project-Based Learning model	Case study	N= several studies	Collaborative learning is facilitated by PjBLs in STEM disciplines	Enhanced career preparedness via PjBL in students with expertise in STEM which is an essential component of vocational training	Collaborative Learning
	To evaluate the	Quasi experimental study	N = 35 students from two	Cognitive learning outcome	PjBL is essential to enhance the	Enhanced practical

Retno et al. (2019)	effectiveness of learning model's basis the impact of problem-solving skills on learning outcomes		classes of Mechanical engineering domain	modulates the influence of learning models on problem solving ability in high school students	cognitive skills, problem solving ability and introduce an active learning environment	skill acquisition
Susanti et al. (2020)	To investigate the perception of students on integration of PjBL in learning English as a foreign language	Mixed method approach	N= 46, (one teacher and 45 students)	The teachers perceived PjBL as an effective English teaching method, supported by students who report increased motivation and engagement in learning behavior	PjBL is responsible for increased motivation in picking up new skills in vocational higher education	Student motivation and engagement
Sudarsono et al. (2022)	To examine the degree of job preparedness in students undertaking integrated PjBL as a part of their curriculum	Quantitative study	N = 10 vocational educators, 10 industrial practitioners, and 54 Automotive Engineering SMK Muhammadiyah 2 Tempel students.	Integrated PjBL is capable of improving work readiness scores by 3.27	PjBL improves the 21st century skills in vocational education students to increase their employability	Enhanced practical skill acquisition
Rusnawati et al. (2020)	To compare the impact between e-learning models and Project-Based Learning models	Quasi-experimental study	N= 133 students	Significant improvement in critical thinking ability of students who participate in Project-Based Learning models	PjBL aggravates problem solving tendency by substantial improvement in critical thinking in vocational high school students	Enhanced practical skill acquisition
Majumder (2020)	To observe how Integrated	Descriptive Qualitative	N = 6 teachers at CTE skill centre in the eastern	Mathematical ability is enhanced by integration of PjBL within	Teachers face major implementation concerns while	Challenges and Barriers to Impleme

Computational Thinking, Engineering Design, and Mathematics can be correlated		Washington	CTE curriculum	employing PjBL in classrooms in higher vocational eduacation	mntation

Table 2: Thematic analysis of identified patterns

Themes	Studies
Enhanced Practical Skill Acquisition	Nilsook et al. (2021), Ahmad et al. (2023), Wulansari et al. (2022), Masdarini et al. (2024 Sumarni & Kadarwati (2020) Yunita et al. (2021), Virtue & Hinnant-Crawford (2019), Rodríguez & Lieber (2020) Retno et al. (2019), Sudarsono et al. (2022) Rusnawati et al. (2020)
Collaborative Learning	Arwizet & Satpura (2019), Ibrahim & Rashid (2022), Nurtanto et al. (2020), Al Rasyid et al. (2019), Huysken et al. (2019)
Student Engagement and Motivation	Viswambaran & Shafeek (2019), Sudjimat et al. (2021), Samsudin et al. (2020), Beier et al. (2019) Susanti et al. (2020)
Challenges and Barriers to Implementation of PjBL	Liu (2019), Megayanti et al. (2020), Majumder (2020), Duc et al. (2022), Martinez (2022), Chen et al. (2021), Evenddy et al. (2023), Aksela & Haatainen (2019), Syahril et al. (2019)

3.1 Enhanced practical skill acquisition

11 out of 30 studies indicate towards the acquisition of practical skills is an effective result in determining the progress of PjBL students in higher vocational education. The PjBL management process in HVE is explored by Nilsook, et al. (2021), Wulansari et al. (2022) and Masdarini et al. (2024), to study its impact on practical skill development. The authors emphasize PjBL as a structured framework for learners to engage themselves in real-world simulation environments and take up hands-on projects that allow them to apply theoretical concepts to demonstrate problem-solving in the real world, which facilitates deep learning (Sumarni & Kadarwati (2020), Yunita et al. (2021), Virtue & Hinnant-Crawford (2019). Therefore, students exposed to PjBL showed enhanced active participation in teamwork and superior skill development than the control groups. Furthermore, Ahmad et al. (2023) employed a bibliometric approach to examine the efficiency of higher vocational education in the development of 21st-century skills in comparison to traditional methods of teaching which is validated by Rodríguez & Lieber (2020), Retno et al. (2019), Sudarsono et al. (2022) and Rusnawati et al. (2020). The authors assert that PjBL enables improvement in problem-solving ability and critical thinking to attain mastery in specific vocational tasks.

