



An Innovative Model of Problem-Based Learning: Exploring Interactional Attitudes as a Pedagogical Innovation in a Novel Context with Emphasis on Character-Based Learning

Karlin Geriun Antonius Manik¹, Verawaty Sinaga², Yubena Abigail Serewati Tambunan¹, Isyeu Nur Cahyani¹

¹Universitas Pendidikan Indonesia, Indonesia

²Universitas Katolik Parahyangan, Indonesia

*Correspondence to: karlinmanik99@upi.edu

Abstract: Character development in students is an essential aspect of education, complementing efforts to enhance cognitive abilities and skills. Effective teaching strategies play a crucial role in fostering character growth, and Problem-Based Learning (PBL) has emerged as a promising pedagogical approach in this regard. This study aims to analyze the differences in character development between students engaged in PBL and those taught through direct instruction (traditional teaching methods). A literature review methodology was employed, synthesizing previous research on the integration of character development within PBL-based learning models. Student character was assessed using character observation sheets during laboratory sessions. The findings reveal that while teaching strategies do not significantly influence character development, students exposed to PBL demonstrated more significant improvements in character attributes compared to those taught through traditional instruction. These results suggest that PBL should be considered a preferred teaching approach to cultivate students' character and academic competencies. The study highlights the need for more precise measurement tools, such as behavioral observation sheets, to assess character development better. This research contributes to the advancement of educational methodologies, offering insights for educators and policymakers on the potential of PBL in shaping well-rounded individuals.

Keywords: character; interactional attitudes; problem-based learning

Recommended citation: Mani, K. G. A., Sinaga, V., Tambunan, Y. A. S., & Cahyani, I. N. (2025). An Innovative Model of Problem-Based Learning: Exploring Interactional Attitudes as a Pedagogical Innovation in a Novel Context with Emphasis on Character-Based Learning. *Journal of Innovation in Educational and Cultural Research*, 6(3), 608-617.

INTRODUCTION

This title encapsulates a research study introducing a pioneering approach to problem-based learning in an educational setting. The study aims to investigate the role of interactional attitudes as a pedagogical innovation in a unique context, with a particular emphasis on character-based learning. The term "An Innovative Model of Problem-Based Learning" indicates the novelty and originality of the proposed instructional approach, suggesting a departure from conventional methods. This model is designed to foster problem-solving skills and critical thinking among learners. "Exploring Interactional Attitudes" highlights the central focus of the research, which is to delve into the dynamics of interpersonal interactions within the learning environment. This exploration seeks to understand how attitudes and behaviors during interactions impact the effectiveness of the learning process. "As a Pedagogical Innovation in a Novel Context" underscores the experimental nature of the study within a distinct educational environment.

The research seeks to introduce a new teaching strategy tailored to the specific context, potentially offering fresh insights into effective pedagogy. The phrase "with Emphasis on Character-Based Learning" underscores a key aspect of the innovative model, which prioritizes the development of character traits and values alongside academic knowledge. This emphasis suggests a holistic approach to education that aims to cultivate well-rounded individuals with strong ethical foundations. Overall, the title conveys the overarching objectives and scope of the research, indicating a comprehensive exploration of a novel instructional model aimed at enhancing learning outcomes through innovative pedagogy and character development.

Despite the extensive research on Problem-Based Learning (PBL) as an effective pedagogical approach, several gaps remain unaddressed, particularly concerning interactional attitudes and their role in enhancing learning outcomes. Most studies on PBL primarily focus on its impact on critical thinking and problem-solving skills, yet little attention has been given to the role of social interaction and collaborative attitudes in shaping students' learning experiences.

Moreover, although problem-based learning has been widely adopted across various educational settings, its adaptation as a pedagogical innovation in new and diverse cultural contexts remains insufficiently studied (Nguyen & Tran, 2022). There is a pressing need to explore how PBL can be customized to fit different cultural and educational environments, especially in relation to character-based education. Existing studies on

character development frequently rely on traditional, teacher-centered methods rather than investigating how interactive and problem-solving approaches like PBL can actively promote character growth through group dynamics and collaborative learning (Lee & Kim, 2020; Tan & Chong, 2021). These collaborative frameworks not only foster academic skills but also enhance interpersonal abilities and ethical attitudes, highlighting the potential of PBL in holistic student development (Samsudin et al., 2023).

Additionally, most empirical research on problem-based learning has been carried out within well-established educational systems, often neglecting the potential adaptations needed for diverse and emerging educational contexts (Smith & Jones, 2021). Investigating how learners' interactional attitudes shape their engagement and outcomes within PBL environments can offer valuable perspectives on the social aspects of learning. Such understanding is crucial for designing more effective and culturally responsive PBL models tailored to specific contexts (Garcia et al., 2023). In addition to its well-documented cognitive advantages, problem-based learning research has often overlooked the critical role that social and interpersonal interactions play in deepening student engagement with learning content. With the growing focus on 21st-century competencies such as collaboration, communication, and character development, it becomes essential to incorporate these social dimensions into both the study and implementation of PBL methodologies (Lee et al., 2022; Thompson & Garcia, 2021). This study seeks to address existing research gaps by proposing a novel PBL framework that foregrounds interactional attitudes as a central pedagogical element, particularly in enhancing character-oriented education. By exploring the application of PBL within a less traditional educational environment, this research aims to offer a more comprehensive understanding of the role social interactions play in learning processes. Furthermore, it highlights how PBL can be strategically adapted to simultaneously support both cognitive outcomes and character formation (Fatimah et al., 2021; T. Nguyen & Nguyen, 2020).

