National Board of Examinations - Journal of Medical Sciences
Volume 4, Issue 6, Pages 930–937, June 2026
DOI 10.61770/NBEJMS.2026.v04.i06.007

ORIGINAL ARTICLE

A Clay-Based Puzzle Icebreaker for Integrated Problem-Based Learning: An Educational Innovation

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Accepted: 25-May-2026 / Published Online: 1-June-2026

Abstract

Background: Effective team formation is an important but often underestimated requirement for problem-based learning (PBL). Newly formed student groups may hesitate to speak, negotiate, or share emerging ideas, particularly at the beginning of a session. Icebreaker activities can help, but many are limited to verbal or cognitive tasks and may not fully engage learners in integrated medical education settings. **Methodology:** We introduced a clay-based puzzle icebreaker at the start of an integrated PBL session for a total of 55 second-year MBBS students, divided into groups of 5 in each. Each group received clue-based questions, a short rhyming hint, and four pieces of coloured clay. Students solved the clues, identified a target concept, and constructed a clay model using all the clay provided. Faculty observed the group process and informally evaluated the completed models for creativity, representational accuracy, teamwork, and use of materials. **Results:** The activity appeared to promote early interaction among students who were initially unfamiliar with one another. Groups began discussing the clues, sharing construction ideas, and negotiating roles within the first few minutes. Faculty observed increased peer communication, reduced hesitation among quieter students, visible psychomotor engagement, and a more energetic learning climate before the main PBL discussion. **Conclusion:** This clay-based puzzle icebreaker was a low-cost and feasible strategy for initiating collaborative work in an integrated PBL setting. By combining puzzle-solving, interpretation, and hands-on model construction, the activity appeared to engage cognitive, affective, and psychomotor domains within a brief time. Further studies using structured learner feedback, validated engagement measures, and comparison groups are needed before stronger conclusions about effectiveness can be drawn.

Keywords: Icebreaker, Tuckman's framework, Team dynamics, Problem-based learning, Bloom's taxonomy

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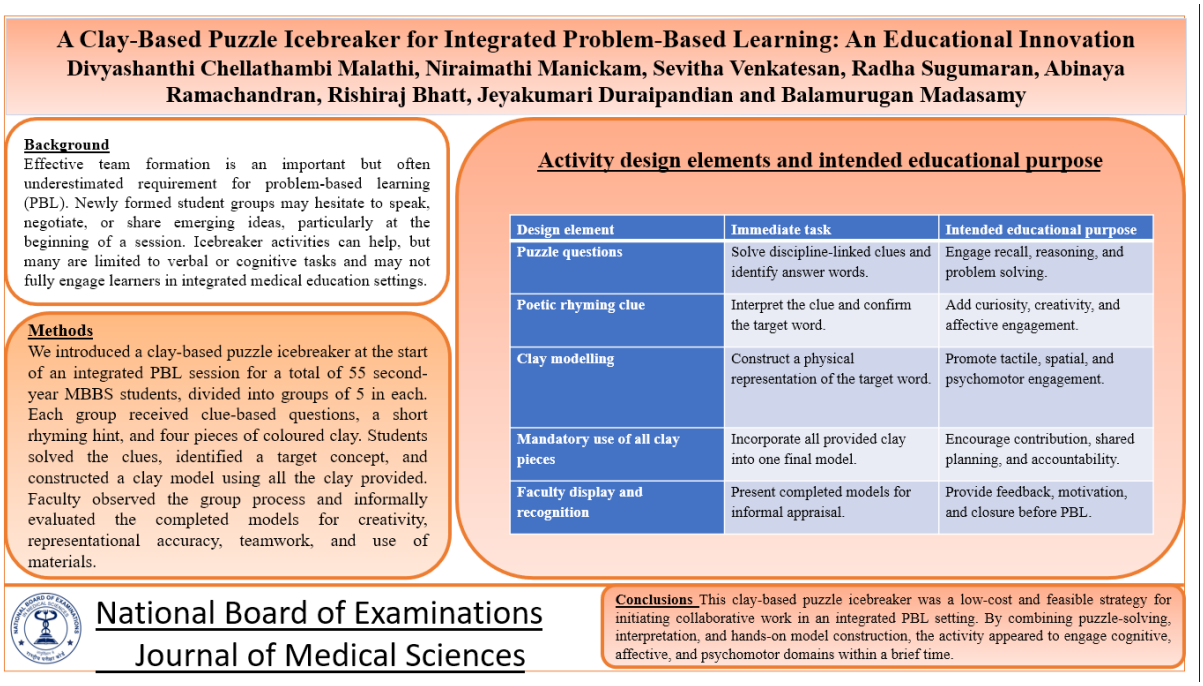
Graphical Abstract



