JURNAL PENDIDIKAN BITARA
Volume 18 Special Issue (2025) / eISSN 2821-3173 (222-227)

This article was carefully selected from
6th International Conference on Special Education (ICSE) 2025,
organized by The Southeast Asian Ministers of Education Organization
Regional Centre for Special Educational Needs (SEAMEO SEN)

BREAKING BARRIERS: HARNESSING PROJECT-BASED LEARNING TO EMPOWER STUDENTS WITH LEARNING DISABILITIES

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Published: 22 September 2025

To cite this article (APA): Bong, L. C., Kong, V. L. S., & Kuppusamy, S. K. (2025). Breaking barriers: Harnessing project-based learning to empower students with learning disabilities. *Jurnal Pendidikan Bitara UPSI*, *18*(Special Issue), 222-227. https://doi.org/10.37134/bitara.vol18.sp.21.2025

To link to this article: https://doi.org/10.37134/bitara.vol18.sp.21.2025

ABSTRACT

This study examines the effectiveness of Project-Based Learning (PBL) as an instructional approach for students with learning disabilities (LD). It focuses on how PBL promotes autonomy, collaboration, critical thinking, and problem-solving skills among students with diverse learning needs. Using a qualitative research approach, the study reviews existing literature on PBL and learning disabilities, as well as case studies from four schools that implemented PBL strategies. The case studies involved a period of 8 weeks, with interviews conducted with 10 educators and analysis of student portfolios to understand the practical application of PBL in inclusive classrooms. The study highlights the significant impact of PBL on student engagement and motivation. PBL helps students with LD by fostering a more dynamic learning experience compared to traditional passive learning environments. It promotes critical thinking, enhances collaboration, and supports self-regulation. The integration of assistive technologies, such as speech-to-text applications, proved crucial in supporting students' cognitive development and keeping them motivated. Challenges identified include cognitive overload, executive function difficulties, and the need for individualized support. The study discusses how these challenges can be mitigated through differentiated instruction, clear scaffolding, and appropriate use of assistive technologies. The paper concludes that PBL can empower students with LD when thoughtfully structured and supported with the right tools. Practical implications for educators include the need for professional development in PBL strategies, the integration of assistive technology, and the importance of providing tailored support structures for students.

Keywords: Project-Based Learning, Learning Disabilities, Technology Integration, Differentiated Instruction, Student Engagement, Educational Empowerment

INTRODUCTION

Learning Disable (LD) students often face systemic barriers in traditional educational environments. These challenges stem from a passive learning model, limited opportunities for autonomy, and abstract teaching methods that cannot accommodate diverse cognitive and sensory needs (Basham et al., 2020). Approaches like these often lead to feelings of marginalization, a decline in academic achievement, and reduced self-confidence among LD students. In response to these challenges, Project-Based Learning (PBL) has emerged as a dynamic pedagogical alternative for LD students that helps them with real-world problem-solving. PBL emphasizes active participation, collaborative learning, and context-based tasks.

This approach aligns with the principles of Universal Design for Learning (UDL), which supports flexible, inclusive, and accessible teaching practices that prioritize diverse learning profiles (Mayer, 2021).

A total of 57,282 students with learning disabilities in primary schools, and 38,648 students in secondary schools (MOE, 2024). This data shows the need to focus on the development of LD students in terms of teaching so that they can master lessons for their future. This study is significant because it aligns with the Sustainable Development Goal (SDG) 4, which advocates for quality education that emphasizes inclusive and equitable learning opportunities for all (Adipat & Chotikapanich, 2022). As schools around the world strive to break down systemic barriers, PBL offers a way to empower students with LD so they can thrive in diverse academic and social environments.

This study aims to evaluate the effectiveness of PBL in addressing the unique needs of students with LD, particularly its role in fostering autonomy, critical thinking, and problem-solving skills. Additionally, it seeks to identify best practices for designing PBL frameworks that support cognitive, social, and emotional growth, such as differentiated instruction and structured scaffolding (Chen et al., 2022). Furthermore, the research analyzes the role of assistive technology in mitigating barriers to PBL implementation, including cognitive overload and executive function challenges. By bridging theory and practice, this paper contributes to the development of equitable pedagogical strategies for marginalized learners. The research questions guiding this study are:

(1) How does PBL improve engagement and academic outcomes for students with LD?
(2) What instructional strategies and technological tools best support PBL for these students? and
(3) What are the key challenges in implementing PBL for students with LD, and how can they be mitigated?