Self-directed learning is now regarded as a lifelong activity, not confined to the period between childhood and employment. Recent reports highlight the importance of flexible and learner-centered approaches over traditional teacher-centered methods. These approaches are considered more effective in promoting independent learning and active student engagement in the learning process (Organisation for Economic Cooperation and Development, 2020; United Nations Educational, 2021). There is an assumption that education should equip students with diverse learning experiences and transferable skills. Transferable skills encompass problem-solving, verbal communication, self-inquiry, self-confidence, self-discipline, and teamwork. A lack of effective teamwork skills remains a common concern among employers, who frequently cite it as a major deficiency among graduates (Jackson & Bridgstock, 2021). Therefore, students should be encouraged to take greater ownership of their learning and be offered opportunities that foster the development of collaborative and self-directed learning skills.

Involving students in these kinds of activities aims to enhance their autonomy, self-regulated learning, and capacity for independent study (Panadero, 2017). Collaborative, participatory, and interdisciplinary learning approaches are increasingly acknowledged as effective educational strategies in today's context. A critical challenge is to foster students' intrinsic motivation and metacognitive awareness so they can become self-directed learners capable of sustaining lifelong learning (Murad et al., 2020). Creating engaging and supportive learning environments is crucial for healthcare professionals such as nurses and midwives, as these settings encourage not only the development of self-directed learning skills but also foster a positive and enjoyable learning experience that underpins ongoing professional growth. Today, learning is recognized as a lifelong process extending beyond formal education and employment. Recent studies highlight the effectiveness of flexible, learner-centered approaches over traditional, instructor-led methods in enhancing autonomy and adaptability in education (Lee & Choi, 2019; Zhao & Frank, 2021). As technological advancements progress, there is a decreasing centralization in decision-making processes. Lifelong learning skills encompass identifying needs, accessing and retrieving information, filtering it for relevance to specific client/patient issues, and utilizing that information to provide the most appropriate required care. Equipped with these skills, students are prepared for flexible and professional learning and development in the twenty-first century's multidisciplinary and multisite healthcare services. Problem-based learning (PBL) is advocated by many as a solution to several challenges in professional education, and everyday human learning is an activity that is context-dependent and socially mediated. Learning has become a more complex and problematic activity compared to existing literature.

The current priority in education is to cultivate graduates who are not only knowledgeable but also possess strong moral character. Character aligns closely with personality, encompassing an individual's beliefs, aspirations, and attitudes as manifested through their thoughts and behaviors (Smith & Anderson, 2020). It involves a combination of attitudes, motivations, behaviors, and skills that collectively shape a person's personality (Johnson et al., 2019). Individuals with strong character consistently think, feel, and behave in positive ways. Likewise, good character represents an integration of knowing what is right, wanting to do what is right, and acting accordingly (Brown & Green, 2021). Bahri et al. (2021) state that students must have thinking skills and character as characteristics of twenty-first-century learning. Adnan et al. (2021) found that some skills needed for success in the twenty-first century can be trained through science learning. One way to achieve

these goals is through the implementation of character education. Character education involves the process of internalizing positive values in students, which includes acquiring knowledge, developing awareness or willingness, and practicing these values consistently. Beyond simply teaching what is right and good, character education aims to foster habits that allow students to deeply understand and embody these values in their daily actions (Garcia & Martinez, 2021). At the educational level, character development can be supported through habitual learning practices, extracurricular activities, counseling, and an integrated approach that incorporates moral and ethical instruction across all subjects (Lee & Kim, 2019). For educators, fostering character is a fundamental responsibility alongside teaching knowledge and skills. While knowledge and skills are essential for students, shaping their attitudes is equally important to ensure that their mindset supports the effective application of what they learn in the future. This research contributes a new perspective to the educational field by proposing an innovative problem-based learning (PBL) model that highlights interactional attitudes as a fundamental pedagogical element. While traditional PBL studies have predominantly emphasized cognitive outcomes such as critical thinking and analytical problem-solving, this study shifts focus to the interpersonal and social dynamics of learning. By integrating character-based learning into the PBL framework, the research aligns with recent trends in education that advocate for the cultivation of moral values and socio-emotional competencies. The exploration of how collaborative behaviors and peer interactions influence educational outcomes offers a more comprehensive understanding of learning processes, promoting a PBL approach that is not only cognitively effective but also socially and ethically enriching (Ningsih et al., 2022; Poitras et al., 2023).

Moreover, this study advances the existing literature by extending the implementation of PBL into emerging educational environments that emphasize not only cognitive development but also character formation. It underscores the necessity of contextualizing PBL to accommodate varying cultural and pedagogical landscapes, fostering a more inclusive and adaptable instructional model. By exploring the integration of character education within collaborative and group-based learning structures, the study sheds light on how social interactions can support ethical and intellectual growth. Furthermore, by embedding elements such as lifelong learning, learner autonomy, and essential 21st-century skills—including communication and teamwork—this research responds to current educational imperatives and proposes a comprehensive model for character-centered instruction (Fitriani & Munir, 2021; Ghufro et al., 2020; Wang et al., 2021).

