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Teachers' Perceptions of the Implementation of Project-Based Learning (PBL) in the Design and Technology Subject (D&T)

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Abstract

Critical thinking skills applied across various subjects among students must be given due attention in shaping educational transformation and reform. To achieve this goal, teachers are encouraged to implement diverse teaching strategies as recommended by the Ministry of Education Malaysia, one of which is Project-Based Learning. This study examines teachers' perceptions regarding the implementation of Project-Based Learning in the Design and Technology subject, aiming to evaluate the effectiveness, challenges, and readiness associated with its practice in the classroom setting. Data were collected through a survey method using a structured questionnaire as the primary instrument. A total of 50 primary school teachers from the Kinta district participated as respondents. The collected data were analyzed descriptively using frequency, percentage, mean scores, and standard deviation. The findings revealed that teachers' perceptions of Project-Based Learning implementation were at a moderate level across all aspects examined, including the teacher factor (mean = 3.04, SD = 0.993), the physical school environment (mean = 3.25, SD = 0.824), the students (mean = 3.19, SD = 1.125), and the curriculum (mean = 3.41, SD = 0.837). These findings can serve as valuable input for the Ministry of Education Malaysia in formulating new initiatives to strengthen the implementation of Project-Based Learning in the Design and Technology subject at both primary and secondary school levels.

Keywords: Project-Based Learning (PBL), Teachers' Perceptions', Design and Technology Education, Primary School Education, Curriculum Implementation

Introduction

The advancement of globalization and technology in the 21st century has brought about rapid and profound changes across various sectors, including the economy, industry, and most notably, education. These changes have impacted the educational landscape from the preschool level to higher education, compelling continuous improvements in teaching methods and learning strategies. In Malaysia, this shift has spurred the introduction of new and innovative pedagogical approaches that align with the Malaysian Education Development Plan (PPPM) 2013–2025 goals. Among these approaches, project-based learning stands out

as it encourages active student engagement through real-world tasks, fostering critical thinking, collaboration, and creativity. This method directly supports the PPPM's aim of nurturing holistic, entrepreneurial, and balanced individuals equipped with 21st-century skills.

Among the crucial competencies emphasized in modern education is the development of thinking skills are linked in educational environments (Ramírez-Montoya et al., 2022) . These skills are essential for preparing students to face dynamic and complex challenges. To meet this goal, teachers are encouraged to endorse a range of pedagogical strategies endorsed by the Ministry of Education Malaysia (MOE), which are designed to suit diverse learning styles and needs. Effective teaching and learning must therefore be student-centered, interdisciplinary, and skills-focused. One promising pedagogical approach that aligns with these principles is inquiry-based learning. This approach empowers students to actively construct their own knowledge and understanding through investigation and exploration, leveraging both prior knowledge and new discoveries to address real-world issues (Sam, 2024). Within the scope of inquiry-based learning, problem-based learning (PBL) and project-based learning (also abbreviated as PBL) are two prominent models that emphasize student autonomy, higher-order thinking, and meaningful engagement. Both approaches are well-suited for classroom use and aim to foster learners who are capable, independent, and equipped with the cognitive skills necessary for lifelong learning (Morris, 2025).

Specifically, project-based learning (PBL) focuses on enhancing students' abilities to apply the knowledge they acquire in meaningful, practical ways. It encourages active exploration, creativity, and collaboration through the development of tangible products or solutions. According to Schlemmer and Schlemmer (2008), PBL enhances student engagement, motivation, and understanding by integrating diverse learning processes, content, and outcomes. Melton et al. (2022) said that authentic learning is most effective when activities mirror real-life situations, making tasks relevant and meaningful for students. This approach enhances engagement and helps students see the value of what they are learning (Utami et al., 2024).

Despite its student-centered orientation, the successful implementation of PBL relies heavily on the teacher's role. Teachers act as guides and supporters, helping students navigate learning materials and encouraging active participation rather than simply delivering information (Inayati & Karifianto, 2022). In technology-limited settings, teachers create resources like educational videos that are designed to reduce cognitive overload, engage students, and foster social cooperation (Astutik et al., 2022). Achieving this goal requires teachers to select and apply the most appropriate and effective strategies that stimulate student interest and promote cross-curricular exploration.

However, research has shown that many teachers are reluctant to implement PBL consistently, citing various challenges. Teachers often feel unprepared due to a lack of content knowledge or pedagogical skills needed for effective PBL. This can reduce their confidence and willingness to use PBL consistently in their classrooms (Habibi et al., 2022). Especially in online or hybrid settings, insufficient technological resources and varying student access can further complicate PBL implementation (Srirangam & Ng, 2022) . Teachers often face challenges in shifting from traditional, teacher-centered methods to more student-

centered approaches, especially in environments with limited support or infrastructure (Tan, 2025).

