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Designing the Behavioral Engagement Ecosystem in Project-Based Learning

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ABSTRACT: The study examines how specific design features of Project-Based Learning (PBL) shape and sustain behavioral engagement among young learners, addressing a gap in research that has largely focused on PBL's effectiveness rather than the factors that drive active participation, effort, and persistence. Semi-structured interviews with elementary teachers were analyzed through the lens of Self-Determination Theory (SDT), revealing three interrelated factors critical to engagement: (1) voice, choice, and ownership, which nurture autonomy; (2) clear pathways to mastery, facilitated through scaffolding and feedback, which build competence; and (3) meaningful social connections, fostered through collaboration and teacher support, which satisfy relatedness. These findings informed the development of the Triadic Model of Behavioral Engagement in PBL, positioning autonomy, competence, and relatedness as interdependent drivers of sustained behavioral engagement. Teachers reported that these factors operate synergistically, forming a motivational ecosystem in which engagement and learning outcomes reinforce each other, producing sustained effort, participation, and ownership. Challenges such as initial student confusion and the need for ongoing scaffolding highlight the importance of responsive and flexible teaching. The study offers practical design levers for cultivating this ecosystem in elementary classrooms and other learning contexts, demonstrating how PBL can function as a structured, socially supported, and adaptive framework that promotes continuous engagement, motivation, and meaningful learning.

Keywords: behavioral engagement, motivation, project-based learning, self-determination theory.

ABSTRAK: *Penelitian ini menelaah bagaimana fitur desain spesifik dari* Project-Based Learning *(PBL) membentuk dan mempertahankan keterlibatan perilaku (*behavioral engagement*) pada peserta didik usia dini, dengan menjawab kesenjangan penelitian yang selama ini lebih banyak berfokus pada efektivitas PBL daripada faktor-faktor yang mendorong partisipasi aktif, upaya, dan ketekunan belajar. Wawancara semi-terstruktur dengan guru sekolah dasar dianalisis melalui kerangka* Self-Determination Theory *(SDT), yang mengungkap tiga faktor saling terkait yang berperan penting dalam keterlibatan belajar: (1) suara, pilihan, dan rasa kepemilikan yang menumbuhkan otonomi; (2) jalur yang jelas menuju penguasaan, difasilitasi melalui* scaffolding *dan umpan balik yang membangun kompetensi; serta (3) hubungan sosial yang bermakna, dipupuk melalui kolaborasi dan dukungan guru, yang memenuhi kebutuhan akan keterhubungan (*relatedness*). Temuan ini menjadi dasar pengembangan* Triadic Model of Behavioral Engagement in PBL, *yang menempatkan otonomi, kompetensi, dan keterhubungan sebagai pendorong saling bergantung dari keterlibatan perilaku yang berkelanjutan. Para guru melaporkan bahwa*

ketiga faktor tersebut bekerja secara sinergis, membentuk ekosistem motivasional di mana keterlibatan dan hasil belajar saling memperkuat, menghasilkan upaya, partisipasi, dan rasa kepemilikan yang berkelanjutan. Tantangan seperti kebingungan awal siswa dan kebutuhan akan scaffolding *yang berkelanjutan menyoroti pentingnya pengajaran yang responsif dan fleksibel. Penelitian ini menawarkan pendekatan praktis untuk membangun ekosistem tersebut di ruang kelas sekolah dasar maupun konteks pembelajaran lainnya, serta menunjukkan bagaimana PBL dapat berfungsi sebagai kerangka yang terstruktur, didukung secara sosial, dan adaptif untuk mendorong keterlibatan berkelanjutan, motivasi, serta pembelajaran yang bermakna.*

Kata kunci: *keterlibatan perilaku, motivasi, pembelajaran berbasis proyek, teori determinasi diri.*

INTRODUCTION

Amid ongoing calls for educational reform, the search for pedagogical approaches that foster deeper engagement and meaningful learning has become more urgent. Project-Based Learning (PBL) has emerged as a promising response, which allows students to collaborate on authentic tasks that address real-life problems (Larmer & Mergendoller, 2025; Maher & Yoo, 2017). Grounded in constructivist prinicples, PBL is a student-centered methodology where learners actively participate in their knowledge acquisition through exploration and discovery (Cole, 2024; Valenzuela, 2024). For young learners, defined as children between the ages of 3 and 12 (De Oliveira & Jones, 2023; Piaget, 1972), PBL offers hands-on experiences that make learning both interactive and personally meaningful (Maher & Yoo, 2017) while also enabling students to confront challenges in their environment (Aldabbus, 2018). By shifting from traditional, teacher-led instruction to active participation, this approach positions learners at the center of the educational process (Steele, 2019).