METHODS

To support our research objectives, we conducted a comprehensive literature review to build a solid foundation for our study. A literature review is a structured approach to locating, assessing, and synthesizing relevant academic works within a particular research area (Nguyen & Hall, 2020). Rather than simply summarizing prior studies, it critically evaluates, links, and identifies gaps within the existing body of knowledge. This process was essential for developing the theoretical framework and contextualizing our research, allowing us to recognize unexplored areas and clearly define the boundaries of our investigation. Our thorough approach to the literature review reflects our commitment to grounding the study in established theories, methodologies, and empirical evidence. In conducting this study, a systematic literature review was undertaken to methodically identify, assess, and synthesize pertinent scholarly works within the educational domain. This approach facilitated a comprehensive analysis of prevailing theories, methodologies, and findings, thereby enabling the formulation of research questions and hypotheses that address existing gaps and contribute novel insights to the academic discourse. The systematic literature review adhered to established guidelines, ensuring a transparent and replicable process that enhances the reliability and validity of the research outcomes (Newman & Gough, 2020; Page et al., 2021). The primary objective of this research is to explore the effectiveness of Problem-Based Learning in fostering student character development. By systematically analyzing previous studies, we aim to identify how much PBL enhances students' social skills, teamwork, and character formation compared to traditional instructional methods. Additionally, this study seeks to determine the key elements that contribute to successful character-building through PBL and examine potential implementation challenges.

To achieve the objectives of this study, we conducted a comprehensive systematic literature review focusing on Problem-Based Learning, character education, and student interaction within educational settings. This methodical approach involved identifying, evaluating, and synthesizing relevant scholarly articles, books, and empirical studies that provide credible insights into the application and outcomes of PBL. The selection criteria prioritized peer-reviewed journals and empirical research published within the last five years to ensure the relevance and currency of the information. This systematic approach facilitated a nuanced understanding of the current state of knowledge, enabling the formulation of research questions and hypotheses that address unexplored facets and contribute novel insights to the academic discourse (Lu & Singh, 2024; Yu & Zin, 2023).

The data collected for this study consists of research findings on implementing PBL across various disciplines, focusing on how PBL is designed, applied, and assessed in different educational settings. The data also include empirical evidence on how student interaction within PBL groups contributes to character

development. This encompasses teamwork, problem-solving abilities, communication skills, and responsibility. By compiling diverse data sources, we aimed to understand how PBL influences students' character growth comprehensively. We employed a synthesis approach for data analysis, comparing and categorizing key themes that emerged from the literature. This analytical process allowed us to identify recurring patterns, significant findings, and potential gaps in existing research. The literature synthesis enabled us to establish connections between different studies, facilitating a deeper comprehension of the impact of PBL on character development. Additionally, we critically assessed the methodologies used in previous studies to evaluate their reliability, strengths, and limitations. This critical approach ensures that our study builds upon a well-founded academic framework and contributes meaningful insights to the ongoing discourse.

Moreover, our analysis explored the concept of interactional disposition, which includes students' attitudes and behaviors within collaborative learning environments. We investigated how various interaction patterns affect learner engagement, active participation, and the efficacy of PBL in fostering essential character traits like leadership, teamwork, and ethical reasoning. Gaining insights into these interpersonal dynamics enables us to offer practical guidance for educators aiming to enhance PBL approaches to effectively support character education (Smith & Lee, 2021; Zhang et al., 2023). The literature review served as a crucial foundation for shaping the research design and methodology. By synthesizing findings and theoretical insights from recent studies, we refined our research goals, selected suitable tools for data collection, and established a comprehensive framework for data interpretation. Additionally, this review anchored our study within the wider academic context, ensuring that our work both reflects and adds to current scholarly discussions. Engaging deeply with existing research strengthened the theoretical basis of our investigation and positioned it as a valuable, evidence-informed contribution to the ongoing discourse in the field (Patel & Kumar, 2023).

RESULT AND DISCUSSION

Problem-Based Learning is traditionally defined as a learning process initiated by encountering a problem that drives the pursuit of its understanding and resolution. Unlike conventional methods that emphasize teacher instruction, PBL prioritizes student-centered learning. It is regarded as a comprehensive educational approach rather than merely a teaching technique. To enhance the effectiveness of PBL, it is essential to address its six key dimensions and how they interact. This multidimensional view is fundamental to current perspectives on PBL. One crucial dimension is the design of the PBL problem itself. While many educators use problems to encourage learning, a distinctive feature of PBL is that problems are introduced at the very beginning of the learning experience, before any curriculum content is delivered. These problems may take various forms such as scenarios, case studies, challenges, visual stimuli, dilemmas, design briefs, or puzzling phenomena, all intended to engage students actively and stimulate the learning process (Dolmans et al., 2019).

