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An examination of the project-based learning approach in education in terms of core concepts: A document analysis and strategic development framework

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Abstract

This study proposes an evidence-based strategic implementation framework by integrating the theoretical foundations of project-based learning, contemporary design standards, and key managerial requirements that emerge in classroom practice through qualitative document analysis. Peer-reviewed meta-analyses, comprehensive literature reviews, foundational theoretical works, and institutional standards such as the PMI process groups and Gold Standard project-based learning were analyzed thematically. The findings indicate that the risk of reducing project-based learning to the level of isolated activities is closely related to the quality of design elements and instructional guidance. They also show that project management processes, including planning, monitoring, and closure, help reduce cognitive load while strengthening self-regulation and collaboration. In addition, assessment practices, stakeholder participation, digital equity, and ethical considerations emerge as critical parameters that determine implementation quality. By addressing instructional design and project management within a unified framework, the study offers practitioners measurable quality indicators and provides researchers with sets of propositions that can be empirically tested.

Introduction

Project-based learning (PBL) is an instructional approach that encompasses student-centered and interdisciplinary learning environments in which learners engage in sustained inquiry around a real-world–related problem or question and produce a tangible product or performance (Thomas, 2000). The central assumption underlying PBL is that learning deepens not only through the transmission of information but through the generation and application of knowledge. For this reason, the approach is frequently associated with outcomes referred to as 21st-century skills, including critical thinking, creativity, collaboration, and communication (Barron & Darling-Hammond, 2008).

In recent years, a growing body of meta-analytic evidence has indicated that PBL generally has positive effects on academic achievement, thinking skills, and learner attitudes (Zhang & Ma, 2023). At the same time, the literature demonstrates that the impact of PBL is not automatic. Design quality, the level of instructional guidance, implementation fidelity, and contextual variables substantially differentiate outcomes across settings (Condliffe et al., 2017). In practice, when PBL is reduced to short-term, product-oriented activities that are weakly aligned with curricular goals, it may result in increased teacher workload, ambiguity in assessment, and superficial student learning.

The point of departure for this study is the need to narrow the gap between the theoretical rationales of PBL and its implementation practices by jointly drawing on principles of instructional design and a project management perspective. While the learning sciences literature offers robust conceptual frameworks for the design of PBL (Krajcik & Blumenfeld, 2006), the integration of project management tools related to planning, monitoring, and closure into classroom-based PBL has received relatively limited attention. Consequently, considering the dimensions of well-

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designed instruction and well-managed projects within a single ecosystem appears critical for quality assurance, stakeholder management, and the sustainability of practice.

Instructional design models define, from a pedagogical standpoint, what needs to be done to achieve learning objectives, whereas project management standards provide an operational framework for how these processes can be managed. In approaches such as Gold Standard PBL, the complexity of the learning process may increase the cognitive load placed on both students and teachers. In this context, integrating the Project Management Institute's process groups (initiation, planning, execution, monitoring, and closure) with instructional design not only facilitates management but also functions as a strategic form of scaffolding that reduces uncertainty in the learning process. The primary motivation of this study is therefore to propose a hybrid structure that brings together pedagogical flexibility and managerial discipline.

Study Background

Historical and Theoretical Foundations

The intellectual roots of project-based learning (PBL) can be traced to the progressive education tradition, which emphasizes learning through experience and conceptualizes schooling as a social institution (Dewey, 1897; Dewey, 1938). Kilpatrick's project method provided an early contribution to the pedagogical framework of PBL by arguing that learning can be organized around students' purposeful activity (Kilpatrick, 1918). Constructivist learning theory further emphasizes that knowledge is actively constructed through learners' engagement, and within this perspective the teacher's role is to design learning environments and provide appropriate forms of support (Vygotsky, 1978; Wood et al., 1976).