These findings highlight the urgent need to explore the readiness and perceptions of teachers regarding the use of project-based learning in Malaysian schools. Teachers play a pivotal role in the success of PBL, and its effective implementation requires a high level of pedagogical competence, confidence, and strategic planning. This study, therefore, seeks to examine the current perceptions of primary school teachers concerning the implementation of project-based learning in the Design and Technology (RBT) subject.

The objective of this study is to identify teachers' perceptions of PBL implementation in RBT based on three key dimensions which is the school environment, the curriculum, and the students. The insights gained from this research can inform strategies to strengthen PBL implementation and ultimately improve teaching practices and student outcomes in alignment with 21st-century educational demand

Literature Review

The physical and cultural environment of the school plays a pivotal role in facilitating the effective implementation of project-based learning (PBL). A supportive school setting fosters collaboration, creativity, and resourcefulness is the elements in PBL. As Rawal (2024) emphasizes, access to appropriate tools and technology is essential to enable students to complete their projects successfully. Within such environments, the role of the teacher evolves from being the primary source of knowledge to serving as a facilitator who guides, listens, and responds to students' needs, thereby nurturing self-reliance and encouraging active participation (Bhardwaj et al., 2025). This shift aligns with the broader aim of cultivating a learning atmosphere that values exploration and experiential learning. Moreover, student-centered approaches, which are foundational to PBL, have been shown to improve academic performance, boost student motivation, and foster essential life skills such as independence, adaptability, and social competence (Wang, 2023)

The curriculum design is one of the critical factor in the successful implementation of PBL. For PBL to be effective, the curriculum must be flexible enough to accommodate project-based tasks and inquiry-based learning activities. A rigid, content-heavy curriculum can limit the potential for PBL, as it may not provide sufficient room for students to engage in deeper exploration or project work. According to Walker and Leary (2008), the curriculum needs to be aligned with the goals of PBL, which include developing critical thinking, creativity, and problem-solving skills. The integration of interdisciplinary themes in the curriculum allows for a holistic approach to PBL, enabling students to apply their learning across subjects in a real-world context. By incorporating PBL into the curriculum, students are better prepared to tackle complex challenges and think critically, skills that are essential for success in the 21st century.

The characteristics of the students, such as their prior knowledge, learning styles, and motivation, are also vital in the successful implementation of PBL. PBL requires students to take ownership of their learning, which demands a certain level of independence and self-regulation. According to Wijnia et al., (2024), motivated students who possess confidence in their problem-solving abilities are more likely to succeed in project-based learning

environments, as these attributes significantly enhance learning outcomes, self-confidence, sustained motivation, and problem-solving competencies. Additionally, the approach encourages students to work collaboratively, which enhances their communication and teamwork skills (Crespí et al., 2022). However, for PBL to be effective, students must be supported in developing these skills and adapting to the demands of this learning approach (Gunarathna et al., 2023). This includes providing guidance on how to manage projects, work in teams, and use resources effectively. According to Azizah et al., (2022), project-based learning enables students to develop the ability to solve problems independently, while simultaneously enhancing their academic performance as well as their personal and interpersonal competencies.

The findings of these studies indicate that the implementation of student-centered approaches is often hindered by several challenges, including limited resources, large class sizes, inadequate institutional and professional support, heavy teacher workload, a persistent reliance on traditional teaching methods, lack of clarity or resistance among students, as well as difficulties in lesson planning and assessment (Nelson, 2023). Teachers often struggle with integrating PBL into their existing curriculum because it requires significant planning and adaptation. Thus, it is essential to provide teachers with adequate training, resources, and support to overcome these challenges and successfully integrate PBL into their teaching practices.

In conclusion, while PBL offers significant potential for enhancing student learning and preparing them for the challenges of the 21st century, its successful implementation is influenced by various factors, including the school environment, curriculum design, and the characteristics of the students. A supportive and flexible school environment, a curriculum that promotes interdisciplinary learning, and motivated students who are equipped with the necessary skills are key components in ensuring the success of PBL. This study aims to explore teachers' perceptions of PBL in the context of the Design and Technology (RBT) subject in Malaysian primary schools, with the goal of identifying the factors that influence the effective implementation of PBL in this setting.