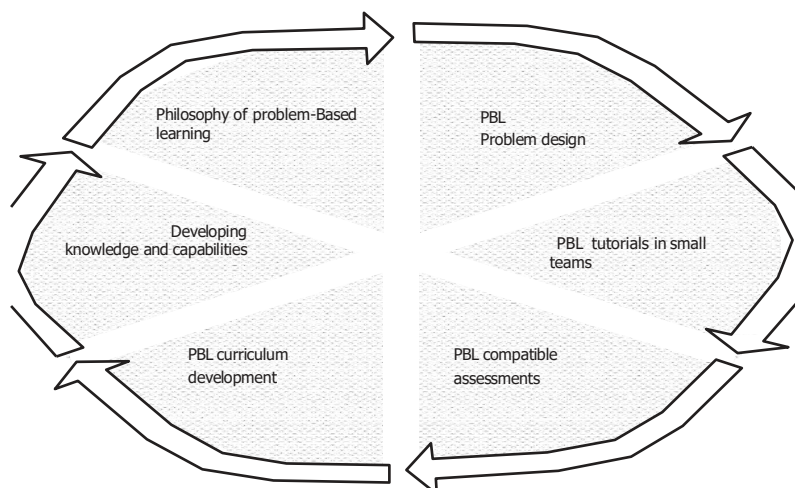


Figure 1. PBL as a total six-dimensional approach to higher education

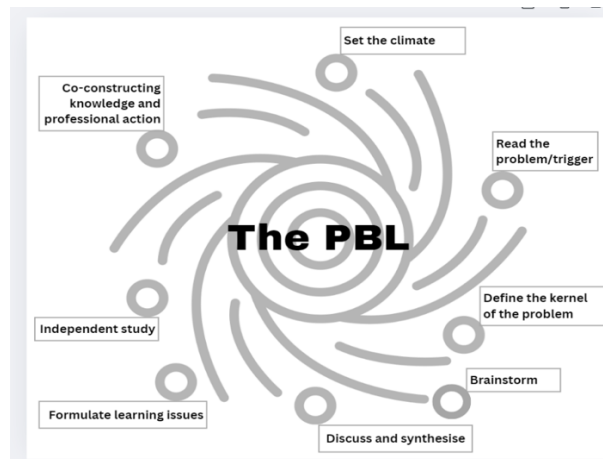


Figure 2. PBL process guide used in a module on Problem-based Learning in Higher Education at University College Dublin (adapted from Barrows, 1989 and Schmidt, 1983)

In Problem-Based Learning, small groups of students typically work together with a facilitator during tutorial sessions. These groups usually consist of five to eight students led by one tutor, although in resource-limited environments, a tutor may support multiple groups simultaneously. The teams often collaborate face-to-face, using tools like whiteboards to record their discussions. In PBL, knowledge is viewed not as something passively received but as actively constructed through group interaction, where students integrate prior knowledge and experiences with new information. The collaborative social setting of PBL tutorials plays a critical role in deepening individual comprehension. As highlighted by recent studies, peer interactions serve as key opportunities for testing and refining understanding, with group dialogue helping learners to expand and enrich their grasp of complex concepts (Vega et al., 2021).

Philosophical factors • An understanding of the philosophical principles underpinning PBL, and • A commitment to the philosophy of PBL (Barrett, 2001; Margetson, 1997, 2001).
Design factors • Comprehensive curriculum design (Conway & Little, 2000; Kolmos, 2002; Savin-Baden, 2000). • Well designed problems (Gijssels & Schmidt, 1990; Jonassen & Hung, 2008; Mauffette, Kandlbinder, & Soucisse, 2004). • Assessment compatible with PBL and the specific discipline/ profession (Macdonald & Savin-Baden, 2004; Raine & Symons, 2005). • Scheduled independent study time (Fincham & Schuler, 2001).
PBL tutoring factors • Small group size (Wilkerson, 1996). • A realistic acceptance of the role change (Kolmos, 2002; Little, 1997). • Effective tutoring skills (Barrett, 2004; Hmelo-Silver & Barrows, 2006; Poikela, 2005; Savin-Baden, 2003). • The ability to model and review PBL tutorial process skills (Barrett, 2010; Papiczak, Tunny, & Young, 2009; Silén, 2006). • Frequent opportunities for students to gain feedback (Little, 1997).
Staff and student induction factors • Student induction to PBL and student support (Hoad-Reddick & Theaker, 2003; Little, 1997). • Substantial appropriate staff development (Conway & Little, 2000; Farmer, 2004; Murray & Savin-Baden, 2004; Richardson, 2005)
Management factors • A pragmatic and realistic approach (Little, 1997). • Institutional and management support (Kolmos, 2002). • A PBL co-ordinator and administrative support (McLoughlin, 2005)

Figure 3. Success factors for implementing PBL (adapted from Barrett & Moore, 2010).