PBL and Its Close Relatives: Problem-Based and Inquiry-Based Learning

In the literature, PBL is frequently discussed alongside approaches such as problem-based learning and inquiry-based learning, which can lead to conceptual ambiguity. Barron and Darling-Hammond (2008) note that these approaches share an emphasis on real-world problems, active student engagement, and collaboration, yet PBL typically culminates in more concrete and publicly shareable products. Condliffe et al. (2017) likewise stress that distinguishing PBL from its "close cousin" approaches is important for interpreting evidence on effectiveness. In the present study, PBL is conceptualized as an instructional design that integrates sustained inquiry, the production of a product or performance, meaningful student voice and choice, and an explicit culture of revision.

Guidance, Cognitive Load, and Debates on Quality

A central claim of PBL is that authentic problems and interdisciplinary tasks make learning meaningful; however, designs based on minimal guidance have been criticized for increasing cognitive load and potentially undermining learning, particularly among novice learners (Kirschner et al., 2006). In response to these critiques, effective PBL designs are argued to require support through structured inquiry cycles, clearly articulated goals, formative assessment practices, and scaffolding strategies (Hmelo-Silver et al., 2007; Sweller, 1988). Accordingly, the success of PBL is less a function of the mere presence of the approach than of the quality of guidance and the degree of implementation fidelity (Condliffe et al., 2017).

Contemporary Design Standards and the Evidence Base

Contemporary design standards for PBL are organized around elements such as a challenging problem or question, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, and public sharing of outcomes (PBLWorks, 2019). From a learning sciences perspective, these elements create conditions that support the development of conceptual understanding, evidence-based reasoning, and interdisciplinary transfer (Krajcik & Blumenfeld, 2006).

Meta-analytic evidence reports statistically significant positive effects of PBL on overall learning outcomes, while also indicating that variables such as implementation duration, disciplinary domain, learner age level, and assessment type may moderate these effects (Zhang & Ma, 2023). In a meta-analysis conducted within STEM contexts, relatively large overall effect sizes were reported for creativity outcomes; however, because these findings are based on a limited number of studies, they should be interpreted with caution in light of measurement approaches and sample characteristics (Kwon & Lee, 2025).

A Project Management Perspective: Adaptation to the Educational Context

The classroom implementation of project-based learning requires not only pedagogical design but also systematic process management. The Project Management Institute's process group framework, consisting of initiation, planning, execution, monitoring and control, and closure, provides a structured approach for breaking complex work into manageable phases (Project Management Institute [PMI], 2022). When applied in educational contexts, this framework makes visible practices such as clarifying project goals and scope, aligning work packages with timelines, anticipating risks, planning stakeholder communication, and formally closing the project in relation to predefined assessment criteria.

The use of project management tools in project-based learning can be justified at two complementary levels. For teachers, these tools facilitate classroom coordination by dividing a complex instructional process into manageable checkpoints. For students, they help structure self-regulatory processes such as goal setting, planning, monitoring progress, and reflecting on lessons learned (PMI Educational Foundation, 2025).

Table 1.
Functional Alignment between the PBL Workflow and PMI Process Groups

PMI Process Group	PBL Pedagogical Correspondence	Example of Practice
Initiating	Project initiation and formulation of the driving question	Signing a "project charter" with students that defines the project scope, expectations, and ground rules
Planning	Research and design process	Student teams allocating tasks and developing a Gantt chart or timeline
Executing	Product development and prototyping	Teams developing prototypes while the teacher provides ongoing, circulating guidance
Monitoring and Control	Feedback and revision	Monitoring progress through peer assessment forms and interim checkpoints or milestones
Closing	Presentation and evaluation	Public presentation of the product and conducting a "lessons learned" reflection session

Note. *The table has been adapted to align the pedagogical steps of instructional design with the logic of project management processes (PMI, 2022; PBLWorks, 2019).*

Current Landscape of the Research Field

Bibliometric evidence indicates a marked increase in project-based learning research between 2014 and 2024, accompanied by the strengthening of international collaboration networks (Mota et al., 2025). This trend suggests that the approach has expanded across multiple disciplines. At the same time, it points to the need for stronger evidence concerning implementation quality, scalability, and contextual sensitivity in order to sustain and enhance effectiveness over time (Condliffe et al., 2017).

