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The Role of Psychological Safety in Problem-Based Learning within Medical Education: A Literature Review

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ABSTRACT

Background: Problem-Based Learning (PBL) in medical education relies on active participation in small-group discussions, where psychological safety is essential for effective learning. **Objective:** This review explores the role of psychological safety in PBL, including its influencing factors, tutor role, and management of incorrect student responses. **Methods:** A narrative literature review was conducted to synthesize findings related to psychological safety and PBL in medical education. **Results:** Psychological safety promotes student engagement, confidence, and participation in PBL. It is influenced by student factors, group dynamics, and especially tutor behavior. Supportive tutors enhance safety through inclusive facilitation and constructive feedback, while judgmental approaches reduce participation. Errors, when handled constructively, support deeper learning. **Conclusion:** Psychological safety is essential for effective PBL, and tutors play a key role in creating a supportive learning environment that improves student engagement and learning outcomes.

INTRODUCTION

Problem-Based Learning (PBL) has emerged as a fundamental component of modern medical education, emphasizing a student-centered learning approach that encourages active participation through small-group discussions and clinical problem-solving activities (Barrows, 1996; Hmelo-Silver, 2004). Within PBL environments, students are encouraged to articulate their ideas, pose questions, and engage in critical discussions with peers to construct knowledge collaboratively. One crucial element influencing the success of PBL is psychological safety, which refers to a shared perception that the learning environment supports interpersonal risk-taking, including speaking up, asking questions, and making mistakes without fear of embarrassment or negative consequences (Edmondson, 1999).

Psychological safety is especially significant in PBL contexts, as students are often expected to share incomplete knowledge and develop clinical reasoning spontaneously, processes that naturally involve vulnerability. Nevertheless, several challenges may emerge within PBL settings. Some students may be reluctant to participate actively because of concerns about making mistakes or being negatively evaluated by peers or tutors. Furthermore, both group dynamics and tutor behaviors play a substantial role in shaping students' willingness to engage in discussions comfortably (Edmondson, 1999; Dolmans et al., 2005). Accordingly, this literature review seeks to examine the role of psychological safety in PBL within medical education by focusing on three primary aspects: (1) factors influencing psychological safety; (2) the contribution of tutors in promoting psychological safety; and (3) strategies

for addressing incorrect student responses while preserving both learning effectiveness and psychological safety.

DEFINITION OF PROBLEM-BASED LEARNING

Problem-based learning (PBL) can be defined as an instructional method in which a problem serves as the primary stimulus for learning. Unlike traditional teacher-centered approaches, PBL is inherently learner-centered (Barrow, 1980; Hmelo, 2004). It aims to build an integrated knowledge base while sharpening reasoning and problem-solving skills. Furthermore, the active engagement of learners in PBL seeks to foster collaborative skills, enhance intrinsic motivation, and instill self-directed learning abilities, ultimately preparing students to become lifelong learners (Hmelo, 2004; Savery, 2006).

The core characteristics of PBL consist of three main pillars: the use of authentic problems as the starting point, learning in small groups (typically 6–8 students), and tutors acting as facilitators rather than information providers (Albanese, 2013). In its implementation, learners collaboratively analyze the problem, formulate hypotheses, identify specific learning issues based on their knowledge gaps, and engage in self-directed learning to gather the relevant information needed to resolve the problem (Hmelo, 2004; Albanese & Dast, 2013). The effectiveness of PBL is frequently compared to traditional lectures, particularly regarding academic performance and knowledge retention. Studies indicate that PBL yields academic performance comparable or even superior to traditional methods, while consistently demonstrating stronger outcomes in social skills, interpersonal communication, and teamwork (Trullàs et al., 2022). Moreover, PBL promotes long-term knowledge retention because students integrate foundational knowledge directly into clinical problem-solving, thereby enhancing their self-directed learning capabilities (Norman & Schmidt, 1992). Early and direct engagement with authentic clinical cases not only sparks students' intrinsic motivation toward the subject matter but also builds their confidence to enter the medical field, preparing graduates to become highly competent practitioners (Bate et al., 2014; Norman & Schmidt, 1992).