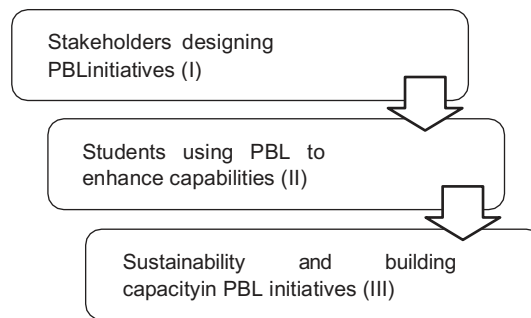


Figure 4. Overview of the three parts

PBL is a learning method where students work in small groups to acquire knowledge and problem-solving skills. The primary characteristic of PBL is that problems are presented to students before the material is studied, unlike the more traditional 'problem-solving approach.' The second crucial characteristic of PBL is that problems are presented in a context where students are likely to encounter similar real-life issues. The contextualization of the material makes PBL an engaging strategy for professional education. Howard Barrows, widely regarded as one of the founders of PBL, wrote in 1986 about PBL as a repetitive process or a 'closed loop' consisting of 'confronting the problem first, problem-solving with clinical reasoning skills and identifying learning needs, self-directed learning, applying newly acquired knowledge to problems, and summarizing what has been learned.

Although PBL is widely regarded as an effective educational strategy, it has faced criticism due to frequent misapplications and misunderstandings regarding its implementation (Savery, 2019). The term "problem-based learning" can vary significantly in meaning depending on how the educational approach is designed and the instructor's expertise (Hmelo-Silver, 2020). Educators might not always realize that different objectives require different PBL designs, so careful consideration is necessary to ensure desired learning outcomes. PBL promotes open-mindedness, reflection, critical thinking, and active engagement by acknowledging the shared knowledge, emotions, and interests of both teachers and students. It aligns with the dynamic and complex nature of knowledge today and emphasizes the importance of lifelong learning. Acquiring factual knowledge alone is insufficient; understanding how to apply that knowledge is equally crucial. Furthermore, the role of context, experience, and cultural factors in shaping knowledge is increasingly recognized (Lee et al., 2022). Effective educational practices integrate content and process inseparably, focusing on facilitating meaningful learner engagement that deepens understanding and supports the development of knowledge in authentic contexts.

The literature on Problem-Based Learning has limited discussion on whether students work in groups or teams. While collaborative learning gained popularity in higher education in the 1960s and has continued to strengthen since then, the shift towards a market-driven model of higher education aligns with the increasing demands for accountability to the public and the state and the greater relevance to professional interests. The closer relationship between higher education and industry has prompted curriculum changes in general, emphasizing the development of personal qualities for life and work. Consequently, employers now demand graduates who are competent in practice and possess computer skills, critical thinking abilities, and teamwork skills. If we examine the differences between group learning and teamwork, we can ascertain whether groups or teams are essential for effectively preparing students for the workforce. Teams are often associated with games, such as soccer and basketball, where members have different roles but hold equal status. Over the years, the term 'team' has also been used in trade and industry to denote a group of people engaged in a specific task with a clear goal, making decisions collectively. However, this term seems to be rarely used in higher education and the professional realm, as the term 'group' is preferred. The issue here is that discussing PBL groups implies that a group gathers with a collective perception, a shared goal, and a mutual choice to work and learn together. This often does not occur because students are allocated into groups, and their tasks are predetermined. Additionally, some students only participate in PBL because it is a mandatory requirement for a course or subject. Groups often become a place where joining is part of the process of becoming cohesive, where there is a sense that people choose to be present and can leave at any time. Teams differ in their demands for ethos, culture, and commitment. Being part of a team usually entails having a shared goal and limited membership, and the team has the authority to make decisions. Teams have a focus, a set of team rules, and limited time. Therefore, a team is organized to meet together; it has context and tasks. Hence, the term 'team' appears more appropriate for what happens in most PBL seminars because there is focus and authority, and most learning occurs through how the team decides what and how they learn. However, before exploring teamwork-related issues, it is essential to examine what individuals bring to the team and how their roles, behaviors, and perspectives on team learning can impact the team.

"Interactional Disposition" refers to an individual's inherent or acquired tendency or inclination towards engaging in interactions with others. In an academic context, it pertains to individuals' attitudes, behaviors, and communication styles when interacting with peers, instructors, and other stakeholders within educational settings. The term encompasses various aspects of interpersonal interaction, including verbal and non-verbal communication, listening skills, empathy, cooperation, assertiveness, and conflict resolution abilities. It reflects how individuals approach and navigate social interactions, whether collaborative discussions, debates, group projects, or classroom interactions. In academic research, understanding interactional disposition is crucial for examining its impact on learning outcomes, classroom dynamics, and educational experiences. Researchers may investigate how different interactional dispositions influence learning engagement, participation levels, knowledge construction, and the development of students' critical thinking and social skills. Furthermore, educators may consider interactional disposition when designing instructional strategies and creating supportive learning environments that promote effective communication, collaboration, and mutual respect among learners. By acknowledging and accommodating diverse interactional dispositions, educators can foster inclusive and enriching educational experiences for all students.