3.2 Collaborative learning

5 out of 11 studies indicate that collaborative learning is a major skill fostered in PjBL-trained students pursuing higher vocational education. The significance of collaboration in PjBL is established by Pan et al. (2021) and Ibrahim and Rashid (2022). In a case study conducted by Pan et al. (2021), the roles of educators and students were investigated for their contribution to PjBL. The findings suggest that collaboration is a critical component to the successful implementation of PjBL

in higher vocational education and not just a byproduct. Hereby students are encouraged to exchange ideas, share responsibilities, and co-create solutions with peer groups which enhance their contribution and functioning in teamwork. The author utilized a quasi-experimental approach to address the authenticity of collaboration as an essential skill, critically enhanced in students placed in the experimental group in comparison to the ones placed in control. Simultaneously, Nurtanto et al. (2020), Al Rasyid et al. (2019) and Huysken et al. (2019) explore the effectiveness of PjBL as a teaching method to find a common factor "collaboration" as a parameter within experimental group showing that effective communication, negotiation, and division of labour help in increasing career readiness post HVE.

3.3 Student engagement and motivation

Out of 11 studies included in the thematic analysis, 5 studies by Viswambaran and Shafeek (2019), Samsudin et al. (2020) and Beier et al. (2019) investigated the impact of PjBL in increasing student engagement and motivation in higher vocational education. Viswambaran and Shafeek (2019) reported student autonomy and the relevance of PjBL in real-world applications, focusing on the ways of handling tasks. This aligns with the mixed method approach by Sudjimat et al. (2021) to examine how PjBL acts as an effective model that nurtures commitment and a sense of responsibility in students placed in higher vocational settings. The study explains how PjBL learners are increasingly motivated to perceive their tasks as relevant, which would elevate their chances of employability. This suggests that PjBL learners are motivated comparatively more than those who undergo general training, which decreases their opportunities of getting recruited (Susanti et al., 2020). Thus, customization of PjBL curriculums helps to capture the interests of HVE learners which is critical for sustainable engagement and future career prospects in professional domains.

3.4 Challenges and barriers to implementation

9 out of 30 studies indicate that implementation of PjBL is faced with several challenges. Liu (2019) in this context conducted a systematic review of the barriers to implementation and success of PjBL in Technical and Vocational Education and Training (TVET) institutes in China. Resistance in learners result in shift from traditional teaching techniques and identifies the absence of sufficient resources, lack of teaching skills and professional approach as well as inadequate institutional support behind the decline of the effectiveness of PjBL. Hereby the PjBL faces hindrances in the promotion of new pedagogical approaches and professional development, primarily due to rigidity in teachers to stick to a lecture-based format or reluctance towards investment in time and resources (Majumder, 2020, Duc et al., 2022; Martinez, 2022). In a similar context, Megyanti et al. (2020) conducted a systematic review consisting of several scholarly articles to identify the challenges in access to resources for collaboration between educational institutes and industry. The author argues that logistics and institutional barriers come in the way of successful outreach of PjBL in higher vocational education. Thereafter Chen et al. (2021), Evenddy et al. (2023), Aksela & Haatainen (2019), Syahril et al. (2019) offer a unanimous systemic change or teacher training programs that prove essential in HVE that support curriculum redesigning for the integration of PjBL into vocational settings.

4. DISCUSSION

The results of this study corresponding to each theme have been used to answer the main research question, divided into four sub-questions. This section presents a critical analysis of themes using relevant literature and theoretical frameworks that offer a nuanced understanding of the strengths and limitations of PjBL in higher vocational education.

4.1 RQ1: *Why do key stakeholders i.e. teachers, students, and staff members become conscious of the implementation of PjBL in Higher Vocational education?*

The conscious implementation of PjBL in Higher Vocational Education by teachers, students, and staff members (key stakeholders) is to improve practical skill acquisition. Currently, stakeholders prefer PjBL for a structured environment to foster expertise in productive subjects, both for Vocational Base and Vocational Competency by maintaining a 70: 30 ratios for functional: theoretical elements in the redesigned curriculum (Fajra & Novalinda, 2020). This enhances the career readiness and job-specific skill sets that increases the knowledge required to survive in a continuously evolving industry. A shift towards PjBL has employed a strategic approach to developing what is popularly