PSYCHOLOGICAL SAFETY IN PROBLEM-BASED LEARNING

Psychological safety is a fundamental element in Problem-Based Learning (PBL), as it actively promotes open communication and sustained student engagement. By creating an environment in which learners feel comfortable expressing their thoughts, it encourages more meaningful participation in group discussions. The concept was first introduced by Edmondson (1999) in the field of organizational research, but it has since been widely adopted and applied in educational contexts, particularly in collaborative and student-centered learning environments such as PBL. When psychological safety is present, students are more willing to articulate their ideas, even when those ideas are incomplete or uncertain. They are also more likely to ask clarifying questions, seek feedback, and participate in analytical discussions without the fear of being criticized or negatively judged by peers or tutors (Edmondson, 1999).

This openness contributes to a more interactive learning atmosphere, where students can collectively construct knowledge and refine their understanding of complex clinical topics. Over time, such an environment not only improves communication but also strengthens students' confidence in their clinical reasoning abilities. In contrast, a lack of psychological safety can significantly hinder the effectiveness of PBL sessions. Students who do not feel safe may remain silent during discussions or contribute only minimally, which reduces the overall depth and quality of group interaction. This avoidance behavior is often driven by fear of making mistakes, appearing unprepared, or receiving negative feedback. As a result, learning may become more superficial, as fewer perspectives are shared and critical discussion is limited. Empirical research in small-group medical education has consistently demonstrated that psychological safety is positively associated with improved learning outcomes and higher levels of student satisfaction (Hmelo-Silver, 2004; Dolmans et al., 2005). These findings highlight the importance of fostering an inclusive and supportive group environment. Therefore, it is essential for tutors and curriculum designers to understand not only the concept of psychological safety but also the practical strategies required to establish and maintain it effectively within PBL settings.