Introduction

Small-group learning is central to many health professions education formats, including PBL tutorials, clinical case discussions, and simulation-based teaching. The educational value of these formats depends not only on the case or task, but also on the quality of interaction within the group. When students participate actively, listen to one another, and build on each other's ideas, group work can support deeper learning and skill development [1].

PBL is particularly dependent on such interaction. It asks learners to reason through uncertainty, articulate tentative explanations, question assumptions, and learn with and from peers [2, 3]. However, this level of participation cannot be assumed at the start of a session, especially when groups are newly formed. In Tuckman's model of group development, early group behaviour is characterized by caution, dependence on structure, and uncertainty about roles [4]. In a short PBL session, a group that remains in this "forming" stage may lose valuable time before meaningful discussion begins.

Icebreaker activities are commonly used to reduce this initial hesitation. Their value lies in giving students a shared task before the main learning activity begins. However, many icebreakers rely mainly on introductions, conversation prompts, or simple quizzes. Such formats may be useful, but they often engage only one dimension of learning. Bloom's revised taxonomy provides a helpful way to view this limitation, as learning may involve cognitive, affective, and psychomotor domains [5]. An opening activity that brings these domains together may create stronger engagement than an activity based only on verbal exchange.

Kolb's experiential learning cycle also supports the use of brief, hands-on tasks in group learning [6]. A concrete shared experience can prompt discussion, reflection, interpretation, and subsequent application. Clay modelling has been described as a tactile learning tool in

medical education and may support spatial thinking, creativity, and active participation [7,8]. It is inexpensive, easy to organize, and suitable for group use.

Based on these considerations, we designed a clay-based puzzle icebreaker for second-year MBBS students during an integrated PBL session. The aim was to help students move quickly into collaborative work, reduce early social inhibition, and prepare the group for the case discussion that followed. This article describes the design, implementation, observed outcomes, and educational interpretation of the activity.

Materials and Methods

Setting and participants

The activity was conducted during an integrated PBL session for a total of 55 second-year MBBS students at a medical college. The session drew content from pharmacology, microbiology, and pathology. Students were arranged into six groups, with five to six members in each group.

Before the task began, each group was assigned a subject-themed name: *Colony Counters, Slide Survivors, Pink and Purple Squad, Therapeutic Window, Half-Life Hustlers, and Invisible Invaders.* This was intended to provide a simple team identity and create an early sense of belonging before the main task started.

Activity design

Each group received a standardised activity packet. The packet contained clue-based questions, a two-line rhyming clue, and four pieces of coloured modelling clay, each approximately 2 × 2 cm.

The activity was designed to engage three learning domains. The clue-based questions required recall and reasoning, thereby addressing the cognitive domain. The rhyming clue added interpretation, curiosity, and an element of play, contributing to affective engagement. The clay model required students to manipulate materials, make spatial decisions, and construct a physical representation of the target concept, thereby engaging the psychomotor domain [5].

A deliberate rule was added: all four pieces of clay had to be used in the final model. (Table 1). This small constraint encouraged shared planning, reduced the chance that only one or two students would complete the task, and made the group responsible for the final product.