Purpose

The purpose of this study is to integrate prominent theoretical debates, design standards, and the project management approach within the project-based learning literature into a coherent thematic framework. Through this integration, the study seeks to contribute to the consistent conceptualization of core project-based learning constructs, to clarify the components that determine implementation quality, and to develop an evidence-based roadmap for classroom practice. Accordingly, the study addresses questions concerning the theoretical foundations and contemporary design standards of project-based learning, the ways in which managerial and pedagogical components that shape implementation quality can be integrated, and the areas in which actionable recommendations for educational stakeholders should be prioritized.

Method

Research Design

The study is situated within the qualitative research tradition and employs a document analysis design. Document analysis involves the systematic examination of written materials related to a particular phenomenon and the generation of meaningful categories and themes from these materials (Bowen, 2009). In this study, an integrative interpretation of project-based learning was developed by drawing on peer-reviewed meta-analyses and reviews, foundational theoretical works, and institutional frameworks and guidance documents.

Data Sources and Selection Criteria

Documents were selected from studies accessible through widely used academic databases in educational research and open-access publication platforms. Selection criteria prioritized sources that addressed the definition and design principles of project-based learning, learning outcomes and impact evaluation with particular attention to meta-analytic evidence, implementation processes including teacher capacity and school context, issues related to project management and implementation fidelity, and themes of sustainability, digital equity, and ethics. Sources that could not be verified or that lacked citation integrity were excluded from the analysis.

Data Selection and Scope

Within the scope of the study, key documents addressing the integration of project-based learning and project management were identified using a systematic approach. The search strategy employed keyword combinations such as “Project-Based Learning” and “Project Management,” as well as “Instructional Design” and “PMP.” Inclusion criteria required that sources had been published within the past ten years, addressed both pedagogical and managerial processes, and were available as full texts in either English or Turkish.

Analysis Process and Trustworthiness

The analysis was conducted using an inductive thematic analysis approach (Braun & Clarke, 2006). Initially, documents were summarized in terms of their aims, scope, methods, findings, and recommendations. Codes were then consolidated to generate higher-order themes. To enhance the trustworthiness of the study, attention was given to source diversity across meta-analyses, theoretical works, and guidance documents, to conceptual triangulation, and to the consistency of the audit trail throughout the analysis process (Lincoln & Guba, 1985).

Table 2.
Adaptation based on Qualitative Trustworthiness Strategies Proposed by Lincoln and Guba (1985).

Dimension	Application in This Study
Credibility	Use of diverse sources and checks for thematic coherence
Transferability	Description of themes together with contextual and implementation conditions
Dependability	Transparent reporting of analytical steps and a traceable thematic structure
Confirmability	Citation integrity and exclusion of unverifiable or fabricated sources

Findings

Theme 1: Conceptual Clarity, Design Elements, and Implementation Fidelity

The documents emphasize that the defining features of project-based learning are sustained inquiry and the production of an authentic product that is shared publicly, and that assigning activity-based projects alone cannot be considered equivalent to project-based learning (Thomas, 2000; PBLWorks, 2019). Implementation fidelity is associated with the coherent enactment of core design elements, including inquiry, authenticity, student voice, and

revision. When one or more of these elements is absent, the learning potential of project-based learning may be weakened (Condliffe et al., 2017).

Theme 2: The Quality of Guidance Shapes Cognitive Load and Learning

Both the strengths and risks of project-based learning are closely related to the level of instructional guidance. Designs based on minimal guidance may increase cognitive load, particularly among learners with limited prior knowledge (Kirschner et al., 2006). For this reason, scaffolding strategies such as clearly articulated goals, structured work packages, exemplar products, checklists, and formative feedback cycles emerge as critical indicators of quality (Hmelo-Silver et al., 2007; Sweller, 1988).