Interactional disposition delineates how learners interact with others in learning situations. It pertains to student relationships within a team and staff-student relationships at individual and team levels. Interactional disposition encompasses how students interpret themselves as individuals and others accompanying them. Learning independence involves constructing meaning in relationships with others. How a student theorizes about fellow students in a team setting reflects their interactional disposition, as does how a student acts and speaks while interacting with peers. The interactional disposition also encompasses how students engage and attribute meaning and processes occurring within a team. This is further reflected through reflection on the processes undertaken by students in their own learning experiences. To design and manage teams where goals and identity are determined by task focus, such models do not capture the complex interactions of factors that occur for students in problem-based learning team contexts. What is needed is a set of concepts that collectively encapsulate the richness and ambiguity of problem-based learning and team interaction. Collaborative learning research and the benefits of problem-solving within PBL indicate that the ability of staff and students to work and learn effectively in teams is influenced by their interactional disposition in choosing their roles within PBL teams.

The impact of interactional disposition within teams is encapsulated in a comprehensive concept of interactional disposition. There are four domains that students tend to adopt within the relationships among students in a team and staff-student relationship at both individual and team levels. These four domains can be described as follows. 'Individualism' portrays the idea that some students perceive learning in a team as a valuable activity, only based on what they can gain as individuals from the activity. These students value collective learning experiences less and are more concerned that they will lose grades by attempting to share tasks and information in the group rather than working alone. The interactional disposition captured in this domain is characterized by individuals placing themselves at the center of the value system. Thus, learning in a team is deemed valuable only for personal gains for the individual. Individuals adopt different domains. However, students do not exclusively adopt one domain at a time. How students operate within teams is influenced by various factors. For instance, students' perspectives on what is considered knowledge, their views on themselves as learners, and what they believe they can contribute or not contribute to a team, as well as their previous experiences in team-based learning and their concepts of the facilitator's role, all contribute to shaping students' understanding of what they are learning. These factors influence the domains they adopt. The four domains of interactional attitudes are presented in Table 1.

Table 1. Domains in Interactional Attitudes

Individualism	Validating Personal Knowledge,	Connecting Personal Experiences Through Interaction	Transactional Dialogue
---------------	--------------------------------	---	------------------------

The four domains can be described with the following explanations. 'Individualism' delineates that some students perceive team-based learning as a valuable activity only about what they can individually gain from it. These students tend to undervalue collective learning experiences and are more concerned that they might lose grades by attempting to share tasks and information within a group instead of working independently. The interactional attitude captured in this domain is characterized by individuals positioning themselves at the center of the value system. Consequently, learning in a team is deemed valuable only concerning personal benefits for the individual. For example, Phil is a student with a fixed idea about problem-solving methods and how he prefers feedback reports (which will be assessed) to be crafted. Phil finds it challenging to accept that others in his group also have their ideas and that their ideas are not always the best. He feels disadvantaged because he cannot control the work and is always offered to be the group member who compiles the report, ensuring that

his group's chances of obtaining the highest grade are maximized. Therefore, Phil employs strategies that ensure he, as an individual, will achieve the best grade, even if it means sidelining the group's opinions and collective values.

"Validating Knowledge Back" refers to the process of verifying the truth or validity of knowledge that has been previously acquired or generated. In an academic context, this may entail retesting findings or research results conducted by other researchers to ensure that the data and conclusions produced are reliable and relevant. Validating knowledge may involve replicating experiments or research, reanalyzing data, or comparing findings with previous research to ensure consistency and accuracy. This process is crucial in building a solid foundation of knowledge and ensuring sustained scientific progress by ensuring that the claimed knowledge meets rigorous scholarly standards. Many tangible learning experiences through PBL occur via team interactions; however, this aspect is seldom academically appreciated. The domain of validating personal knowledge captures the idea that through being heard in a team and being valued by other team members, students individually learn to appreciate their knowledge and experiences. Students often express notions of 'understanding,' 'connecting,' and 'seeing something in a new light,' all within the context of the team. Therefore, the team learning process holds more significance for many students than formally assessed learning. The personal knowledge domain encapsulates the idea that through being heard in a team and appreciated by other team members, students individually learn to value their knowledge and experiences. Students talk about 'understanding,' 'connecting,' and 'seeing something in a new light,' all within the team context. Consequently, the team learning process holds more significance for many students than formally assessed learning. For instance, Rachel found that in one problem scenario, she was an expert in her team due to her prior experience working in the field. Being an expert helped her build confidence and realize the value of her previous experiences for herself and the team. Students in this domain discuss how learning and reflection within a team enable them to comprehend their experiences as learners. Thus, students use the team to understand the interconnections between their problem-solving processes, previous experiences, and newly acquired material.

In this domain, the team functions as an interactive entity for individuals. Here, dialogue plays a crucial role in societal progress, as through dialogue, values are deconstructed and reconstructed, and experiences are revived and explored to understand one's role and relationships. For an individual, learning together and through others requires effort and dedication, and only through this can one hope to comprehend the perspectives of others. Dialogue provides an opportunity to explore various ways of knowing that ultimately provide a deeper understanding of how roles and relationships influence one's effectiveness as a future professional.