Procedure

The activity was completed in 15 minutes. Groups first solved the clue-based questions and used the initial letters of the answers to identify the target word. They then used the rhyming clue to confirm or refine their interpretation. After this, they constructed a clay model representing the target word and presented the completed model to the faculty panel.

The sample clue card and representative student outputs are shown in Figures 1 and 2.

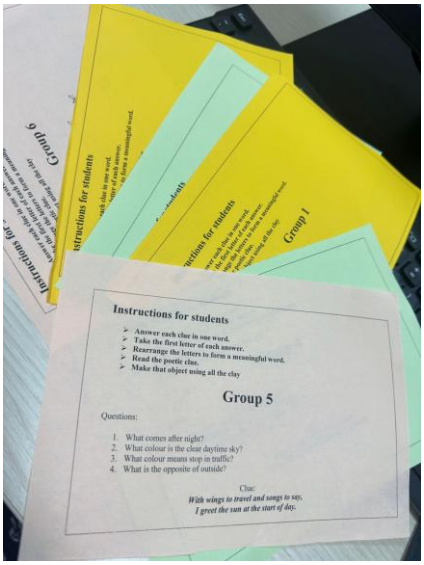


Figure 1. The sample Clue cards

Figure 2. Clay models prepared by students

Evaluation approach

Faculty members observed the group process during the activity and informally reviewed the completed models. The models were appraised using four broad criteria: creativity of representation, accuracy in depicting the target word, evidence of teamwork during construction, and efficient use of the materials provided. The purpose of the appraisal was formative. It was used to provide feedback, recognition, and closure before the PBL discussion, rather than to assign marks.

Table 1. Activity design elements and intended educational purpose

Design element	Immediate task	Intended educational purpose
Puzzle questions	Solve discipline-linked clues and identify answer words.	Engage recall, reasoning, and problem solving.
Poetic rhyming clue	Interpret the clue and confirm the target word.	Add curiosity, creativity, and affective engagement.
Clay modelling	Construct a physical representation of the target word.	Promote tactile, spatial, and psychomotor engagement.
Mandatory use of all clay pieces	Incorporate all provided clay into one final model.	Encourage contribution, shared planning, and accountability.
Faculty display and recognition	Present completed models for informal appraisal.	Provide feedback, motivation, and closure before PBL.

Results

The observed group processes during the ice breaker activity is explained in Table 2.

Rapid team formation

Students began interacting within two to three minutes of receiving the activity materials. The shared task gave each group an immediate focus and appeared to reduce the usual hesitation seen at the beginning of newly formed group work. Students moved quickly from reading the clues to discussing possibilities, assigning small roles, and making construction decisions. This pattern suggested an early shift from social caution toward purposeful collaboration.

Psychomotor engagement

All groups handled the clay actively and worked toward a visible shared product. Students leaned forward, exchanged clay pieces, tested possible shapes, and modified their models based on peer suggestions. The requirement to use all four pieces of clay appeared to increase participation because the group had to decide how every piece would contribute to the final representation.

Peer communication

The activity generated spontaneous peer discussion. Students debated clue answers, interpreted the rhyming hint, and negotiated how the target concept could be shown through clay. Much of this communication occurred without direct faculty prompting, suggesting that the structure of the task itself encouraged interaction.

Reduced social inhibition

Some students who were initially quiet became more involved as the activity progressed. The informal and creative nature of the task appeared to lower the threshold for participation. Because the task was group-based and formative, students could contribute ideas without feeling individually evaluated.

Learning climate before PBL

At the end of the icebreaker, the classroom atmosphere was more energetic and collaborative. Faculty facilitators

observed that students entered the subsequent PBL discussion with greater readiness to speak, share ideas, and respond to case-based questions. These observations should be interpreted cautiously, as they were based on faculty perception and not on a formal comparison with a control group.