Methodology

This study employed a quantitative descriptive survey method, utilizing a questionnaire as the primary instrument for data collection. The survey was administered online to obtain responses from participants. The respondents comprised primary school teachers who teach the subject of Design and Technology (RBT) in national schools located in the Kinta Selatan district, Perak. A purposive sampling technique was used to select teachers who met the specific criteria relevant to the study's objectives. A total of 50 respondents participated in the study, all of whom were primary school teachers currently teaching RBT.

To ensure the reliability and validity of the survey instrument, a reliability test was conducted using Cronbach's alpha. If the value of Cronbach's alpha coefficient is low (i.e., $\alpha < .60$), it indicates that the reliability of the items is weak. Conversely, if the alpha value is excessively high (i.e., $\alpha > .95$), it may suggest that the items are too similar or redundant, reflecting overlapping content. An ideal range for Cronbach's alpha coefficient is between .65 and .95, indicating acceptable to high internal consistency (Babbie, 2010) (Creswell, 2012). As shown in the table, each perspective had an alpha value above the threshold of 0.60, indicating that

the instrument is reliable and valid for use in this study. Therefore, the questionnaire used in this study demonstrates adequate reliability and validity for the purpose of data collection

Perceptions	Alpha Cornbach
Teachers	0.771
Physical Environment	0.670
Students	0.744
Curriculum	0.763

Findings

This study involved primary school teachers. A total of 50 primary school teachers participated in the study. Of these, 44% were male respondents, and 56% were female respondents, all of whom teach the subject of RBT in primary schools.

The majority of the respondents had teaching experience of more than 5 years. Specifically, 18 teachers (36%) had teaching experience ranging from 5 to 10 years, another 18 teachers (36%) had teaching experience between 11 and 20 years, and 10 teachers (20%) had teaching experience of 21 to 30 years. Only 4 teachers (8%) had teaching experience of less than 5 years. The demographic analysis of the respondents is summarized in Table 2.

Table 2
Analysis of Respondent Demographics

Respondent Demographics	Study Sample	Frequency	Percentage (%)
Gender	Male	22	56
	Female	28	44
Teaching Experience in the Subject of Design and Technology (RBT)	Less than 5 years	4	8
	6–10 years	18	36
	More than 11 years	28	56

Teachers

The findings showed that the overall perception of teachers regarding the implementation of Project-Based Learning (PBL) was at a moderate level, with a mean score of 3.04 and a standard deviation of 0.99. As present n table 3 below, the results indicate that the mean scores for each item ranged from 2.12 to 4.00.

The item with the highest mean score was "I am capable of using educational technology in project-based learning," with a mean of 4.00 and a standard deviation of 0.73. Of the respondents, 8 teachers (16%) strongly agreed, 34 teachers (68%) agreed, and 8 teachers (16%) were uncertain. No teacher disagreed or strongly disagreed with this item.

The second highest item was “My prior knowledge is insufficient for using electronic resources to access information for the application of project-based learning,” with a mean score of 3.24 and a standard deviation of 1.080. The results showed that 18 teachers (36%) agreed, 6 teachers (16%) strongly agreed, 18 teachers (36%) disagreed, and 8 teachers (16%) were uncertain regarding this statement. The item with the lowest mean score was “I do not

need in-service training related to project-based learning," with a mean of 2.12 and a standard deviation of 0.961.

Table 3
Descriptive Analysis of Teachers' Perceptions

Bil	Item	Frequency and Percentage							Interpretation
		SD	D	N	A	SA	Min	SP	
1	During the implementation of Project-Based Learning (PBL), there is a lack of collaboration from teachers of other subjects.	2 (4%)	24 (48%)	12 (24%)	8 (16%)	4 (8%)	2.76	1.041	Moderate
2	I possess the ability to utilise educational technology in Project-Based Learning (PBL).	0 (0%)	0 (0%)	8 (16%)	34 (68%)	8 (16%)	4.0	0.517	High
3	My existing knowledge and skills are insufficient for using electronic resources to access information for the implementation of Project-Based Learning (PBL)	0 (0%)	18 (36%)	8 (16%)	18 (36%)	6 (12%)	3.24	1.080	Moderate
4	I do not require in-service training related to Project-Based Learning (PBL)	8 (16%)	36 (72%)	2 (4%)	0 (0%)	4 (8%)	2.12	0.961	Low
5	My existing knowledge and skills are sufficient to implement Project-Based Learning (PBL).	2 (4%)	14 (28%)	16 (32%)	10 (20%)	8 (16%)	3.16	1.131	Moderate
6	The education and training I received during pre-service were adequate to guide students in the implementation of Project-Based Learning (PBL).	2 (4%)	22 (44%)	12 (24%)	4 (8%)	10 (20%)	2.96	1.228	Moderate

Physical Environment

Based on Table 4, it was found that the overall items related to teachers' perceptions of the implementation of Project-Based Learning (PBL) from the perspective of the physical environment were at a moderate level, with a mean score of 3.25 and a standard deviation of 0.824. The findings show that the mean scores for each item ranged from 2.44 to 3.88.