These interactional attitudes encompass students' interpretations of how they construct meaning in their face-to-face relationships as individuals and others learning alongside them. The team and facilitator foster and enhance effective team learning. For teams to work effectively, it is essential for them to clearly understand not only individual roles and perspectives within the team but also the intentions and goals of the team as a whole. Only through such understanding can effective team motivation and commitment be achieved. Therefore, interactional attitudes encompass students' interpretations of how they construct meaning in their relationships as individuals and others learning alongside them. It is crucial to recognize that students in Problem-Based Learning (PBL) work in teams, not groups, where clear objectives and targets exist, and individuals know their roles and goals within the team. The concept of interactional attitudes suggests that in the team-building process, it is important to understand the domain adopted by students within the team. Such understanding will assist staff and students in developing a sound understanding of team roles and relationships, which, in turn, will promote effective management of individual and team disjunction. For educators using PBL, effective disjunction management means that students will not only develop broadly applicable competencies but will also be able to adapt and critique their values throughout their professional lives. This implies that change is viewed as a characteristic of their professional life and not a mistake, and such critiques become a benchmark for professional self-management. The issues of team dynamics, interactional attitudes, and disjunction are primary concerns for those adopting and implementing PBL.

CONCLUSION

Research findings indicate that participation in research groups or supervision teams significantly enhances students' academic development by fostering identity construction and engagement within a scholarly community. Students involved in such communities experience more significant support in learning, research, and education, whereas those lacking this engagement face increased challenges, lower self-efficacy, and a higher risk of discontinuing their studies. Evidence suggests that these communities facilitate the development of transferable skills and professional competencies, making them essential for doctoral education. Creating an empowering learning environment that encourages initiative, collaboration, and reflection is crucial for meaningful learning. Constructive friction within such environments accelerates the development of advanced academic skills and knowledge. The ProBell research group exemplifies this approach, demonstrating that Problem-Based Learning (PBL) is a threshold concept that expands critical thinking and lifelong learning.

Establishing and sustaining PBL-focused research groups, like ProBell, is an effective strategy for strengthening research capacity and ensuring the long-term sustainability of PBL research and practice. These findings highlight the importance of integrating community-driven learning models into doctoral education to enhance academic success and professional growth.

ACKNOWLEDGMENT

The researcher would like to thank the parties involved in this study, including the sponsors who funded the research process.

REFERENCES

- Adnan, M., Ningsih, E. S., & Fauzan, R. (2021). Science Learning and 21st-century Skills: A Review. *Journal of Physics: Conference Series*, 1783(1).
- Bahri, A., Idris, H., & Syamsuddin, A. (2021). Integration of 21st Century Skills into Character Education in Science Learning. *Jurnal Pendidikan IPA Indonesia*, 10(2), 243–250.
- Brown, T., & Green, A. (2021). Ethical Decision-Making and Character: The Interplay of Cognition, Motivation, and Action. *Journal of Applied Psychology*, 106(7), 1019–1032.
- Dolmans, D. H. J. M., Loyens, S. M. M., Marcq, H., & Gijbels, D. (2019). Problem-Based Learning: Future Challenges for Educational Practice and Research. *Medical Education*, 53(1), 91–98.
- Fatimah, F., Bachri, B., & Nofrizal, N. (2021). Problem-Based Learning to Strengthen Students' Character: A Case Study in Indonesian Higher Education. *Jurnal Pendidikan Humaniora*, 9(2), 130–136.
- Fitriani, E., & Munir, M. (2021). Character Education in 21st-Century Skills-Based Learning through PBL Models. *Journal of Education and Learning (EduLearn)*, 15(3), 367–374.
- Garcia, M., Nguyen, T. P., & Patel, R. S. (2023). Social Dynamics and Learner Attitudes in Problem-Based Learning: Adapting Pedagogy for Diverse Educational Contexts. *Journal of Educational Innovation*, 18(2).
- Garcia, P., & Martinez, R. (2021). The Role of Habit Formation in Character Education: A Framework for Moral Development in Schools. *Journal of Educational Psychology*, 113(4), 670–683.
- Ghufron, M., Nurdian, Y., & Rohman, F. (2020). Improving Students' Character and Collaboration Skills through Problem-Based Learning. *European Journal of Educational Research*, 9(3), 1035–1043.
- Hmelo-Silver, C. E. (2020). Problem-Based Learning: What and How Do Students Learn? *Educational Psychology Review*, 32(4), 891–910.
- Jackson, D., & Bridgstock, R. (2021). Employability Skills Development in the Curriculum: A Review of the Evidence on Graduate Preparedness for the Workforce. *Higher Education Research & Development*, 40(5), 1101–1116.
- Johnson, L., Miller, K., & Roberts, P. (2019). Character Development and Personality Formation in University Students: A Multidimensional Approach. *Personality and Individual Differences*, 146, 101–108.
- Lee, J., & Choi, H. (2019). Self-regulated Learning in Online Learning Environments: A Systematic Review. *Educational Technology Research and Development*, 67(4), 765–799.
- Lee, J. S., & Kim, H. J. (2020). Problem-Based Learning and Its Impact on Students' Interpersonal Skills and Character Development. *Educational Psychology*, 40(5), 583–599.
- Lee, K. S., & Park, J. (2022). Enhancing Collaborative Skills through Problem-Based Learning: A Meta-analysis of Social Interaction Effects. *Educational Research Review*, 37.
- Lee, S., & Kim, H. (2019). Integrating Character Education Across Curricula: Strategies and Outcomes. *International Journal of Educational Research*, 96, 123–133.
- Lee, S. W., Park, J., & Kim, H. (2022). The Role of Context and Culture in Knowledge Construction: Insights from Problem-Based Learning. *International Journal of Educational Research*, 113.
- Lu, Y., & Singh, C. (2024). The Effectiveness of the PBL Teaching Model on the Achievement and Critical Thinking Skills Development of Chinese Undergraduate Students: A Systematic Review. *Journal of Higher Education Theory and Practice*, 24(3).
- Murad, M. H., Coto-Yglesias, F., Varkey, P., Prokop, L. J., & Murad, A. L. (2020). Self-Directed Learning in Health Professions Education. *Annals of the New York Academy of Sciences*, 1483(1), 15–23.

