

Physiology Education

Perception of First-Year MBBS Students Regarding Model Making as a Learning Method: Fostering Creativity, Teamwork, and Conceptual Understanding in Physiology

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Summary: Medical education increasingly emphasizes active learning strategies to enhance engagement, understanding, and higher-order cognitive skills. Model-making competitions represent a creative, student-centered approach that encourages conceptual clarity, innovation, and teamwork in physiology education. This study aimed to explore undergraduate medical students' perceptions of model-making competitions as an active learning strategy in physiology, focusing on conceptual understanding, creativity, and teamwork. A model-making competition was organized for 150 first-year MBBS students, divided into 30 self-formed teams. Each team prepared a model on a physiology topic of their choice over one month, with faculty guidance available as needed. Completed models were exhibited and evaluated by senior faculty using a structured rubric. Following the event, students completed a structured feedback questionnaire to assess their perceptions of the activity. Of 150 participants, 128 (85.3%) provided feedback. The overall experience was rated Excellent (53.9%) or Good (44.5%). A majority (97%) reported improved conceptual understanding, while 95% agreed the activity fostered creativity. Teamwork was rated Excellent by 50% and Good by 39%. Most students (95%) felt preparation time was adequate, 69% expressed willingness to participate again, and 90% reported being motivated to explore physiology concepts further. Model-making competitions were perceived as highly effective in enhancing conceptual understanding, fostering creativity, and promoting teamwork. These findings support the integration of model-making into the physiology curriculum as an engaging and practical student-centered teaching-learning strategy..

Keywords: Model-making competition, active learning, physiology education, medical students, conceptual understanding,

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INTRODUCTION

Medical education is increasingly shifting from passive to active learning strategies, with greater emphasis on interactive sessions, discussions, and hands-on activities that foster student engagement and promote deeper understanding (Bavishi *et al.*, 2022). Student-centered approaches such as quizzes, seminars, and role-play are gaining prominence; among these, model preparation is a highly effective, proactive learning method that not only makes the process more engaging but also enhances comprehension of the subject matter (Pant *et al.*, 2020).

In the medical curriculum, physiology is a core foundational subject that explains the normal mechanisms occurring continuously in the human body (Liu *et al.*, 2024). However, many students perceive its concepts as complex, creating challenges for educators in promoting critical thinking, self-directed learning, and active engagement (Haramati, 2000). Traditional methods often encourage passive learning, where students struggle to retain intricate information and apply it in clinical contexts (Timmer *et al.*, 2020).

According to Bloom's taxonomy, learning by doing facilitates higher-order cognitive skills by enabling students to analyze, apply, and demonstrate the concepts they have learned (Anderson *et al.*, 2001; Liou *et al.*, 2016). Young learners are inherently innovative and dynamic in their thought processes; model-making activities channel this creativity, helping students refine their ideas and strengthen their conceptual understanding (Liou *et al.*, 2016).

Although prior studies have demonstrated that model-making enhances students' understanding and long-term retention of physiological concepts (Liou *et al.*, 2016; Soundariya *et al.*, 2018; Kakasaniya *et al.*, 2024), limited research has examined first-year MBBS learners' perceptions of model-making in Indian medical institutions. In particular, there is a scarcity of structured feedback on how such activities influence teamwork, creativity, innovation, and conceptual clarity within the Competency-Based Medical Education (CBME) framework. Addressing this gap, the present study examines first-year MBBS students' perceptions of model-making as an active learning strategy in physiology. The specific aim of the study is to

assess students' perceptions regarding the impact of model-making competitions on conceptual understanding, creativity and innovation in learning, teamwork and communication skills, and to identify the challenges or limitations experienced during the model-making process.

MATERIALS AND METHOD

A descriptive cross-sectional perception-based study was conducted among 150 first-year MBBS students in the Department of Physiology.

Students self-organised into 30 teams and prepared models on selected physiology topics over one month. Faculty guidance was provided, and ethical approval (SIMSRH/IEC/2025-26/452) and informed consent were obtained. Each team had one month to construct a model—either working or non-working—using materials such as thermocol sheets, bottles, battery-powered motors, lights, cellophane, plasticine and colored clay balls. Faculty members were available throughout the process to clarify doubts and guide students as needed.

Upon completion, teams displayed their models at an open exhibition, attended by faculty members and students from other departments. Two senior faculty experts evaluated the models using a structured rubric assessing creativity (innovative use of materials), relevance (alignment with the chosen topic), craftsmanship (neatness and build quality), demonstration of working principles (for functional models), and presentation clarity. Each team member was required to actively engage during the Q&A with judges. Judges' scores for each team were averaged to determine the final rankings. The top three teams received prizes, and all participants were awarded certificates. Finally, students completed a structured feedback questionnaire immediately after the exhibition and award ceremony to capture their perceptions of the process, learning experience, and overall satisfaction with the model-making activity.