The item with the highest mean score was "The school's library facilities are inadequate for students to access information," with a mean score of 3.88 and a standard deviation of 0.824. A total of 6 teachers (12%) strongly agreed, 38 teachers (76%) agreed, 2 teachers (4%) were undecided, 2 teachers (4%) disagreed, and 2 teachers (4%) strongly disagreed. This indicates that the majority of teachers agree that the existing library facilities are insufficient to support the needs of PBL, which requires access to various information sources for research and learning.

The second-highest item was "The financial assistance needed for project visits is inadequate," with a mean score of 3.84 and a standard deviation of 0.976. A total of 30 teachers (60%) agreed, 10 teachers (20%) strongly agreed, 2 teachers (4%) strongly disagreed, 4 teachers (8%) disagreed, and 4 teachers (8%) were undecided. This indicates that there is a lack of financial support for project visits, which is an important activity in PBL that provides students with real-world experience.

The third-highest item was "The school's technology equipment is inadequate for student use," with a mean score of 3.44 and a standard deviation of 1.110. A total of 24 teachers (48%) agreed, 6 teachers (12%) strongly agreed, 10 teachers (20%) were undecided, 6 teachers (12%) disagreed, and 4 teachers (8%) strongly disagreed. This shows that most teachers feel that technology facilities, such as computers and multimedia equipment, are insufficient to support the implementation of PBL, which involves the use of technology in teaching and learning.

The last item with the lowest mean score was "The school's computer facilities are adequate for student use," with a mean score of 2.44 and a standard deviation of 1.072. The highest frequency was for disagreement, with 20 teachers (40%), followed by strong disagreement (10 teachers, 20%), undecided (8 teachers, 16%), and agreement (12 teachers, 24%). This indicates that most teachers believe that the school's computer facilities are insufficient to support the effective implementation of PBL.

Table 4
Descriptive Analysis of Teachers' Perceptions on the Physical Environment

Bil	Item	Frequency and Percentage							Interpretation
		STS	TS	TP	S	SS	Min	SP	
1	The financial support required for project-related field trips is insufficient.	2 (4%)	4 (8%)	4 (8%)	30 (60%)	10 (20%)	3.84	0.976	High
2	The school library facilities are inadequate for students to access relevant information.	2 (4%)	2 (4%)	2 (4%)	38 (76%)	6 (12%)	3.88	0.824	High
3	The availability of school computers is sufficient for student use	10 (20%)	20 (40%)	8 (16%)	12 (24%)	0 (0%)	2.44	1.072	Moderate
4	The Design and Technology workshop equipment in schools is insufficient for student use.	4 (8%)	6 (12%)	10 (20%)	24 (48%)	6 (12%)	3.44	1.110	Moderate
5	The school environment is conducive for conducting hands-on project activities.	4 (8%)	10 (20%)	6 (12%)	26 (52%)	4 (8%)	3.32	1.113	Moderate

Students

Based on Table 5, it was found that the overall items related to teachers' perceptions of the implementation of Project-Based Learning (PBL) from the perspective of students were at a moderate level, with a mean score of 3.19 and a standard deviation of 1.125. The findings show that the mean scores for each item ranged from 2.52 to 3.56.

The item with the highest mean score was "Students' interest in the implementation of Project-Based Learning is satisfactory," with a mean score of 3.56 and a standard deviation of 0.861. A total of 32 teachers (64%) agreed, 2 teachers (4%) strongly agreed, 10 teachers (20%) were undecided, 4 teachers (8%) disagreed, and 2 teachers (4%) strongly disagreed. This suggests that most teachers perceive that student are generally interested and engaged in PBL.

The second-highest item was "Differences in students' achievement levels pose challenges in implementing Project-Based Learning," with a mean score of 3.48 and a standard deviation of 0.953. The findings show that 36 teachers (72%) agreed, while 4 teachers (8%) disagreed, 4 teachers (8%) strongly disagreed, and 6 teachers (12%) were undecided. This indicates that

teachers face challenges in addressing varying levels of student achievement when implementing PBL, which may require differentiated strategies.