Theme 3: Evidence of Impact Is Positive but Sensitive to Context and Measurement

Meta-analyses indicate that project-based learning has generally positive effects on academic achievement, thinking skills, and learner attitudes (Zhang & Ma, 2023). However, effect sizes are sensitive to factors such as disciplinary domain, duration of implementation, teacher experience, assessment approaches, and sample characteristics (Condliffe et al., 2017). Meta-analytic evidence on creativity outcomes in STEM contexts reports relatively high effect sizes, yet the generalizability of these findings should be interpreted with caution due to the limited number of studies and the diversity of measurement instruments used (Kwon & Lee, 2025).

Theme 4: Project Management Processes Support Self-Regulation and Collaboration

The reviewed documents recommend making planning, progress monitoring, risk management, and closure activities explicit in order to support effective implementation of project-based learning. The PMI process groups provide a functional backbone for classroom-based project-based learning by making tasks visible, supporting the management of time–quality trade-offs, and systematizing stakeholder communication (PMI, 2022). This structure can strengthen students' self-regulatory processes, such as goal setting and progress monitoring, while also enhancing coordination within teams (PMI Educational Foundation, 2025).

Theme 5: Assessment Should Encompass Both Process and Product

When assessment in project-based learning is limited to scoring the final product, important evidence of learning may remain invisible. The documents therefore recommend a multiple-evidence approach supported by process-oriented rubrics, peer assessment, reflective journals, and structured checkpoints (Barron & Darling-Hammond, 2008; PBLWorks, 2019). This approach requires that success criteria be communicated transparently from the outset and that a culture of feedback and revision be deliberately established.

Theme 6: Digital Equity and Ethics as Components of Quality Assurance

While technology enriches research, design, and dissemination processes in project-based learning, it also introduces risks related to digital inequality. The digital divide concerns not only access to hardware and connectivity, but also disparities in skills and opportunities for meaningful participation (van Dijk, 2020). Accordingly, project-based learning designs should address issues such as access planning, data privacy, and the ethical use of artificial intelligence tools from the outset. Integrating sustainability themes into project-based learning may further contribute to the development of students' social responsibility and systems thinking (UNESCO, 2015).

Theme 7: Field Development Reflected in Publication Growth and Networking

Bibliometric findings indicate a substantial increase in project-based learning research between 2014 and 2024, along with the strengthening of international collaboration networks (Mota et al., 2025). This trend suggests that the approach has been adopted across a wide range of disciplines, while also highlighting the need for stronger evidence related to implementation quality, scalability, and contextual sensitivity in order to sustain effectiveness over time (Condliffe et al., 2017).

Proposed Strategic Framework and Implementation Indicators

To operationalize the integrated framework developed in this study and to provide a standardized structure for future applications, concrete quality indicators and testable propositions have been articulated. Key indicators of

process quality include the implementation of at least three formal feedback or milestone meetings throughout the project as part of structured guidance, the establishment of role clarity through written documentation of each student's responsibilities within the project team, and the use of risk management processes in which teams prepare contingency plans in anticipation of potential disruptions.

In addition, two propositions are advanced for future research seeking to test the theoretical validity of the proposed framework. First, it is expected that student groups using PMI-based planning tools, such as timelines and work breakdown structures, will demonstrate higher levels of self-regulation than groups that do not employ such structured tools. Second, an inverse relationship is posited between the frequency of monitoring and control activities implemented during instruction and the level of intra-group conflict, such that increased process monitoring strengthens team coordination and reduces conflict.

Discussion

This document analysis indicates that project-based learning should be conceptualized not merely as a pedagogical approach, but as a "learning project" that requires coherence between instructional design and management. From a learning sciences perspective, the capacity of project-based learning to support conceptual understanding and transfer depends on the integrated design of disciplinary knowledge, inquiry cycles, and explicit assessment criteria (Krajcik & Blumenfeld, 2006).

Insights from cognitive load theory further demonstrate that the effectiveness of project-based learning is not automatic, highlighting the critical role of structured guidance, goal clarity, and iterative assessment cycles (Kirschner et al., 2006; Hmelo-Silver et al., 2007). This finding calls for a correction of the common misconception that equates student-centered learning with an absence of guidance. Rather than withdrawing instructional support, the teacher's role involves making pathways toward learning goals visible and gradually increasing the level of responsibility that students are able to assume.