LITERATURE REVIEW

Project-Based Learning (PBL) has gained significant attention as an effective way to support cognitive development, particularly in students with learning disabilities. This method is especially useful for enhancing critical thinking, creativity, problem-solving, and psychomotor skill key areas where students with LDs often need additional support. Traditional lecture-based approaches tend to fall short of engaging these students, making it harder for them to connect with the material (Chen et al., 2022). Because of this, more teachers and researchers are exploring alternatives like PBL to help foster a deeper level of learning. These students often experience a mix of cognitive, emotional, and motivational obstacles, which interact in complicated ways and make it tough to find one-size-fits-all solutions. In the PBL environment, students need to manage their own learning, come up with creative ideas, and maintain focus for extended periods of time.

Teaching strategies and educational technology are key in enhancing problem-based learning (PBL) for students with learning disabilities in inclusive education settings. The right pedagogical interventions and tools can boost student engagement while supporting their cognitive, social, and emotional development. Some strategies, such as graduated scaffolding, collaborative facilitation, and metacognitive reflection, have shown promise in helping LD students navigate PBL's complexities (Chen et al., 2022; Sormunen et al., 2020; Nuur & Chamidah, 2025). Technology can also strengthen access and expression during problem-solving tasks, though empirical evidence on its effectiveness for LD students is still limited (Eldiva & Azizah, 2019; Almulla, 2020). This section explores the key teaching strategies and technological tools identified for supporting PBL in LD students, along with the challenges and principles for successful integration.

Structured scaffolding and metacognitive reflection are key strategies for implementing PBL with LD students. Scaffolding provides step-by-step instructions, cues, and rubric-based guidance to help students navigate complex tasks (Chen et al., 2022; Nuur & Chamidah, 2025), effectively managing cognitive load and building self-efficacy. Guided questioning and reflective activities, like daily journals or teacher-student discussions, promote higher-order thinking and self- awareness (Sormunen et al., 2020). Research shows that LD students offer more meaningful reflections when given consistent metacognitive prompts. Both strategies highlight the teacher's role as an active

facilitator in PBL.

While collaborative learning is often promoted in PBL, its effectiveness with LD students is mixed. Umar and Ko (2022) found that team contracts and heterogeneous peer grouping improved social interaction and cohesion. However, students' interest in flipped classrooms declined, suggesting some collaboration methods may not align with LD students' digital skills or self-perceptions. Lestari et al. (2024) stressed the need to adapt both the physical environment and behavioral expectations, such as desk arrangements and visual cues for hyperactive learners. This highlights the importance of planning collaborative elements in PBL with inclusivity and flexibility to accommodate diverse neurocognitive needs.

Educational technology can support PBL strategies through tools like OneNote and OneDrive for project documentation, and platforms like Padlet and Jamboard for reflections (Sormunen et al., 2020). However, no studies have examined their effectiveness specifically for LD contexts. Assistive technologies such as text-to-speech, video subtitles, and screen readers improve access, but require modification based on disability severity (Eldiva & Azizah, 2019). Gamification and adaptive apps show promise in boosting motivation, yet Al Husaeni (2024) found limited testing of their impact on LD students, particularly regarding accessibility and learning outcomes. Therefore, technology should enhance pedagogy, not replace it, with ongoing monitoring to ensure its effectiveness for students with special needs.

In conclusion, Project-Based Learning (PBL) offers a valuable approach to supporting the cognitive, social, and emotional growth of students with learning disabilities (LD). By using strategies like scaffolding, metacognitive reflection, and collaborative learning, teachers can encourage deeper engagement and critical thinking. While educational technology can enhance PBL, it needs to be carefully adapted to meet the unique needs of LD students for accessibility and effectiveness. Ongoing research and thoughtful implementation of both teaching methods and technology are key to creating inclusive environments that truly support LD students' learning outcomes.

METHODOLOGY

This study adopts a qualitative research approach to explore the effectiveness of Project-Based Learning (PBL) in empowering students with learning disabilities (LD). This approach is ideal for examining the experiences, perceptions, and impacts of educational interventions in real-world classroom settings (Creswell & Creswell, 2023). The study combines two primary methods, a comprehensive literature review and case study analysis.The literature review will systematically examine existing academic works, such as peer-reviewed journal articles, educational reports, and academic texts, focusing on the application and outcomes of PBL for students with LD, differentiated instruction, assistive technology, and frameworks like Universal Design for Learning (UDL).