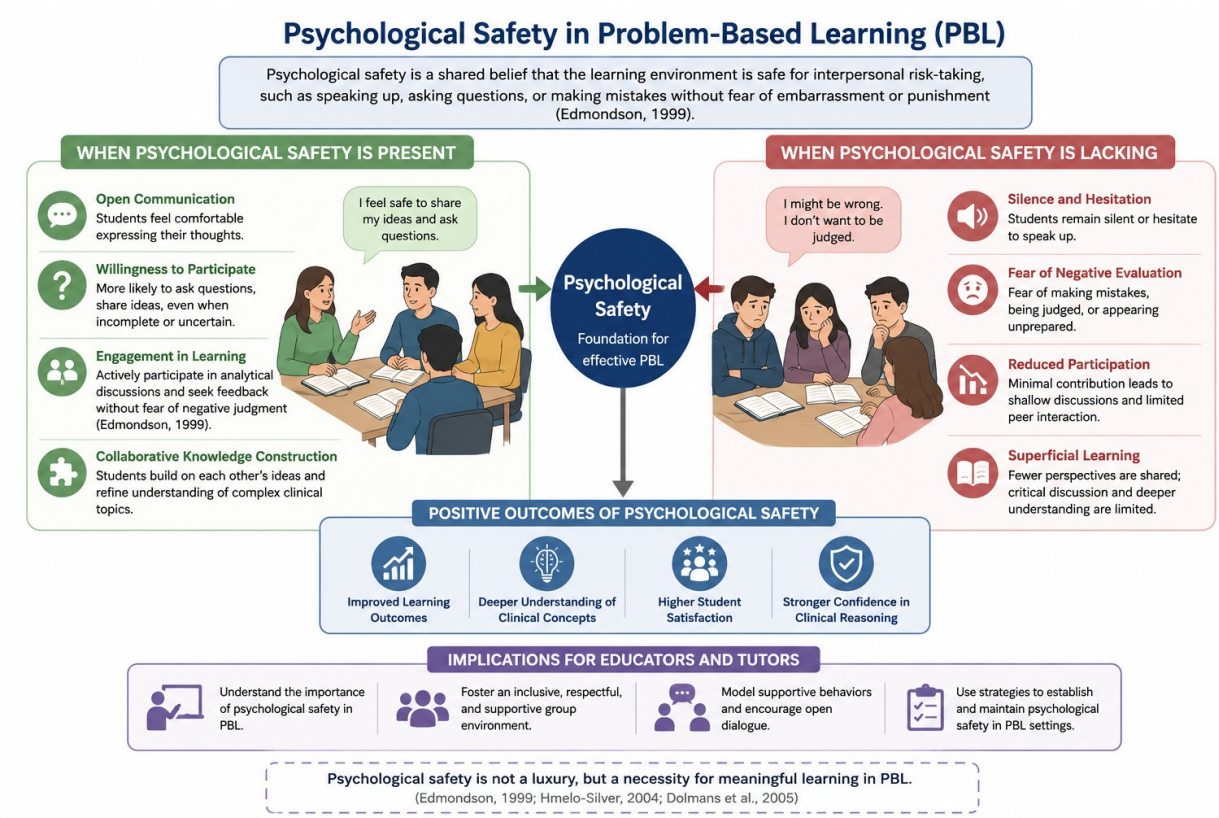

Figure 1. Psychological Safety in Problem-Based Learning (PBL), Conceptual Overview illustrates the role of psychological safety within PBL environments in medical education.

FACTORS INFLUENCING PSYCHOLOGICAL SAFETY

Psychological safety in PBL small groups rarely develops spontaneously. Instead, it is shaped by the continuous interaction between student-related characteristics and the interpersonal environment created within the group. Because PBL requires students to think aloud, propose preliminary ideas, ask questions, and reason collaboratively before reaching complete certainty, the quality of the learning environment becomes fundamental to effective participation (Edmondson, 1999; Hmelo, 2004). Identifying the factors that support or undermine psychological safety is therefore essential for improving student engagement, collaborative learning, and clinical reasoning in medical education (Dolmans et al., 2005). For example, developing learning media is one way to increase student safety awareness (Fatimatuzzahro et al., 2025).

Student-Related Factors

At the individual level, students' confidence, academic self-efficacy, prior knowledge, communication skills, and fear of negative evaluation strongly influence their willingness to participate in PBL discussions. Students who perceive themselves as less prepared or less knowledgeable than their peers may choose to remain silent, not because they lack ideas, but because they fear embarrassment, correction, or negative judgment from others (Edmondson, 1999). This is particularly relevant in PBL, where students are expected to share developing ideas and provisional hypotheses as part of the learning process (Hmelo, 2004).

Prior academic performance and language proficiency may further shape students' comfort in contributing to group discussions. Students with lower academic confidence may interpret PBL discussions as evaluative situations rather than opportunities for collaborative learning, which can reduce their willingness to speak up (Dolmans et al., 2005). Similarly, students who are less fluent in the language of instruction may face an additional cognitive burden because they must process academic content while also formulating their ideas clearly in real time (Chan et al., 2024). Personality traits, such as introversion, may also influence participation patterns. However, introversion should not be viewed

as a weakness. The more important issue is whether the learning environment provides sufficient opportunities for both reflective and vocal students to participate meaningfully without fear of negative judgment (Edmondson, 1999).

Cultural Factors

Cultural background is another important factor influencing psychological safety in PBL. PBL was originally developed within educational traditions that emphasize open questioning, active discussion, and student-led inquiry (Barrows, 1996). However, these assumptions may not be experienced in the same way across different cultural contexts. A systematic review of PBL implementation in non-Western medical schools found that student engagement, language use, expectations toward authority, tutor skills, and institutional readiness can influence how effectively PBL is adopted and experienced by students (Chan et al., 2024).

In some Southeast Asian educational contexts, students may be more accustomed to learning environments that emphasize respect for teachers, group harmony, and deference to authority. These values can support respectful interaction, but they may also make students hesitant to disagree openly, challenge a tutor's explanation, or express uncertainty in front of peers (Chan et al., 2024). Therefore, silence in PBL should not automatically be interpreted as lack of preparation or disengagement. It may also reflect cultural expectations, language insecurity, fear of disrupting group harmony, or uncertainty about how much disagreement is acceptable in the learning setting (Thomas & Gupta, 2024).