Table 2. Observed group processes during the clay-based icebreaker

Observed domain	What was observed	Educational interpretation
Team formation	Students began interacting within two to three minutes and organized around the task.	Suggests an early transition from forming toward collaborative working.
Psychomotor engagement	All groups manipulated clay and worked toward a visible shared product.	Indicates hands-on participation and purposeful use of materials.
Peer communication	Students discussed clues, negotiated ideas, and made shared construction decisions.	Reflects peer-supported problem solving and collaborative learning.
Social inhibition	Initially, quiet students became more comfortable contributing.	Suggests that the creative format may have reduced hesitation.
Learning climate	The room became more active and collaborative before the PBL discussion.	Supports the role of the icebreaker as a preparatory group activity.

Discussion

This educational innovation was developed in response to a common challenge in PBL facilitation: students may need time to become comfortable with one another before they can engage meaningfully with a case. In the present activity, a brief clay-based puzzle task appeared to help groups begin working together quickly. The findings are best understood as preliminary observations from a single implementation, but they offer useful insights for educators designing short preparatory activities for small-group learning.

Relevance to Tuckman's group development model

Tuckman's model describes the early "forming" stage as a period in which group members are cautious, uncertain about expectations, and dependent on external structure [4]. This stage can limit the discussion expected in PBL. The clay-based task provided a defined goal, shared materials, and a short time frame. These features appeared to help students move from hesitation to interaction more quickly. The observed behaviours, including spontaneous discussion, role negotiation, and shared decision-making, are consistent with early movement toward more functional group processes.

Engagement across learning domains

The activity was intentionally designed to include cognitive, affective, and psychomotor elements [5]. The puzzle questions required students to recall and reason through discipline-linked clues. The

rhyming hint introduced curiosity and interpretation. The clay model required physical construction and spatial representation. This combination may explain why students remained engaged throughout the short activity. However, because formal engagement measures were not used, this interpretation should be viewed as a plausible explanation rather than a measured outcome.

Experiential learning perspective

Kolb's experiential learning cycle provides another useful lens for interpreting the activity [6]. The clay construction served as a concrete experience. The discussion around the clues and model encouraged reflection and interpretation. The subsequent PBL discussion allowed students to apply the collaborative ease developed during the icebreaker. In this sense, the activity acted not as a separate game but as a bridge into the main learning task.

Peer scaffolding and collaborative learning

The activity also created opportunities for peer scaffolding. Students with stronger spatial, creative, or verbal skills naturally supported others, while quieter students found smaller but meaningful ways to contribute. The rule that all clay pieces had to be incorporated into the model promoted interdependence, as the final product required collective planning. This aligns with the broader principle that well-structured group tasks can make peer contribution necessary rather than optional [2, 3,10,11].

Practical value for educators

The practical strengths of the activity are important. It required inexpensive materials, minimal preparation, and no specialised equipment. It could be completed within 15 minutes and adapted to different subjects by changing the clues and target words. For resource-limited settings, these features make the activity feasible. The use of team names, faculty display, and informal recognition also added motivation without making the task high-stakes.

Limitations

This report has several limitations. It describes a single implementation at one institution and is based mainly on faculty observation. There was no control group, no validated tool to measure engagement or team development, and no structured pre- and post-activity comparison. Faculty interpretation may have been influenced by observer expectations, and student perceptions were not systematically collected. Therefore, the findings should be interpreted as early observations from an educational innovation rather than evidence of effectiveness. Future work should include structured student feedback, validated engagement or teamwork measures, and implementation across different learner groups and institutions.

Conclusion

A clay-based puzzle icebreaker may be a useful and feasible strategy for preparing students for integrated PBL. In this implementation, the activity appeared to promote early interaction, hands-on participation, peer communication, and a more collaborative classroom climate. Its value lies in its simplicity: a short, low-cost task can give students a shared experience before they begin the main case discussion. Further research using structured outcome measures and comparison groups is needed

to determine whether such activities consistently improve engagement and team functioning in PBL settings.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

Funding

No funding was received for conducting this study.

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