known as 21st-century skills such as creativity, communication, and collaboration (Nilsook et al., 2021, Deep et al., 2020; Masdarini et al., 2024; Sumarni & Kadarwati, 2020). In this light, stakeholders feel the need to extend their knowledge beyond rote learning to indulge in critical thinking, problem-solving, and experimental learning to process real-life challenges. In Project-Based tasks, the students get involved in concrete experiences which aligns with Kolb's (1984) Experiential Learning Theory (Nurunnabi et al., 2022). Hereby the stakeholders engage in a four-stage cyclical process that posits experimentation as a major source of learning, in which self-reflection on experiences, active participation in experimentation, and forming abstract concepts help to reason with real-world skills. Thus, "learning by doing" comes across as an essential factor that helps in the translation of classroom knowledge into practical life, which requires graduates to be equipped with the necessary skills. Consequentially stakeholders continue to advocate for the inclusion of PjBL in higher vocational education as it bridges the gap between knowledge and application prompts. Despite the potential of PjBL being promising, it comes along with implementation in real life. The stakeholders are aware of the topic definition, ongoing assessment, and intensive preparation demanded from PjBL instructors, which compromises the acquisition of practical skills. This realization is echoed by Chua & Islam (2021) who warn possibility of confusion and anxiety among some students who cannot keep up with the progress in the classroom. This suggests consequential frustration and dropout rates in these students, who suffer because of failed PjBL initiatives. Overall, stakeholders must consciously plan and seek institutional assistance to promote 21st-century practical skill acquisition via PjBL and advocate for curricula redesigning to mitigate these barriers.

4.2 RQ2: *What is the impact of PjBL in the acquisition and retention of practical skills in higher vocational education?*

The impact of PjBL on practical skill acquisition is reflected mostly reflected in collaborative learning. As noted by Arwizet and Satpura (2019) and Ibrahim & Rashid (2022), PjBL encourages students to complete projects in teams and actively communicate with peer groups for the enhancement of vocational skills. This suggests that solving practical problems in collaboration with fellow classmates and co-creating solutions reduce the time for problem-solving. Thus, the collaborative nature of modern workspaces is replicated by the integration of PjBL in higher vocational education. This process can be drawn upon by Vygotsky's (1978) socio-cultural theory whereby social interaction within the learners increases the scope for newly acquired knowledge and skill set. In this process, the learners can be potentially involved in culturally competent Project-Based Learning that supports involvement with the community to solve complex literacy challenges (Skalet, 2019). As a result, students understand the value of active participation with peers and community, for a deepened understanding of practical tasks supported by multiple ideations of problem-solving. This concept of collaborative approach is aligned with Njai (2021) who explains Piaget's constructivist theory behind deeper understanding and long-term skill retention by active engagement and negotiation within groups. This instils a sense of responsibility towards definite contribution in the completion of a group-based project. Thus, a huge inflow of passive information is facilitated by PjBL, in promoting collaborative learning as a technique to amplify the application of practical skills. Moreover, Farrow et al. (2022) assert the need for collaborative learning to create an impactful pedagogical shift, with teachers as facilitators. This implies that collaborative real-time projects in PjBL act as a student-centred approach in which educators must be capable of scaffolding and monitoring the dynamics of a group. This ensures that every student is equally involved in collaboration and that each and every one is responsible for the outcome of the project. However, collaboration in PjBL should be guided by positive independence and individual accountability, which could otherwise deviate the students from achieving homogenized growth. Overall PjBL has a profound impact on practical skill acquisition and retention by facilitating a collaborative structured stimulus for students to flourish post-attainment of vocational skills.

4.3 RO3: *How does PjBL influence the sustainable indulgence of students in higher vocational education?*

The impact of PjBL on student engagement and motivation is the key to understanding the factors behind the consistent indulgence of vocational education learners in PjBL. The findings by both the identified articles: Viswambaran & Shafeek (2019) and Sudjimat et al. (2021) highlight a positive relationship between PjBL and student engagement. These findings are aligned with the self

Determination Theory formulated by Deci and Ryan in 1965 whereby intrinsic motivation is highly boosted with the onset of autonomy in students undergoing PjBL programs (Ryan & Deci, 2024). This suggests that students can be directed towards learning new concepts and get the opportunities to develop enough competence for the completion of hands-on tasks. Success in problem-solving can lead to an increment in perceived social support which contributes to a surge in engagement span and motivates further indulgence (Susanti et al., 2020). PjBL in students resulted in surged levels of confidence and self-efficiency which are crucial components behind motivation. Hereby, the Social Cognitive Theory proposed by Bandura in 1977 proves this evidence true by explaining the role of self-efficacy in accelerating performance and motivation (Lawrence, 2024). This can be linked to a stronger sense of self-efficacy in PjBL graduates who believe that their approach to challenging tasks can be non-conventional and thus, they can solve complex issues or complete projects in a shorter interval of time. This research is supported by Sudira et al. (2022) who state that constant student involvement is very crucial for the improvement of practical skills. This means that the increment in student engagement which drives the implementation of PjBL is relevant in every industry.