For this reason, cultural factors should not be treated as fixed barriers to PBL. Instead, they should be understood as contextual influences that require sensitive facilitation. Tutors need to recognize that students from different educational and cultural backgrounds may require explicit reassurance that asking questions, expressing uncertainty, and offering incomplete ideas are acceptable and valuable parts of the PBL process (Chan et al., 2024; Dong et al., 2025).

Environmental and Group Dynamics

Beyond individual and cultural factors, the social dynamics of the PBL group play a central role in shaping psychological safety. Group norms, peer relationships, and patterns of interaction determine whether students perceive the discussion space as supportive or threatening. A supportive and inclusive group culture promotes openness and encourages all members to contribute, while a judgmental or competitive atmosphere can discourage participation (Dolmans et al., 2005).

Peer dynamics are particularly important because PBL depends on collaborative reasoning. When group members treat incomplete contributions as part of a shared learning process, students are more likely to ask questions, share ideas, and take intellectual risks (Hmelo et al, 2004). In contrast, when a few students dominate the discussion or when mistakes are met with impatience, quieter students may become increasingly reluctant to participate. Psychological safety is strengthened when participation is distributed more evenly, disagreement is expressed respectfully, and mistakes are framed as opportunities for collective learning rather than individual failure (Edmondson, 1999; Hmelo et al, 2008).

THE TUTOR'S ROLE IN FOSTERING PSYCHOLOGICAL SAFETY

Among the factors that shape psychological safety in PBL, tutor behavior has a particularly strong influence. Tutors are not merely content facilitators; they also help establish the interpersonal climate of the group. Because of their position within the learning environment, students often interpret tutors' responses as signals of what is acceptable during discussion (Maudsley, 1999; Azer, 2005). When tutors respond supportively to student contributions, they encourage further participation. Conversely, when tutors dismiss, criticize, or ignore student ideas, students may become more hesitant to speak up (Kindler et al., 2009). The tutor's role therefore extends beyond guiding the discussion toward learning objectives. Tutors help determine whether PBL is experienced as a safe space for exploration or as an evaluative setting where students feel pressured to provide only correct answers. In psychologically safe PBL environments, tutors communicate that participation is valued even when student contributions are incomplete, uncertain, or in need of refinement (Hmelo, 2004; Chang et al., 2011).

Supportive Tutor Behaviors

Supportive tutor behaviors include inviting participation from all students, especially quieter learners; acknowledging student contributions before redirecting or correcting them; asking open-ended questions; providing constructive feedback; and managing dominant voices so that discussion remains balanced (Azer, 2005; Chang et al., 2011). Tutors can also model intellectual humility by acknowledging uncertainty and demonstrating that learning is an iterative process rather than a demand for immediate correctness (Hmelo-Silver, 2004). These behaviors help students perceive PBL as a collaborative learning activity rather than an evaluative test. When students feel that their ideas will be taken seriously, they are more likely to ask questions, admit confusion, propose hypotheses, and engage in clinical reasoning (Edmondson, 1999; Hmelo-Silver, 2004). Recent literature in health professions education also emphasizes that educators should normalize mistakes as part of learning, encourage questions, and monitor whether learners feel comfortable enough to participate actively (Dong et al., 2025).

Unsupportive Tutor Behaviors and Their Impact

Conversely, unsupportive tutor behaviors can significantly weaken psychological safety. These behaviors include dominating the discussion, dismissing student ideas, showing impatience, publicly criticizing mistakes, or allowing stronger students to consistently override quieter voices without intervention (Kindler et al., 2009). Such behaviors can create a group environment in which the perceived cost of speaking up becomes high, leading students to avoid participation rather than risk embarrassment or negative evaluation (Edmondson, 1999).