Additionally, the study will analyse case studies from schools that have successfully implemented PBL for students with LD. Data from these case studies will include interviews with educators, analysis of student work samples, and classroom observations, offering practical insights into effective implementation. Both the literature review and ca se study data will be analysed using thematic and content analysis to identify recurring themes, patterns, and best practices. While the qualitative nature of this research limits generalizability, the study aims to provide a deeper understanding of how PBL can be thoughtfully designed and supported to help students with LD overcome academic barriers and achieve success in inclusive educational settings.

RESULTS AND FINDINGS

The comprehensive review of existing literature and the analysis of selected case studies reveal significant insights into the effectiveness of Project-Based Learning (PBL) for students with learning disabilities (LD). A primary finding indicates that PBL significantly enhances student engagement and motivation for this population. Traditional learning environments often lead to disengagement among students with LD due to their passive nature and abstract concepts (Chen et al., 2022). In contrast, PBL,

with its emphasis on student-driven inquiry, real-world problem- solving, and active participation, directly addresses these issues, fostering a more dynamic and enjoyable learning experience. This increased engagement, as evidenced by multiple studies and reported in various case studies, translates into improved attendance, greater task persistence, and a more positive attitude towards learning. Furthermore, PBL's promotion of critical thinking and problem-solving skills is consistently highlighted. By requiring students to analyse complex situations, devise solutions, and apply knowledge in authentic contexts, PBL moves beyond rote memorization, helping students with LD develop higher-order cognitive abilities that are often underdeveloped in conventional settings. The collaborative nature of PBL also significantly contributes to the development of social and communication skills, as students with LD learn to work effectively in teams, share ideas, and navigate group dynamics, which are crucial for both academic and future life success.

Moreover, the research underscores the critical role of differentiated instruction and clear scaffolding in maximizing the benefits of PBL for students with LD. Effective PBL implementation necessitates teachers providing varied levels of support, adjusted tasks, and multiple pathways for students to demonstrate their understanding. This includes breaking down complex projects into manageable steps, offering graphic organizers, providing sentence starters, and implementing frequent check-ins. Case studies consistently demonstrated that when these scaffolding strategies are thoughtfully integrated, they mitigate challenges such as cognitive overload and executive function difficulties, allowing students with LD to participate meaningfully and successfully. Crucially, the integration of assistive technology emerges as a powerful enabler within PBL frameworks. Technology-based tools, ranging from text-to-speech and speech-to-text software to digital organizers and collaborative platforms, play a vital role in overcoming barriers related to literacy, writing, organization, and information processing for students with LD. These tools not only provide accessible learning opportunities but also maintain student motivation and empower them to work more independently. While challenges such as initial cognitive overload, difficulties with executive function, and the need for highly individualized support were identified, these were largely mitigated through careful planning, robust scaffolding, and the strategic deployment of technology.

Interviews conducted with six teachers, reveal that Project-Based Learning (PBL) offers substantial benefits for students with learning disabilities. Once authentic projects are introduced, previously disengaged students frequently assume leadership roles during group ideation sessions and demonstrate the ability to apply abstract concepts to concrete, real-world tasks. All participating teachers underscored the importance of structured scaffolding mechanisms, including tiered rubrics and visual checklists, which consistently alleviate student anxiety and provide clear, step by step guidance. Additionally, assistive technologies such as tablet based speech-to-text applications were found to enhance communication and foster confidence, particularly among students facing reading or writing difficulties. Despite these gains, the primary challenge identified was the additional planning time and professional development required of teachers, tightly packed schedules often hinder the consistent implementation of effective scaffolding. Nevertheless, teachers concurred that, with intentional support structures and appropriate technological tools, PBL cultivates intrinsic motivation, enhances task perseverance, and promotes both cognitive and social development among learners with special educational needs.

Observations of 60 minutes PBL sessions for 8 weeks further highlighted a notable transformation in classroom dynamics. Teachers assumed primarily facilitative roles as speaking only 18 percent of the time, while engaging in monitoring, questioning, and offering subtle guidance. Peer interaction increased considerably, with learners with learning disabilities frequently sharing tools and posing questions to one another. Visual supports such as timers and pictorial schedules significantly bolstered executive functioning**,** enabling 87 percent of students to transition between tasks punctually without verbal prompts. Nearly all groups succeeded in producing a functional prototype, while the one group that did not still submitted a comprehensive reflective account detailing their missteps. The classroom climate was similarly positive, marked by spontaneous laughter and affirmations such as “I can do this!”, alongside a 40 percent reduction in off task or restless behaviours compared to conventional lessons**.** Collectively, these findings suggest that PBL enhances collaboration, self-regulation, and motivation within a more structured and inclusive learning environment for students with learning disabilities.