In the Philippines, where education is undergoing significant transformation, the importance of adopting effective, research-based pedagogies has gained renewed attention. The Second Congressional Commission on Education (EDCOM II, 2025) highlights this movement by conducting a comprehensive review of the education system to recommend reforms that ensure quality and equity. Within this context, schools are increasingly turning to innovative models such as PBL, which has been recognized for its potential to improve learning outcomes and sustain engagement among students (Cole, 2024; Rahman et al., 2024). For Filipino elementary learners, PBL offers particular promise as it aligns with EDCOM II's (2025) call to strengthen foundational skills in literacy and numeracy while cultivating 21st-century competencies. PBL addresses these needs by integrating skill development within authentic, meaningful, and contextually relevant projects. Instead of teaching literacy and numeracy in isolation, PBL situates these skills in tasks that require reading, writing, problem-solving, and quantitative reasoning to accomplish a real-world goal. This approach not only reinforces foundational competencies through repeated, purposeful practice but also actively engages students by giving them agency, choice, and opportunities to collaborate. By connecting learning to students' experiences and

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interests, PBL rekindles curiosity and motivation, which support deeper engagement and promote the transfer of learning beyond the classroom.

PBL is commonly regarded for enhancing student engagement and improving academic performance (Blumenfeld et al., 1991; Johnson & Delawsky, 2013; Thomas, 2000; Condliffe et al., 2017). However, research has largely focused on its overall effectiveness, with limited understanding of the specific factors that shape and sustain behavioral engagement defined as students' active participation, effort, and persistence, across the phases of a PBL experience (Bell, 2010; Fredricks et al., 2004). Identifying these influencing factors is essential, as it allows educators to design PBL experiences that do more than simply capture initial interest, they create conditions that nurture sustained participation, effort, and ownership of learning. Knowing what drives engagement helps teachers make intentional choices in structuring projects, supporting student needs, and adapting instruction to ensure that PBL remains both motivating and meaningful (Fredricks, 2011; Fredricks et al., 2004).

Engagement in the early years of elementary education is critical, as it lays the foundation for lifelong learning habits (Ladd et al., 1999; Early et al., 2007). The EDCOM 2 report also highlights that learning losses from short-term school closures are driven more by declines in student interest and engagement than by teaching inefficiencies, with 75% of elementary dropouts occurring between Kindergarten and Grade 4. Despite this, research has largely focused on older learners, with limited insight into how younger students maintain participation in inquiry-driven tasks (Patall, 2013). Early engagement experiences are pivotal, as it shapes how students later approach academic challenges and collaborative work (Ladd et al., 1999). To address this gap, the present study investigates the key factors that, from teachers' perspectives, sustain students' behavioral engagement in Project-Based Learning.

Guided by Self-Determination Theory (Deci & Ryan, 2000, 2013), which emphasizes the role of autonomy, competence, and relatedness in fostering intrinsic motivation, this study examines how these psychological needs intersect with the behavioral dimension of engagement in PBL. By looking into teachers' perspectives, it seeks to uncover the key factors that support or hinder students' sustained participation and effort throughout PBL tasks. In doing so, the study aims to: (1) identify the instructional strategies teachers perceive as most influential in promoting behavioral engagement; (2) examine how classroom dynamics and teacher-student relationships contribute to students' active involvement; and (3) analyze these findings in relation to SDT, highlighting the behavioral dimension within Fredricks' (2011) multidimensional view of engagement.

In addressing these objectives, this study contributes to the growing literature on PBL by shifting attention to the micro-level processes that sustain behavioral engagement among younger learners. It underscores the importance of understanding not just whether PBL works, but how it supports students' behavioral engagement in ways that can build the foundation for long-term learning and motivation.

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RESEARCH METHOD

Design of the Study

This study employed a qualitative descriptive design to explore teachers' perspectives on Project-Based Learning (PBL) and its influence on student behavioral engagement. The research was conducted in a private school in Metro Manila, Philippines, with five purposively selected teachers. While the number of participants was limited, this size was sufficient to generate rich and focused insights, allowing for in-depth analysis without positioning the study as a case study.