The impact of unsupportive tutor behavior is not limited to the student who directly receives the negative response. Other group members may observe the interaction and adjust their own willingness to participate accordingly (Kindler et al., 2009). Over time, this can reduce openness, weaken collaborative reasoning, and undermine the core purpose of PBL (Dolmans et al., 2005; Hmelo-Silver, 2004). Therefore, faculty development for PBL tutors should not focus only on content expertise or procedural facilitation, but also on interpersonal communication, cultural sensitivity, and strategies for sustaining psychological safety in small-group learning (Azer, 2005; Dong et al., 2025).

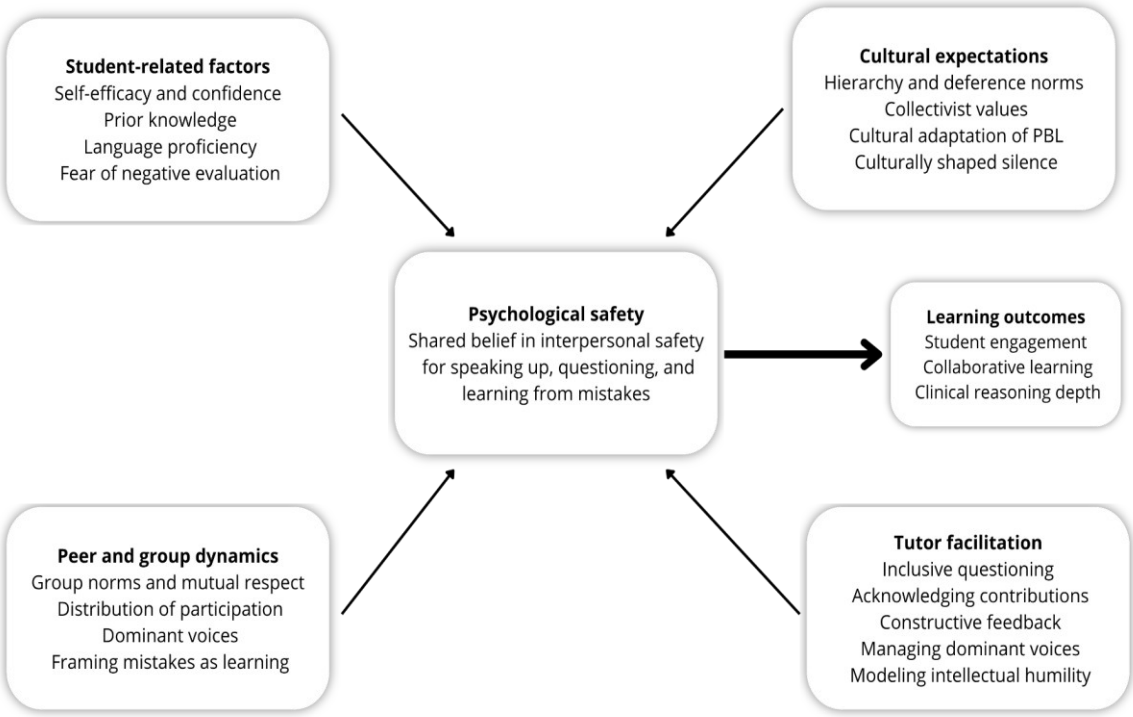

Figure 2. Conceptual framework of factors influencing psychological safety in PBL.

Managing Incorrect Responses and Student Errors

Incorrect or incomplete answers are a natural and valuable part of the learning process in PBL. Rather than being discouraged or suppressed, these moments can be strategically used as opportunities for deeper learning and conceptual development (Hmelo-Silver & Barrows, 2008). The way tutors manage student errors is critical to maintaining psychological safety while maximizing learning potential.