RESULTS

All 150 first-year MBBS students in the cohort were invited and enrolled in the study; no separate sample-size calculation was performed, as the entire available cohort was included using convenience/total-population sampling to maximise representativeness. Feedback was obtained from 128 students (response rate 85.3%), and analyses were conducted on respondents using complete-case analysis. Descriptive statistics are presented as frequencies and percentages for categorical variables, and the internal consistency of the self-developed questionnaire was assessed using Cronbach's alpha. Among the 128 respondents, 53.9% rated their overall experience with the model-making competition as Excellent, while 44.5% rated it as Good. With respect to topic relevance, 55.4% reported it was highly relevant and 42.9% considered it relevant to the subject. In terms of learning outcomes, 52.3% of students *strongly agreed* and 44.5% *agreed* that the activity enhanced their understanding of the subject. The conduct of the competition was rated *Excellent* by 52.3% of students and *Good* by 45.3%. For interest and involvement, 56.7% gave an *Excellent* rating and 42.2% gave a *good* rating.

A total of 95.3% of students felt that the time allotted for preparation was sufficient, and 68.8% expressed willingness to participate in similar events in the future. Furthermore, 94.5% agreed that the activity encouraged creativity and innovation, and 89.8% reported feeling motivated to explore more concepts in physiology as a result of the competition. Regarding the application of knowledge, 52.3% *strongly agreed* and 43.7% *agreed* that the activity helped in applying theoretical concepts to practical situations. Finally, teamwork experience was rated as *Excellent* by 50% of students and *Good* by 39%.

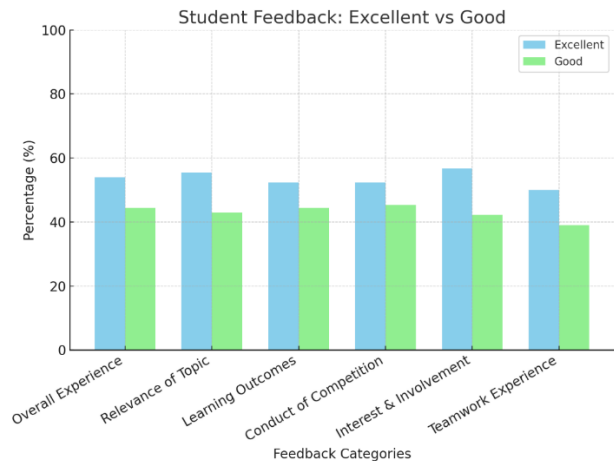


Figure 1: Ratings (Excellent vs. Good) for overall experience, relevance, learning, conduct, involvement, and teamwork.



Figure 2: Other feedback metrics like sufficient time, willingness to participate again, creativity, motivation, and application of knowledge.

DISCUSSION

This study confirmed that model-making competitions serve as an effective active learning strategy in physiology, as evidenced by the overwhelmingly positive student responses. A majority of participants reported enhanced conceptual understanding, improved creativity, and stronger teamwork skills, indicating that the activity effectively promoted deeper learning and engagement. The findings also corroborated that hands-on, collaborative approaches

can motivate students to explore subject concepts beyond classroom teaching and integrate theoretical knowledge with practical application.

These results align with and strengthen earlier reports in medical education literature. Previous authors such as Soundariya *et al.* (2018), Pant *et al.* (2020), Kakasaniya *et al.* (2024), and Tasleem *et al.* (2024) have also highlighted similar benefits of model-making and related participatory learning methods. Thus, this study established that integrating creative, student-centred activities like model-making within physiology teaching not only sustains learner interest but also contributes to conceptual clarity, teamwork, and motivation—key elements in competency-based medical education.

The results of the current study are consistent with the above findings (Soundariya *et al.*, 2018; Kakasaniya *et al.*, 2024), with a large majority of students reporting that the competition improved their understanding of physiology, encouraged creativity, and helped them apply theoretical knowledge in practice. Importantly, teamwork was also rated positively, underscoring the value of such collaborative activities in developing communication and interpersonal skills competencies that are essential in clinical practice but often underemphasized in traditional classroom teaching.

One unique strength of this study is the structured evaluation framework, which included both faculty assessment of models and student feedback. This dual perspective provides a more holistic view of the educational benefits of model-making. Furthermore, the high response rate (85.3%) enhances the reliability of the findings.

However, certain limitations should be acknowledged. The study relied primarily on self-reported perceptions, which may be influenced by response bias or enthusiasm for the activity's novelty. In addition, the absence of a control group limits the ability to directly compare the effectiveness of model-making with other teaching–learning methods. Future studies could incorporate pre- and post-tests or longitudinal follow-up to objectively measure knowledge retention and application.

Overall, the findings reaffirm that model-making competitions serve as an engaging, student-centered learning strategy in medical education. By combining creativity, collaboration, and application of knowledge, such activities not only enhance conceptual clarity but also contribute to the development of higher-order cognitive and teamwork skills, making them a valuable complement to traditional teaching approaches in physiology.

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