Purposive sampling was employed to ensure representation across grade levels and years of teaching experience. Inclusion criteria specified that participants be regular teachers with at least three years of experience implementing PBL and teaching within the elementary levels (Kindergarten to Grade 6). Teaching performance ratings were not considered; rather, participants were chosen based on their teaching load to provide coverage across the elementary spectrum (see Table 1).

Table 1. Demographic and Professional Profile of Teacher Participants

Participant	Grade Level(s) Assignment	Subject Area(s)	Years of Teaching in Current School	Years Implementing PBL
P1	Kindergarten	Self-contained (all core learning areas)	23	10
P2	Grades 1 & 5	Araling Panlipunan and Makabansa *(Social Studies)*	6	4
P3	Grade 2	Reading and Language	10	3
P4	Grades 3 & 4	Mathematics	9	4
P5	Grade 6	Science	8	4

Before addressing questions directly related to the research problem, the interviews first verified the fidelity of PBL implementation in each teacher's practice through these questions: *"What PBL model or approach do you follow? Are there specific elements of PBL (e.g., student-driven inquiry, real-world connection, collaboration, reflection) that are emphasized in your implementation?* This step was necessary to ensure that the strategies being described were grounded in authentic PBL application and not in loosely adapted project work. Establishing fidelity also addressed concerns raised in prior research that inconsistencies in PBL implementation have contributed to debates regarding its effectiveness on academic performance (Ferrero et al., 2021).

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Data Collection and Analysis

Data were gathered through semi-structured interviews, which provided consistency across participants while allowing flexibility for follow-up questions and elaboration. The interview protocol was designed to elicit teachers' perceptions, observations, and experiences regarding how Project-Based Learning (PBL) influences and sustains students' behavioral engagement. The questions were categorized into four thematic areas: (a) factors influencing behavioral engagement, (b) changes in engagement over time, (c) the role of teacher strategies, and (d) the impact of engagement on PBL implementation and success. Table 2 presents these categories along with representative sample questions.

Table 2. Summary of Interview Question Categories and Sample Prompts

Category	Focus of Questions	Sample Question
Factors Influencing Behavioral Engagement	Explores teachers' perspectives on what drives students' participation, effort, and persistence in PBL activities.	What specific factors do you believe influence students' behavioral engagement in PBL?
Changes in Engagement Over Time	Examines variations in students' engagement across different stages of a PBL project and teachers' responses to these changes.	Have you noticed any changes in students' engagement levels at different stages of their PBL journey?
Role of Teacher Strategies in Behavioral Engagement	Identifies strategies teachers use to encourage and sustain students' active participation in PBL activities.	What strategies do you use to encourage students to stay actively engaged in PBL tasks?
Impact of Engagement on PBL Implementation and Success	Investigates how students' engagement levels influence teachers' implementation, adaptation, and perceptions of PBL success.	How do students' levels of engagement impact the way you implement and adapt PBL in your classroom?

**Only representative sample questions are shown for brevity.*

These open-ended questions encouraged participants to express their thoughts freely while maintaining focus on the study's objectives. Each interview lasted approximately 45 minutes and was conducted via Zoom, as preferred by the participants. A face-to-face interview option was also offered, but all participants opted for the online format for convenience. Given the complexity of the topic, the researcher personally conducted all interviews to ensure that participants' ideas were accurately captured and clarified. Although the researcher also holds an administrative role in the school, measures were taken to maintain neutrality throughout the process. Participation was voluntary, confidentiality and anonymity were assured, and participants were informed that their responses would not influence their professional standing.

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The interview voice recordings were transcribed using TurboScribe during the initial phase to allow for efficient and accurate editing. After the software-generated transcriptions were produced, the researcher listened to the recordings and manually edited any words or phrases spoken in Filipino, which were then translated into English to ensure linguistic accuracy and fidelity to meaning. Given the manageable number of participants, manual coding was employed. The researcher adopted a thematic analysis approach, identifying recurring patterns and key themes related to teachers' perceptions and experiences. The initial phase of analysis involved an open review of the data to identify general themes. Through iterative deductive coding, the data were refined over three coding cycles until the main themes emerged, which provides a coherent representation of the participants' shared and distinct insights.