The third-highest item was "In the production of projects, students struggle to create a real product," with a mean score of 3.40 and a standard deviation of 1.069. The findings show that 24 teachers (48%) agreed, and 6 teachers (12%) strongly agreed. Meanwhile, 16 teachers (32%) disagreed, and 4 teachers (8%) were undecided. This suggests that teachers recognize the difficulty students face in producing tangible outcomes from PBL activities.

The item with the lowest mean score was "Students are unable to collaborate during the implementation of Project-Based Learning," with a mean score of 2.52 and a standard deviation of 1.035. The frequency of disagreement was the highest, with 30 teachers (60%) disagreeing, followed by 4 teachers (8%) strongly disagreeing. Additionally, 10 teachers (20%) agreed, 2 teachers (4%) strongly agreed, and 4 teachers (8%) were undecided. This indicates that a significant number of teachers observed difficulties in student collaboration during PBL, which may impede its effectiveness.

Table 5
Descriptive Analysis of Teachers' Perspectives on Students

Bil	Item	Frequency and Percentage							Interpretation
		STS	TS	TP	S	SS	Min	SP	
1	Students do not cooperate during the implementation of Project-Based Learning (PBL).	4 (8%)	30 (60%)	4 (8%)	10 (20%)	2 (4%)	2.52	1.035	Moderate
2	Students face difficulties in bringing reference materials into the classroom.	2 (4%)	18 (36%)	2 (4%)	24 (48%)	4 (8%)	3.20	1.143	Moderate
3	In the production of projects, students struggle to create a real product.	0 (0%)	16 (32%)	4 (8%)	24 (48%)	6 (12%)	3.40	1.069	Moderate
4	Students know how to access information.	0 (0%)	20 (40%)	10 (20%)	16 (32%)	4 (8%)	3.08	1.027	Moderate
5	Students' learning in Project-Based Learning (PBL) is satisfactory.	2 (4%)	10 (20%)	6 (12%)	32 (64%)	0 (0%)	3.36	2.75	Moderate
6	The differences in students' academic achievement levels pose challenges in the implementation of Project-Based Learning (PBL).	4 (8%)	4 (8%)	6 (12%)	36 (72%)	0 (0%)	3.48	0.953	Moderate
7	Students face communication	4 (4%)	16 (32%)	8 (16%)	22 (44%)	0 (0%)	2.96	1.049	Moderate

	problems with group members during the implementation of Project-Based Learning (PBL).								
8	Students have difficulties in managing and presenting the information they have obtained.	2 (4%)	8 (16%)	10 (20%)	30 (60%)	0 (0%)	3.36	0.898	Moderate
9	Students know how to utilize the information they acquire.	2 (4%)	8 (16%)	18 (36%)	20 (40%)	2 (4%)	3.24	0.916	Moderate
10	Students' interest in the implementation of Project-Based Learning (PBL) is satisfactory.	2 (4%)	4 (8%)	10 (20%)	32 (64%)	2 (4%)	3.56	0.861	Moderate

Curriculum

Based on Table 6, it was found that the overall items related to teachers' perceptions of Project-Based Learning (PBL) implementation from the perspective of curriculum were at a moderate level, with a mean score of 3.41 and a standard deviation of 0.837. The mean scores for the individual items ranged from 2.00 to 4.20.

The item with the highest mean score was "In the implementation of project-based learning, parents are encouraged to support students financially," which recorded a mean of 4.20 and a standard deviation of 0.571. A total of 32 teachers (64%) agreed, and 14 teachers (28%) strongly agreed, while 4 teachers (8%) were undecided. This finding suggests that most teachers acknowledge the importance of parental financial support in facilitating PBL activities, particularly when projects require resources or materials beyond what schools can provide.

Another item that also recorded a mean score of 4.20 (SD = 0.495) was "The implementation of project-based learning helps students in other subjects." According to the results, 36 teachers (72%) agreed, and 12 teachers (24%) strongly agreed, while only 2 teachers (4%) were undecided. This reflects the perception that PBL enhances interdisciplinary learning and strengthens students' understanding and application of knowledge across various subjects.

Conversely, the item with the lowest mean score was "Project-based learning has a negative impact on students' exam preparation," which recorded a mean of 2.00 and a standard deviation of 0.639. A significant number of teachers disagreed with this statement, with 36 teachers (72%) disagreeing and 8 teachers (16%) strongly disagreeing. Only 2 teachers (4%) agreed, and 4 teachers (8%) were undecided. This indicates that most teachers do not perceive PBL as detrimental to students' academic performance or exam readiness, suggesting a broader acceptance of PBL as a complementary approach rather than a distraction from exam-focused instruction.