The findings also show that project management tools perform a critical function from the perspective of Cognitive Load Theory. Project-based learning processes are inherently complex and may generate high levels of extraneous cognitive load for students. The PMI-based integration proposed in this study helps minimize this extraneous load by providing templates, checklists, and clearly defined process steps. As a result, students are able to allocate their cognitive resources not to uncertainty about what to do next, but to the construction of schemas related to the core learning content, corresponding to germane cognitive load.

Project management tools therefore have the potential to enhance implementation fidelity in project-based learning, provided that their integration remains lean and clearly oriented toward instructional goals. In addition, digital equity and ethical considerations constitute integral components of quality assurance in project-based learning. When disparities in access and digital skills are not addressed, the equity-oriented potential of project-based learning may be substantially weakened (van Dijk, 2020).

Conclusion

When well designed and well managed, project-based learning represents a powerful approach for supporting student learning, motivation, and higher-order skills. The strategic framework proposed in this study demonstrates that the quality of project-based learning can be enhanced through the coherent integration of design elements, high-quality instructional guidance, systematic use of project management processes, holistic assessment of both process and product, and explicit attention to digital equity, ethics, and sustainability.

Recommendations

Teachers should clearly define learning objectives, success criteria, and product expectations during the initiation phase, and share rubrics and checkpoints with students at the outset of the project (PBLWorks, 2019). During the planning phase, task distribution, timelines, resources, and potential risks should be made visible, while the execution phase should incorporate regular formative assessments that sustain feedback and revision cycles (Barron & Darling-Hammond, 2008). Instructional guidance should be adjusted progressively in accordance with students' prior knowledge, with more structured supports such as exemplar products, step-by-step task lists, and modeling provided at the beginning, and increased student voice and choice introduced in later stages (Hmelo-Silver et al., 2007).

To support the sustainability of project-based learning at the school level, teachers should be provided with shared planning time, opportunities for interdisciplinary collaboration, and access to professional learning communities. As emphasized by Condliffe et al. (2017), implementation success is shaped not only by classroom-level design, but also by school-level decisions related to time allocation, resource distribution, and scheduling. Standards for digital access and data security should be clarified, and ethical principles and academic integrity guidelines governing the use of artificial intelligence–supported tools should be explicitly articulated.

Future studies may employ experimental or mixed-methods designs to examine the effects of project management–based interventions, such as structured planning tools, risk analysis, and closure reflections, on learning outcomes. Effectiveness studies should report implementation fidelity and contextual variables in detail, with particular attention to how differences in digital access and skill levels shape project-based learning experiences across diverse socioeconomic contexts (van Dijk, 2020).

Limitations

By its nature, this study is limited to the evidence and interpretations presented in the documents analyzed through the document analysis method (Bowen, 2009). The review was not designed as a systematic review reported under a formal protocol such as PRISMA; instead, it aimed to produce a thematic synthesis based on selected theoretical, empirical, and institutional documents for purposes of conceptual integration. In addition, source selection was constrained by accessibility and verifiability criteria and was therefore limited to specific databases and open-access platforms. As a result, some studies, particularly within the local Turkish-language literature, may have fallen outside the scope of the analysis.

Several contextual factors should be taken into account when applying the proposed framework under conditions specific to Türkiye. Large class sizes and the pressure of centralized examinations may limit teachers' capacity to conduct individualized process monitoring. For this reason, the use of digital project management tools, such as Trello or Microsoft Teams, may be considered a practical necessity in the Turkish context to reduce teacher workload. Moreover, as the present study is largely grounded in the international literature, future research is encouraged to empirically examine the relationship between local collaborative traditions, such as the concept of imece, and formal project management practices within educational settings.

Declaration of Conflicting Interests

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Consent for Publication

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Authors' Contributions

Hasan Taşay: Conceptualization; Methodology; Data curation; Formal analysis; Writing original draft; Visualization. Mustafa Çelebi: Conceptualization; Methodology; Supervision; Validation; Writing

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