To ensure trustworthiness and credibility, several strategies were employed. Member checking was conducted by sharing the coded summaries with participants to verify whether their views were accurately represented; all participants confirmed their agreement with the interpretations. In addition, regular peer debriefing sessions were held with the researcher's academic supervisor, to ensure that the investigation and coding decisions remained grounded and reflective of the data.

Ethical considerations were central to the study: informed consent was secured from all participants, they retained the right to withdraw at any time, and all data were treated with strict confidentiality. Credibility was ensured by faithfully representing participants' responses, dependability through consistent data collection procedures, confirmability by minimizing researcher bias, and transferability by providing sufficient contextual description for possible application in similar educational settings.

RESULT AND DISCUSSION

Result

Analysis of the interview transcripts produced eight interrelated themes (see Table 3) that explain how Project-Based Learning (PBL) fosters and sustains behavioral engagement in the participating classrooms. The results are organized by theme, supported with participants' statements that illustrate teachers' perspectives.

Table 3. Themes, Supporting Quotes, and Interpretations

Theme	Illustrative Quotes from Participants	Interpretation / Explanation
Authenticity in Learning	"We need to make learning authentic for the kids. That's when they really invest in what they're doing." "You just see it in their faces when they realized	Projects anchored in real-world issues foster ownership and personal investment. Authentic learning connects academic content to students' lived experiences, motivating

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	this is about their life, their experiences, their family."	them to take initiative and sustain engagement.
Voice and Choice as Drivers of Engagement	"We always put a premium on the voice and choice of the students… so it's really the children who are the drivers of their own learning." "When we say yes to their ideas, they work harder. It becomes their project, not ours."	Allowing students autonomy in decision-making nurtures intrinsic motivation. Ownership transforms learning from teacher-directed to student-driven, strengthening behavioral engagement.
Integration and Holistic Development	"We design our learning experiences in such a way that numeracy skills are integrated, literacy skills…and others." "Sometimes it feels like we're teaching everything at once—reading, math, values—all in one project."	PBL encourages holistic learning by integrating multiple disciplines. This interconnected approach sustains focus, supports diverse learning styles, and reflects real-life problem-solving.
Collaborative Learning and Social Skills	"They feel proud when their group works well, and they're quick to fix things when someone is not cooperating." "They want to impress each other, and that pushes them to do better."	Group work nurtures accountability and cooperation. Peer relationships become motivational forces that enhance engagement and improve social skills.
Student Reflection and Feedback	"Even a smiley chart sometimes makes them pause and think about what they learned." "Reflection builds confidence and helps them see what they can improve."	Reflection deepens metacognitive awareness. It allows learners to recognize progress, identify gaps, and take ownership of their growth—key aspects of sustained engagement.
Teacher Adaptability and Growth Mindset	"Sometimes they asked to use apps I've never tried before. I just say okay, let's figure it out together." "You really need to let go sometimes and trust the process."	Teachers' openness to experimentation models adaptability and shared learning. A growth mindset among teachers fosters a flexible, student-centered environment conducive to engagement.

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Increased Behavioral Engagement During PBL	"They're even more engaged, especially when they share their work… when they listen to the experts." "Even the quiet kids start to shine when it's a project they care about."	PBL environments produce observable behavioral changes—longer attention spans, more participation, and visible enthusiasm—especially when learning feels purposeful.
Excitement and Joy in Learning	"They always want more centers… It's heartening to see how much they truly love school." "Even after the activity is finished, they ask for extra time—'Can we stay and finish?'"	Positive emotions fuel engagement. Joy, curiosity, and anticipation sustain motivation and make learning experiences memorable and meaningful.

To further clarify the relationship between the emergent themes and the factors influencing behavioral engagement within PBL, Table 4 presents a summary of these themes aligned with the three basic psychological needs of Self-Determination Theory: autonomy, competence, and relatedness (Deci & Ryan, 2000).

Table 4. Factors Influencing Behavioral Engagement within PBL

SDT Need	Theme	Supporting Observations
Autonomy	Promoting Student Voice and Choice	Students choose topics and formats (e.g., TikTok, games); formulate driving questions.
	Allowing Flexible Learning Paths	Differentiated tasks, multiple outputs, and choice-based activities.
Competence	Scaffolding Learning Effectively	Teachers guide using probing questions, feedback loops, and clear structure.
	Celebrating Small Academic Wins	Recognition of milestones and visible progress to sustain motivation.
	Developing Real-World Skills	Projects enhance critical thinking, creativity, and communication through hands-on application.
Relatedness	Fostering Collaboration and Peer Interaction	Students work in groups, share roles, and keep each other accountable.
	Building Teacher–Student Connections	Teachers check students' well-being and adapt to individual needs.