This section highlights that teacher generally perceive the curriculum context to be moderately supportive of PBL, particularly when parental involvement and cross-subject learning are considered. At the same time, the concern that PBL might negatively affect exam preparation is largely unfounded according to the majority of teacher responses. These findings underscore the importance of curriculum flexibility, cross-disciplinary integration, and stakeholder support especially from parents to enhance the success of PBL in schools

Table 6
Descriptive Analysis of Teachers' Perspectives on the Curriculum

Bil	Item	Frequency and Percentage							Interpretation
		STS	TS	TP	S	SS	Min	SP	
1	Project-Based Learning (PBL) has a negative impact on students' preparation for exams.	8 (16%)	36 (72%)	4 (8%)	2 (4%)	0 (0%)	2.00	0.639	Low
2	In the implementation of project-based learning, parents are encouraged to support students financially.	0 (0%)	0 (0%)	4 (8%)	32 (64%)	14 (28%)	4.20	0.571	High
3	The implementation of Project-Based Learning (PBL) helps students in other subjects.	0 (0%)	0 (0%)	2 (4%)	36 (72%)	12 (24%)	4.20	0.495	High
4	The time allocated is sufficient for the implementation of Project-Based Learning (PBL)	4 (8%)	16 (32%)	10 (20%)	12 (24%)	8 (16%)	3.08	1.243	Moderate

Discussion

The findings of this study revealed that teachers' perceptions toward the implementation of Project-Based Learning (PBL) in the Design and Technology (RBT) subject at the primary school level were generally moderate. However, one notable finding was that teachers demonstrated a high level of competence in utilizing educational technology as a medium for implementing PBL. This aligns with the study by Yusof, (2022) which found that the majority of teachers were proficient in integration of ICT in the classroom especially after the pandemic Covid-19. This suggests that teachers possess a solid technological foundation necessary for supporting effective PBL practices.

Nonetheless, teachers' perceptions of the physical environment for implementing PBL were also moderate. This indicates that the physical infrastructure, technological equipment, and financial support available in schools play a crucial role in the successful execution of PBL. Institutional backing from school administrators and relevant agencies such as the Teacher

Professionalism Development Division (BPPK) is essential to ensure smooth and structured implementation.

From the perspective of students, teachers perceived that student generally responded positively to the PBL approach. Student attitude is one of the key factors contributing to the success of an instructional approach. According to Yusof, (2022) attitude assessment in education enables educators to systematically evaluate and cultivate students' dispositions, thereby fostering effective learning outcomes and holistic character development. In this context, positive student attitudes toward PBL can significantly influence their level of engagement and motivation. A study by Guat & Hamidon, (2022) supports this notion, showing that students expressed greater interest and involvement in learning through PBL compared to traditional methods, especially in terms of performance.

Moreover, PBL was seen to benefit students in terms of enhancing knowledge, fostering critical thinking, and promoting creativity. (Nabilah et al., 2021) emphasized that PBL provides students with opportunities to develop essential soft skills such as collaboration, communication, and problem-solving through authentic real-world tasks. In this study, teachers observed high levels of student involvement during project activities, including active group discussions and idea sharing.

However, the implementation of PBL in the RBT subject still faces several challenges. These include time constraints (with only 60 minutes allocated for teaching), lack of materials and equipment, and the high cost of executing project-based tasks. If not well-planned and executed, PBL can negatively impact student motivation and learning effectiveness. This is consistent with the findings of Noor & Nurhayati, (2024), who emphasized that thorough planning and adequate preparation are essential for the successful implementation of Problem-Based Learning (PBL). Effective PBL implementation also requires a structured introduction, real-world application, and collaborative engagement, supported by the use of modern digital platforms."

Overall, despite the challenges, PBL implementation in the RBT subject shows strong potential for enhancing the learning experience. Teachers, as the primary facilitators of this approach, should be provided with ongoing training and institutional support to ensure that PBL can be effectively and sustainably integrated into classroom practice.