Constructive Error Management Strategies

Tutors can manage incorrect responses constructively by employing evidence-based strategies that support learning while preserving student dignity. Instead of providing direct answers, tutors can use scaffolding to ask open-ended questions, encouraging students to reflect on their thinking processes. This probing is essential for knowledge construction, it prompts students to articulate their assumptions and independently recognize gaps in their understanding without feeling dictated to (Schmidt et al., 2011). Crucially, this dialogue must remain objective and non-judgmental. By methodically guiding students from one question to another, tutors help unravel confusion and correct misconceptions while maintaining psychological comfort, ensuring students do not feel personally attacked for their knowledge gaps (Pangastuti et al., 2022).

Furthermore, tutors must foster students' metacognitive skills and self-regulation by habituating them to detect errors independently, enabling them to generate their own internal feedback. With strong self-correction and self-assessment abilities, students become adept at evaluating their level of understanding and cognitive strategies. Consequently, when encountering obstacles or failures, they are better equipped to modify their approaches to achieve improvement (Hattie & Timperley, 2007).

Facilitating peer discussion provides an ideal space for students to collectively examine misconceptions. Within group dynamics, learners can exchange opinions, provide mutual feedback, and explore alternative perspectives that might otherwise be overlooked. Even if this collaborative process initially yields incorrect solutions, it serves as a form of productive failure that ultimately strengthens their knowledge adaptation and conceptual grasp (Kapur, 2008). For this process to succeed, mistakes must be framed not as evidence of inability, but as necessary steps for exploration. When students adopt this perspective, they view errors as instruments for self-improvement. Conversely, if this exploratory process is neglected and students are pressured solely to provide correct answers, they may fear appearing foolish and adopt self-protection strategies, such as deliberately withdrawing from the discussion. In fact, research shows that deeply analyzing the logical reasoning behind an error and subsequently correcting it is highly effective for improving long-term reasoning ability and retention (Metcalfe, 2017).

Naturally, students often experience self-esteem concerns when making mistakes. The fear of humiliation or being judged as incompetent leads many to remain silent, hiding their ignorance (Edmondson, 1999; Turner et al., 2002). To prevent the collapse of learning commitment, feedback regarding errors must be managed with profound sensitivity. Specifically, feedback should always focus on the task level or the underlying thinking process, rather than targeting the student's personal attributes (self-level). The use of demeaning language, sharp sarcasm, or public embarrassment creates anxiety that actively deters future participation (Hattie & Timperley, 2007). Sensitive corrections should be delivered cautiously and privately, when appropriate to protect the student's dignity. When tutors manage feedback with this level of care, they establish a climate of psychological safety, ensuring students feel entirely secure in taking intellectual risks (Edmondson, 1999).

Ultimately, this constructive approach empowers students to identify and correct their misunderstandings while maintaining their confidence and engagement. When errors are handled with respect and transformed into teachable moments, students develop greater metacognitive awareness and achieve a much deeper conceptual understanding of the clinical scenarios at hand (Hmelo-Silver & Barrows, 2008).