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	Engaging Community and Experts	Students interact with parents and professionals through presentations and expert talks.

Collectively, these themes highlight that behavioral engagement in PBL is not a single construct but a multifaceted interaction among authenticity, autonomy, collaboration, and emotional investment. They provide insight into the research question by demonstrating that students' engagement is maximized when learning experiences are meaningful, learner-centered, socially connected, and emotionally resonant. The teachers' narratives reveal that engagement flourishes when learning is meaningful, student-driven, and socially connected.

Discussion

The findings from this study suggest that behavioral engagement among young learners may not be driven by PBL tasks alone, but rather by the dynamic interplay of autonomy, competence, and relatedness as they unfold within the PBL process**.** The analysis indicates that engagement in PBL tends to emerge as *a* holistic, situated experience shaped by both pedagogical design and the satisfaction of these psychological needs, rather than an isolated, linear outcome. This supports previous findings (Fredricks et al., 2004), emphasizing that engagement is a multidimensional construct influenced by cognitive, behavioral, and emotional elements.

Within PBL context, autonomy, expressed through student voice and choice, plays a vital role in fostering intrinsic motivation and ownership of learning. This is consistent with Deci and Ryan's (2000) Self-Determination Theory (SDT), which identifies autonomy as a basic psychological need central to motivation. However, in this context, autonomy is not simply about freedom; it is carefully supported and scaffolded by teachers who adapt tasks to suit developmental levels and cultural expectations. This reflects a contextual nuance where young learners benefit from structured autonomy, with enough freedom to engage meaningfully but with clear guidance to prevent overwhelm. This echoes Blumenfeld et al. (1991), who argue that students need both ownership and teacher structuring in PBL contexts to remain engaged.

Competence is strengthened through teacher scaffolding, regular feedback, and real-world relevance of projects. The recognition of small academic wins and opportunities to apply skills in authentic contexts builds students' confidence and deepens their cognitive engagement, which aligns with Bell (2010) on the importance of mastery opportunities in PBL. More importantly, competence development is not isolated from social factors but is reinforced within collaborative and reflective learning environments where peer and teacher validation matter, a point also highlighted by Krajcik and colleagues (2006) in their work on scaffolding PBL.

Relatedness emerges as a powerful influence in the Filipino setting, where strong social connections and community involvement are integral to motivation. Collaborative group work, peer accountability, and interactions with teachers and

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parents create a supportive emotional climate that satisfies students' need for belonging. This is consistent with Patall (2013), who noted that relatedness fosters persistence and participation, especially in younger learners. The social dimension thus underpins and enhances both autonomy and competence by providing safety and encouragement.

The relationship among these needs is evident in how teachers' flexibility and growth mindset moderate engagement. Their responsiveness to student preferences and interests, including integrating digital tools or alternative formats, supports an adaptive learning environment that honors students' voices while maintaining structure and academic rigor (Provenzano, 2018). Overall, the pattern that emerges highlights the interconnectedness of SDT's psychological needs within a culturally and developmentally sensitive framework. Behavioral engagement is sustained when autonomy is scaffolded, competence is celebrated within real-world contexts, and relatedness fosters a secure and motivating community.

While the findings affirm that PBL nurtures behavioral engagement through autonomy, competence, and relatedness, the data also surfaced important challenges that can hinder these outcomes if left unaddressed. Teachers shared that at the start of a project, especially when topics are broad or unfamiliar, some students experience confusion or hesitation. This reflects what Sweller et al. (2011) describe in Cognitive Load Theory as the risk of overload for novice learners when tasks are ill-structured or demand more than their working memory can process. Others emphasized the continued need for structured support, even in student-centered environments. This aligns with Kirschner and fellow researchers (2006), who argue that minimal guidance approaches often fail without scaffolding, particularly for inexperienced learners. Teachers also acknowledged their own reservations when students expressed preferences for complex or unfamiliar formats. These insights highlight that while PBL can elevate engagement, its successful implementation depends on teachers' ability to scaffold learning thoughtfully and manage cognitive demands, an approach supported by van Gog et al. (2010), who show that scaffolding reduces learners' cognitive burden and enhances persistence.