Conclusion

The results of this study yield significant implications for the enhancement of pedagogical practices through the integration of Project-Based Learning (PBL), particularly within the Design and Technology (Reka Bentuk dan Teknologi, RBT) curriculum. PBL has been shown to foster more dynamic, engaging, and meaningful learning experiences that equip students with essential 21st-century competencies, including critical thinking, creativity, collaboration, and problem-solving. With structured training and sustained exposure, educators can more effectively implement PBL in their instructional practices. Therefore, PBL emerges as a pedagogically sound and impactful approach that warrants broader application within the school system. When executed systematically and thoughtfully, PBL can significantly strengthen student comprehension and skill acquisition in alignment with the aspirations of the national curriculum. The insights derived from this study may inform the Ministry of

Education's strategic efforts to reinforce PBL adoption, particularly in cultivating students' preparedness to navigate future educational and societal demands.

From a theoretical standpoint, this research reinforces the pedagogical value of PBL by underscoring its capacity to promote authentic, learner-centered education closely aligned with real-world contexts. It substantiates the claim that PBL enhances student engagement and supports meaningful learning through inquiry-based and interdisciplinary experiences. Contextually, the study provides a critical examination of the current landscape faced by Malaysian RBT teachers, particularly regarding their moderate perceptions of PBL, varying levels of technological readiness, and the expressed need for professional development. These findings offer a context-specific lens into the realities of PBL implementation, presenting actionable recommendations for policymakers and practitioners seeking to optimise its use across diverse educational settings.

References

Astutik, Y., Setiawan, S., Anam, S., & Suhartono, S. (2022). "I Can Teach With My Videos": How Do Teachers Teach English to Young Learners in a Technology-Limited Environment? *International Journal of Learning, Teaching and Educational Research*. https://doi.org/10.26803/ijlter.21.7.9

Azizah, N., Nisak, A. Z., & Tristanti, I. (2022). Model Problem Based Learning Kompetensi Komunikasi Interpersonal Pada Mahasiswa Kebidanan. *Jurnal Ilmu Keperawatan Dan Kebidanan*. https://doi.org/10.26751/jikk.v13i1.1319

Babbie, E. (2010). The Practice of Social Research. In *California: Wardsworth Publishing* (12th ed.). https://doi.org/10.26751/jikk.v13i1.1319

Bhardwaj, V., Zhang, S., Tan, Y., & Pandey, V. (2025). Redefining learning: student-centered strategies for academic and personal growth. *Frontiers in Education*. https://doi.org/10.3389/feduc.2025.1518602

Crespí, P., García-Ramos, J. M., & Queiruga-Dios, M. (2022). Project-Based Learning (PBL) and Its Impact on the Development of Interpersonal Competences in Higher Education. *Journal of New Approaches in Educational Research*. https://doi.org/10.7821/naer.2022.7.993

Creswell, J. (2012). *Educational Research Planning: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*.

Guat, C. L., & Hamidon, Z. (2022). A case study of problem-based learning approach in a mathematics online learning course. *The 5th Innovation and Analytics Conference & Exhibition (IACE 2021)*. https://doi.org/10.1063/5.0092735

Gunarathna, C., Yang, R., Mudiyanselage, P. W., Amarasinghe, G., Samarasinghalage, T., Weerasinghe, R., Zhao, H., Zhang, C., Liu, C., Wang, K., & Jayakumari, S. D. S. (2023). Project-based learning for proactive skills development of postgraduate students in solar energy building design digitalisation. *Smart and Sustainable Built Environment*. https://doi.org/10.1108/sasbe-08-2022-0173

Habibi, A., Riady, Y., Alqahtani, T. M., Rifki, A., Albelbisi, N. A., Fauzan, M., & Habizar, H. (2022). Online project-based learning for ESP: Determinants of learning outcomes during Covid-19. *Studies in English Language and Education*. https://doi.org/10.24815/siele.v9i3.24928

Inayati, N., & Karifianto, D. M. (2022). Supports to Self-Regulated Learning in the Online Grammar Course. *The Journal of AsiaTEFL*.

https://doi.org/10.18823/asiatefl.2022.19.3.18.1033

Melton, J. W., Saiful, J. A., & Shein, P. P. (2022). Interdisciplinary STEM program on authentic aerosol science research and students' systems thinking approach in problem-solving. *International Journal of Science Education*, *44*, 1419–1439. https://doi.org/10.1080/09500693.2022.2080886

Morris, D. L. (2025). Rethinking Science Education Practices: Shifting from Investigation-Centric to Comprehensive Inquiry-Based Instruction. *Education Sciences*. https://doi.org/10.3390/educsci15010073

Nabilah, B. F., Degeng, N. S., Kamdi, W., & Sulton. (2021). *The Effect Of Mixed Gamification And Achievement Motivation On Concept Comprehension And Creative Thinking Skills In Learning Science*. *58*, 5139–5152. https://doi.org/10.17762/PAE.V58I1.1735