4.4 RQ4: *What are the major challenges faced by vocational institutes and organisations while implementing PjBL and what are the ways by which they can be mitigated*

Besides the benefits of PjBL in HVEs, its implementation can be resource-intensive. PjBL requires significant resources such as well-trained facilitators and specific tools to engage with students in inquiring about learning difficulties. Due to probable financial constraints or less developed infrastructures, implementing PjBL can be hindered due to a lack of resources (Meng et al., 2023). Hereby an instructor might feel hesitant in implementation of PjBL due to absence of culturally competent resources for a linguistically or culturally diverse classroom. According to Liu (2019), collaborations with local industries might fill in the gaps created because of inadequate tools and resources in vocational institutes. These opportunities help students in addressing real-world projects and offer practical application of knowledge that elevates the importance of academic learning in vocational education. Apart from that, training the teachers and shifting their collective mindset towards a PjBL approach effective for students can be difficult to attain. It is because of the transition period needed for making the shift since they lack experience and expertise in implementing PjBL. Without adequate training of the teachers, their confidence in guiding students through complex or open-ended problems cannot be established. Hence, transitioning from a lecture-based method to a student-centric approach can be a notable hurdle. A culture of innovation can be practiced in educational institutes to propagate openness and acceptance among stakeholders. Moreover, providing scope for e-learning platforms for PjBL such as Cura in Australia, Dreamdo in Finland, and EPjBL in China would help in taskforce readiness and increased participation of teachers in mastering instructions for project-based curriculums in vocational education (Meng et al., 2023). These can be collaborated with cooperative- PjBL learning to accelerate the learning outcomes as suggested by Syahril et al. (2019). However, the limiting belief here is that students are assumed to be competent simulators of being productive and deriving meaning from activities and using the resources in productive ways (Pan et al., 2021). This might not be the case for all students so, implementing the PjBL approach can become challenging for teachers if they are not acquainted with catering to individual student needs. Due to the assumption that students are competent enough for self-learning, their readiness and autonomy in learning might be ignored (Gloria et al., 2021). They may struggle to learn collaboratively in groups, with cultural differences and without teacher guidance. As a solution, Cifrian et al. (2020) explain that the involvement of students in rubrics and formative assessments can be an additional valuable learning process. This aligns with the teacher training programs facilitating PjBL as an effective learning method to improve career readiness in HVE (Evenddy et al., 2023). Hence, the use of traditional methods of assessing students will not be able to measure PjBL's learning outcomes, for which newer evaluation parameters should be introduced to support institutional shifts.

5. CONCLUSION

This study highlights the effectiveness of Project Based Learning (PjBL) in fostering the acquisition of practical skills within higher vocational education. Pre-existing literature reflects on the increasing student engagement, critical thinking, and problem-solving abilities of students undergoing Project-Based Learning. Therefore, the application of theoretical concepts makes it easier to solve real-world

problems. For identifying the domains of the efficacy of PjBL, four broad themes have been identified from 30 scholarly articles and thematically analyzed using a qualitative approach. Four broad themes were identified – enhanced practical skill acquisition, collaborative skills, student engagement and motivation, and challenges and barriers to implementation of PjBL. Findings reveal that stakeholders have shown an inclined interest in the integration of PjBL in HVE, primarily to enhance the quality of employed human resources. PjBL is highly effective in developing soft skills (21st-century skills) by engaging in rigorous collaborative projects involving key stakeholders, various communities, and organizations, providing multiple perspectives on problem-solving. Thus, improved communication, creativity, and teamwork act as an intrinsic motivator for prolonged student engagement. Despite the promising effects of PjBL on learners, some challenges such as the non-availability of resources, lack of teacher preparedness, cultural differences and absence of institutional assistance hinder full-fledged implementation of PjBL. However, each of these barriers can be overcome by local collaborations, e-PjBL training applications, and definite rubrics for guidance.

6. LIMITATIONS AND RECOMMENDATIONS

- Lack of generalizability in this study prohibits long-term skill retention, gained during PjBL in HVEs. The cultural and social contexts of different geographical locations act as a limiting factor to apply the current study's findings owing to regional differences in HVE. There is ample scope for researchers to adopt some directions for their research. These have been suggested below:
- Larger sample sizes need to be used so that longitudinal studies can be conducted to evaluate long-term skill retention via PjBL.
- Educators and teacher perspectives need to be considered by future research. This will allow to shed light on the necessary support frameworks for teaching staff to transition into PjBL.
- Researchers can also explore more on integration of technology in PjBL approaches. It will assist them in mitigating resource limitations and provide valuable hands-on learning for students.

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