These findings contribute to a grounded theoretical model of behavioral engagement in PBL. The proposed Triadic Engagement Model (see Figure 1) builds on, yet extends, Self-Determination Theory (Deci & Ryan, 2000) by illustrating how autonomy, competence, and relatedness interact dynamically within a PBL context that is both culturally and developmentally sensitive. While SDT conceptualizes these three needs as parallel determinants of motivation, the present model highlights their reciprocal and reinforcing relationships as they manifest in classroom practice. Specifically, autonomy enhances competence when student choices are respected, and relatedness strengthens both autonomy and competence by providing a safe and motivating social climate. Sustained behavioral engagement emerges at the intersection of these three needs, not as a linear outcome but as a synergistic process shaped by teacher adaptability and contextual factors.

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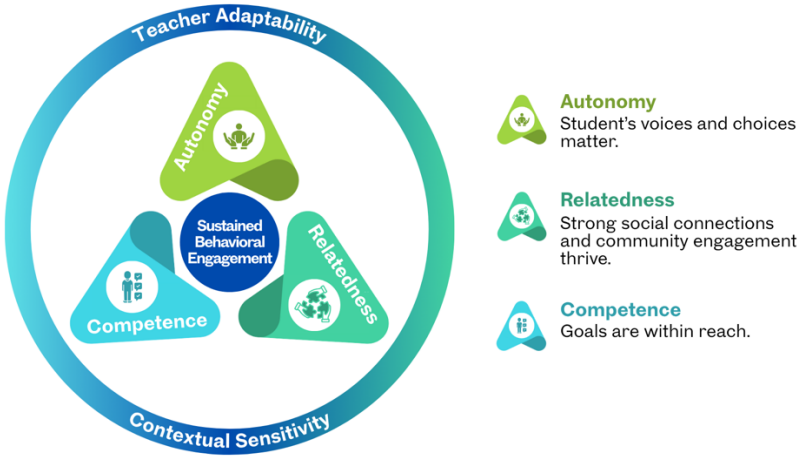

Figure 1. Triadic Model of Behavioral Engagement in PBL

To further illustrate this reciprocity and flow, Figure 2 presents a process-oriented schematic of the Triadic Model of Behavioral Engagement in PBL. Whereas Figure 1 captures the conceptual structure of autonomy, competence, and relatedness as intersecting needs, Figure 2 visualizes the dynamic interplay among them which shows how the satisfaction of one need reinforces the others and culminates in behavioral engagement. This mechanistic representation complements the conceptual model by depicting engagement not as a fixed product but as an emergent, recursive process mediated by teacher adaptability and contextual sensitivity.

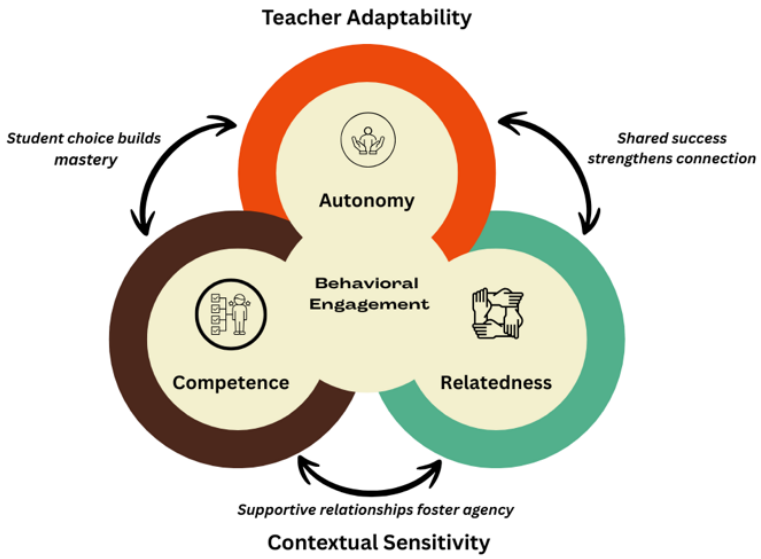

Figure 2. Dynamic Interrelations among Autonomy, Competence, and Relatedness within the Triadic Engagement Model of Behavioral Engagement in PBL

In this sense, the model does not merely adapt SDT to the PBL context but proposes a refined mechanism that integrates psychological needs theory with