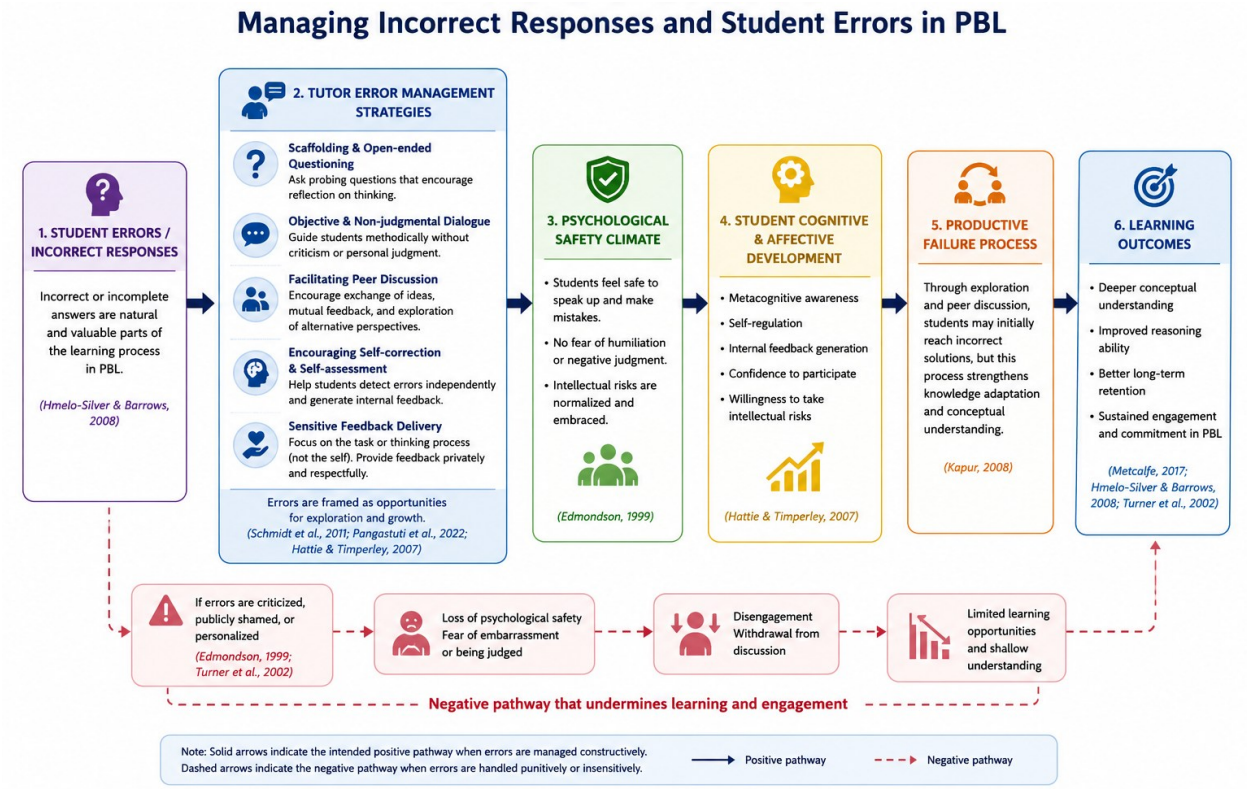

Figure 3. Managing Incorrect Responses and Student Errors

Why Error Management Matters?

Fundamentally, the correction of mistakes must be executed in a respectful manner that preserves student dignity and sustains their commitment to participation. When students experience public humiliation or punitive criticism for their errors, they are highly likely to disengage from future interactions, thereby severely limiting their learning opportunities (Turner et al., 2002). Conversely, when errors are mediated supportively, they transition from sources of anxiety into catalysts for profound learning. Effective error management ultimately fosters a culture of psychological safety, where taking intellectual risks is normalized and embraced as an indispensable part of the educational journey (Edmondson, 1999).

Conclusion

Psychological safety is a critical component of effective Problem-Based Learning in medical education. This paper demonstrates that psychological safety enables students to participate actively, express ideas freely, and engage in meaningful collaborative learning that supports a deeper understanding of clinical concepts. Tutors play a key role in establishing and maintaining this environment through their facilitation style, communication patterns, and responses to student contributions.

Constructive handling of incorrect opinions, rather than punitive or judgmental responses, supports student confidence and enhances learning outcomes. By reframing errors as opportunities for learning and using strategic questioning and feedback techniques, tutors can maintain psychological safety while promoting deeper conceptual understanding. Strengthening psychological safety in PBL through tutor training and supportive group facilitation practices may therefore improve both student engagement and educational effectiveness in medical training, ultimately contributing to the development of more competent and compassionate healthcare professionals.

CONFLICT OF INTEREST

The authors declared there is no conflict of interest.

FIGURE DECLARATION

The figures included in this manuscript were generated with the assistance of ChatGPT (OpenAI) for scientific visualization purposes only. The generated figures did not alter, influence, or modify the scientific content, interpretation, results, or conclusions of the study.

AUTHORS' CONTRIBUTION

Conceptualization of the framework: MAI, ASR. Data analysis, synthesis of the findings, and drafting of the manuscript: ZEM. All authors (ASR, MAI, ZEM) contributed and approved the final version of the manuscript.

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