An analysis of 10 student project portfolios corroborated these findings, revealing marked improvements in conceptual understanding, knowledge application, creativity, and reflective capacity. Prior to PBL, students' work typically consisted of brief, formulaic responses. Following the project cycle, however, learners produced more sophisticated conceptual explanations, established meaningful real-world connections, and approached problem solving with increased strategic rigour**.** Creative thinking was manifested in the development of novel prototypes, vibrant illustrations, and innovative use of recycled materials. Students also demonstrated enhanced process documentation skills, incorporating short video demonstrations, sequential photographs, voice memos, and written reflections that mapped trial-and-error processes and subsequent refinements. Remarks such as "This mind map kept my ideas from slipping away" illustrate a growing metacognitive awareness, collaborative capacity, and resilience. Taken together, the depth and quality of students' outputs indicate that PBL not only reinforces academic content for learners with disabilities but also nurtures higher order thinking, multimodal expression, and more advanced reflective practices.

Overall, the findings strongly suggest that with thoughtful design, appropriate resources, and a commitment to inclusive practices, PBL serves as a transformative pedagogical approach that empowers students with learning disabilities to overcome academic barriers, develop essential skills, and achieve significant academic success within inclusive educational environments.

DISCUSSIONS

This study shows that Project-Based Learning (PBL) has a significant impact on the educational outcomes of students with learning disabilities (LD). The clear improvement in motivation and participation among LD students indicates that PBL can address issues of disengagement often seen in traditional learning approaches. By integrating student research, real-world problem- solving, and active participation, PBL creates a more engaging learning experience, encouraging students to think critically and solve problems in relevant contexts.

Although PBL has proven effective in enhancing motivation and collaborative skills, it also requires clear support to address specific challenges among LD students (Sormunen et al., 2020). For example, challenges such as cognitive overload and difficulties in executive functions faced by some students need to be managed with tailored approaches and structured support. This can be achieved through effective scaffolding, including task breakdowns, the use of clear visual materials, and continuous progress monitoring. While these challenges can be overcome with careful planning and assistive technology, there are still some students who may require additional support in certain aspects. Therefore, it is crucial to understand the individual context of each student when planning PBL.

For example, PBL may not be suitable for all LD students, especially those with significant difficulties in basic literacy skills. For students with substantial gaps in literacy skills, PBL may add to their cognitive load, causing them to become more stressed. Therefore, it is important to assess the specific needs of each student and adjust tasks and support according to their abilities. By giving more attention to individual needs, PBL can be tailored for students with greater learning disabilities, allowing them to benefit as well (Eldiva & Azizah, 2019). Teachers should be trained to design projects that recognize the diverse abilities of their students (Hassan and Ahmad, 2023). This training should emphasize structured scaffolding strategies and the use of assistive technology to provide necessary support. Project-Based Learning (PBL) should also be flexible, offering various options to cater to different needs. Teachers might use digital materials to deepen students' understanding or provide assistive tools to help with literacy challenges.

CONCLUSION AAND RECOMMENDATIONS

In conclusion, PBL is an effective and transformative approach for empowering students with learning disabilities (LD). When properly organized and supported, PBL can overcome many barriers present in traditional education (Campoy-Cubillo, 2025). This approach not only enhances motivation and participation but also enriches critical thinking, problem-solving, and collaboration skills among LD students. The success of PBL depends heavily on differentiated instruction, effective scaffolding, and

the appropriate use of assistive technology. Despite challenges such as cognitive overload and executive function difficulties, this study shows that these challenges can be overcome with careful planning and appropriate support. Therefore, it is essential to ensure that PBL is tailored to each student's needs, with support adjusted for students requiring additional help.

Future research should be conducted in the form of longitudinal studies to assess the long-term effects of PBL on LD students. Additionally, parental involvement should be expanded in future studies to examine the impact of family engagement on students' success in PBL. Other studies could explore the cultural influences and how PBL can be adapted to accommodate LD students from various cultural backgrounds. Overall, PBL offers an inclusive and effective educational approach that can overcome learning barriers for students with learning disabilities, helping them to grow and achieve meaningful success in a broader inclusive educational environment.

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