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pedagogical practice. This approach can offer a more situated understanding of behavioral engagement among young learners in project-based learning settings. Existing models of student engagement, such as Fredricks et al. (2004), conceptualize engagement as comprising behavioral, emotional, and cognitive dimensions, while Reeve (2012) emphasizes the role of teacher support in promoting agentic engagement. Similarly, Skinner and Pitzer (2012) described engagement as a dynamic, reciprocal process that reflects ongoing interactions between students and their learning environments. The Triadic Behavioral Engagement Model in PBL complements and extends these frameworks by identifying the mechanistic interplay among the three psychological needs as the underlying forces that sustain behavioral engagement within PBL contexts. Unlike linear or componential models, the triadic model situates engagement as an emergent state that arises from the reciprocal reinforcement of these needs, moderated by teacher adaptability and contextual sensitivity. This integration of Self-Determination Theory with classroom-level engagement frameworks offers a more dynamic and situated account of how engagement is co-constructed between teachers and students in collaborative, project-based environments.

Further, the findings strongly suggest that behavioral engagement may not occur in isolation; rather, teachers' ability to scaffold, adapt, and respond to learners' developmental stages, cultural expectations, and resource conditions appears to sustain this balance of needs. Within this framing, the model extends SDT (Deci & Ryan, 2000) by demonstrating that in young learner PBL contexts, behavioral engagement appears to thrive through structured autonomy, socially reinforced competence, and culturally embedded relatedness, each of which may be sustained through responsive teacher adaptability and context sensitivity.

CONCLUSION

This study addresses a critical gap in the literature by identifying which specific design features within PBL most effectively foster engagement among young learners through the lens of Self-Determination Theory. The findings suggest that when projects are intentionally designed to support students' psychological needs for autonomy, competence, and relatedness, learners are more likely to demonstrate active participation, sustained effort, and greater ownership of their learning. Behavioral engagement and PBL also operate as mutually reinforcing processes: deeper engagement enhances project quality, while successful projects, in turn, amplify motivation and self-direction.

However, the results also reveal that behavioral engagement within PBL is not a guaranteed outcome but a function of responsive and adaptive teaching. Teachers emphasized challenges such as students' initial confusion, the need for continuous scaffolding, and tensions between learner choice and curricular requirements. These insights reaffirm that meaningful engagement arises not solely from strong project design but also from teachers' capacity to flexibly mediate structure and autonomy ensuring that projects remain developmentally appropriate and pedagogically sound.

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Building on these findings, this study advances the Triadic Model of Behavioral Engagement in PBL**,** which situates autonomy, competence, and relatedness as interdependent levers sustaining motivation and engagement. Within this model, PBL functions as a classroom ecosystem: well-crafted projects stimulate learners' sense of agency, scaffold their progress toward mastery, and cultivate meaningful relationships with peers and teachers. Behavioral engagement thus emerges at the intersection of these three needs, shaped by the dynamic interplay among design features, teacher practices, and classroom climate.

The model offers concrete implications for classroom design and teacher professional growth. For teachers, integrating the model means embedding opportunities for authentic voice and choice (autonomy), structuring tasks that balance challenge and attainability (competence), and intentionally building collaborative learning communities (relatedness). Teacher preparation programs and in-service training may use the model as a reflective tool for planning, observation, and feedback, supporting educators in creating psychologically supportive learning environments. At the policy level, schools may institutionalize such practices by aligning professional development, curriculum standards, and assessment frameworks around student engagement and motivation. This will will help make sure that PBL implementation remains both rigorous and responsive to learner needs.

While the study provides an initial framework for understanding behavioral engagement within PBL, it is not without limitations. The small number of participants and the single-site context constrain the generalizability of the findings. Moreover, as the model emerged from a focused group of elementary teachers, the nuances of need interaction may differ across subjects, developmental stages, and cultural contexts. Future research should extend this work across the basic education continuum, involving a larger and more diverse participant pool, including neurodiverse learners, and public school contexts implementing PBL, to test and refine the model's robustness.

Ultimately, the Triadic Model of Behavioral Engagement in PBL represents a work in progress, a conceptual foundation that may evolve as more teachers, students, and contexts contribute to its development. By viewing behavioral engagement as a dynamic, co-constructed process rather than a static outcome, this model invites educators to design classrooms that do not merely deliver projects but cultivate enduring curiosity, connection, and self-driven learning among young learners.

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