Nelson, J. (2023). Addressing blank stares and unintended paths in student-centered learning. *The Journal of the Acoustical Society of America*. https://doi.org/10.1121/10.0018824

Noor, A. H., & Nurhayati, S. (2024). Project-Based Learning Implementation in a Participative Planning Course: Strategies, Outcomes, and Challenges. *CAHAYA PENDIDIKAN*. https://doi.org/10.33373/chypend.v9i2.5660

Ramírez-Montoya, M., Castillo-Martínez, I. M., Sanabria-Z, J., & Miranda, J. (2022). Complex Thinking in the Framework of Education 4.0 and Open Innovation—A Systematic Literature Review. *Journal of Open Innovation: Technology, Market, and Complexity*. https://doi.org/10.3390/joitmc8010004

Rawal, D. M. (2024). Mapping of school teachers' digital competency in the context of digital infrastructure: a systematic review and empirical study of India. *Journal of Professional Capital and Community*. https://doi.org/10.1108/jpcc-01-2024-0016

Sam, R. (2024). Systematic review of inquiry-based learning: assessing impact and best practices in education. *F1000Research*. https://doi.org/10.12688/f1000research.155367.1

Srirangam, S., & Ng, V. (2022). The New Normal for Architecture Design Studio: Conceptualizing a Design Implementation Model. *Journal of Design and Built Environment*. https://doi.org/10.22452/jdbe.vol22no2.3

Tan, D. (2025). Tapping into the Potential of Project-Based Learning by Exploring the Core Elements in Its Implementation. *Science Insights Education Frontiers*. https://doi.org/10.15354/sief.25.co396

Utami, I. Q., Hwang, W.-Y., & Hariyanti, U. (2024). Contextualized and Personalized Math Word Problem Generation in Authentic Contexts Using Generative Pre-trained Transformer and Its Influences on Geometry Learning. *Journal of Educational Computing Research*. https://doi.org/10.1177/07356331241249225

Wang, Y. (2023). Study on the Influence of School Culture on Students' Academic Motivation. *Journal of Education and Educational Research*. https://doi.org/10.54097/jeer.v5i2.12581

Wijnia, L., Noordzij, G., Arends, L. R., Rikers, R. M. J. P., & Loyens, S. M. M. (2024). The Effects of Problem-Based, Project-Based, and Case-Based Learning on Students' Motivation: a Meta-Analysis. *Educational Psychology Review*. https://doi.org/10.1007/s10648-024-09864-3

Yusof, R. (2022). Online Distance Learning: A New Learning Approach in the Malaysian Gifted Education System. *FWU Journal of Social Sciences*. https://doi.org/10.51709/19951272/spring2022/3

Norazilawati. (2014). Kesediaan Guru Sains dan Matematik dalam Pelaksanaan Kurikulum Standard Sekolah Rendah.*Jurnal Pendidikan Sains & Matematik Malaysia*. 8 (1): 81-96.

Bahagian Teknologi Pendidikan. (2006). *Project Based Learning Handbook.* Kuala Lumpur: Bahagian Teknologi Pendidikan.

Bahagian Teknologi Pendidikan. (2007a). *Laporan Pelaksanaan Projek Rintis Project Based Learning.* Kuala Lumpur: Bahagian Teknologi Pendidikan.

Grant, M. (2009). *Understanding Projects in Project-Based Learning: A Student's Perspective*. Pembentangan Kertas Kerja di Annual Meetings of the American Educational Research Association. San Diego, CA.

Yahya, H. (2012). *Teori Belajar Menurut Konstruktivisme Dan Landasan Filosofinya.* http://wahyushine.blogspot.com/2012/06/v-behaviorurldefaultvmlo.html [3 September 2021].

Kementerian Pelajaran Malaysia, (2007). *Laporan Perlaksanaan Projek Rintis : Project- Based-Learning. Bahagian Teknologi Pendidikan Negeri Sabah 2007*. Kuala Lumpur :Bahagian Teknologi Pendidikan.

Baharuddin, M. A. (2010). Kertas Projek Ijazah Sarjana Muda Sains Serta Pendidikan (Fizik), Fakulti Pendidikan. Universiti Teknologi Malaysia, Skudai, Johor, D.T.

Yassin, R. M. (2011). Pembelajaran Berasaskan Projek. Dlm. Mohamed Amin Embi (pnyt.). Panduan Amalan Pengajaran dan Pembelajaran, hlm. 117-132. Bangi: Pusat Pengajian Siswazah, Universiti Kebangsaan Malaysia.