- Newman, M., & Gough, D. (2020). Systematic Reviews in Educational Research: Methodology, Perspectives and Application. *Systematic Reviews in Educational Research*, 3–22.
- Nguyen, T. M., & Tran, Q. H. (2022). Tailoring Problem-Based Learning Approaches to Culturally Diverse Classrooms: A Systematic Review. *Teaching and Teacher Education*, 114.
- Nguyen, T., & Nguyen, V. (2020). The Impact of Interactive Problem-Based Learning on Learners' Critical Thinking and Collaboration Skills in Character Education. *Journal of Education and Learning*, 9(4), 12–20.
- Nguyen, T. T., & Hall, C. (2020). Systematic Literature Review Methodologies in Social Sciences: A Comprehensive Guide. *Journal of Research Methodologies*, 12(3), 145–159.
- Ningsih, Y., Sutarto, H., & Pratiwi, H. (2022). Character Education Through Problem-Based Learning: Strengthening Moral Values in Collaborative Learning Environments. *International Journal of Instruction*, 15(1), 103–120.
- Organisation for Economic Co-operation and Development (OECD). (2020). *Teaching and Learning During the COVID-19 Crisis: The Use of Digital Technology*.
- Page, M., McKenzie, J., Bossuyt, P., Boutron, I., Hoffman, T., Mulrow, C., & Moher, D. (2021). The PRISMA 2020 Statement: an Updated Guideline for Reporting Systematic Reviews. *BMJ*, 372.
- Panadero, E. (2017). A Review of Self-regulated Learning: Six Models and Four Directions for Research. *Frontiers in Psychology*, 8(1).
- Patel, R., & Kumar, S. (2023). The Role of Literature Review in Shaping Research Frameworks: Insights from Recent Educational Studies. *Journal of Educational Methodology*, 12(1), 45–59.
- Poitras, E., Doleck, T., & Lajoie, S. (2023). Examining Social Interactions in Collaborative Problem-Based Learning through a 21st-Century Skills Framework. *Educational Technology Research and Development*, 71, 45–68.
- Samsudin, N. A., Halim, L., & Yusoff, N. M. (2023). The Implementation of Problem-Based Learning in Diverse Cultural Contexts: Challenges and Opportunities. *Journal of Educational Innovation and Practice*, 10(2), 123–138.
- Savery, J. R. (2019). Problem-Based Learning: An Overview of its Process and Impact on Learning. *Educational Psychology Review*, 31(4), 889–911.
- Smith, J., & Anderson, R. (2020). The Role of Character Education in Developing Professional Competence in Higher Education. *Journal of Moral Education*, 49(2), 158–172.
- Smith, J., & Jones, K. M. (2021). Challenges and Adaptations of Problem-Based Learning in Emerging Educational Settings. *International Journal of Educational Research*, 105.
- Smith, J., & Lee, C. (2021). Interactional Dispositions in Collaborative Learning: Implications for Problem-Based Learning Effectiveness. *Journal of Educational Psychology*, 113(2), 345–359.
- Tan, L. C., & Chong, S. C. (2021). Fostering Character Development through Collaborative Problem-Based Learning in Higher Education. *International Journal of Educational Research*, 105.
- Thompson, R., & Garcia, M. (2021). Integrating Character Education in Problem-Based Learning Environments: Challenges and Opportunities. *Journal of Learning and Development*, 14(3), 210–226.
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2021). *Reimagining Our Futures Together: A New Social Contract for Education*.
- Vega, R. M., Cifuentes, L., & Carrasco, E. (2021). Collaborative Learning and Knowledge Construction in Problem-Based Learning: A Systematic Review. *Studies in Educational Evaluation*.
- Wang, Y., Wang, Y., Wen, Y., & Hu, W. (2021). Promoting Students' Self-Directed Learning and Communication Skills in a Collaborative PBL Environment. *Frontiers in Psychology*, 12.
- Yu, L., & Zin, Z. (2023). The Critical Thinking-Oriented Adaptations of Problem-Based Learning Models: A Systematic Review. *Frontiers in Education*, 8.
- Zhang, Y., Wang, H., & Liu, X. (2023). Fostering Ethical Decision-Making and Leadership through Problem-Based Learning: The Role of Group Interaction Dynamics. *Educational Technology Research and Development*, 71(1), 87–105.
- Zhao, Y., & Frank, K. A. (2021). Flexible Learning and Student Engagement: A Systematic Review of Recent Trends in Higher Education. *Journal of Educational Research*, 114(3), 301–315.