



ENHANCING CLINICAL SKILLS THROUGH CASE-BASED PHYSIOLOGY PRACTICALS: EVALUATED USING STUDENT FEEDBACK

Physiology

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ABSTRACT

Background: Traditional physiology practical assessments often focus on isolated tasks, failing to reflect the complexity of real-world clinical situations. Integrating clinical scenarios into practical exams may bridge this gap by enhancing students' ability to apply physiological knowledge in clinical settings. **Objective:** This study aimed to evaluate the effectiveness of a case-based practical exam format in improving clinical reasoning and application skills among first-year MBBS students. **Methods:** The study involved 100 first-year MBBS students at a medical college in Uttarakhand. The case-based practical exams were introduced as part of their human physiology curriculum. These exams integrated clinical scenarios requiring students to apply multiple physiological concepts in a practical context. Feedback was collected through a combination of objective Likert scale-based questions and open-ended subjective responses, focusing on clarity of instructions, relevance, integration of knowledge, and overall effectiveness of case-based exam pattern. **Results:** Most students found the clinical scenarios relevant and appreciated the integration of theoretical and practical knowledge, which fostered critical thinking and problem-solving skills. However, only 46% agreed that the difficulty level was appropriate, and challenges such as time management and differentiating between similar cases were noted. Suggestions for improvement included clearer instructions, more guidance, and adjusted difficulty levels. **Conclusion:** The case-based practical exam format was generally well-received, enhancing clinical reasoning and application skills. However, further refinement is needed to balance exam difficulty with student preparedness. This approach has the potential to better prepare students for clinical practice by fostering early development of critical clinical skills.

KEYWORDS

Case-Based Physiology Practicals, Student Feedback, critical thinking, clinical skills.

INTRODUCTION:

The traditional format of physiology practical assessments primarily focuses on evaluating students through isolated tasks or experiments, aimed at assessing their grasp of physiological concepts. While this method is effective in measuring technical skills and theoretical understanding, it often lacks the capacity to assess how well students can apply this knowledge in clinical settings. The introduction of a case-based physiology practical format aims to bridge this gap by integrating clinical scenarios into practical assessments, thus enhancing students' clinical application skills.

Typically, traditional assessments involve tasks such as measuring pulse and blood pressure, conducting spirometry, or analysing blood groups—each of which tests specific skills and knowledge. However, these tasks do not adequately represent the complexity of real-life clinical situations that require a blend of multiple skills and integrative thinking.

Case-based learning (CBL) and problem-based learning (PBL) are well-established in medical education for their effectiveness in fostering critical thinking and the application of knowledge. (1) Research shows that a case-based clinical reasoning approach enhances the overall clinical reasoning skills of medical students. (2) PBL graduates perform as well, and sometimes better, on clinical examinations and faculty evaluations. (3) Faculty also tend to enjoy teaching using PBL methods. PBL graduates often perform equally well, or even better, in clinical examinations and faculty evaluations compared to their conventionally trained counterparts. (3) However, some PBL students have reported feeling less prepared in basic sciences and have scored lower in basic sciences examinations. These issues often arise from suboptimal implementation of PBL, which may not align with current educational insights. Therefore, research on PBL should focus on understanding the circumstances under which the principles of constructive, self-directed, collaborative, and contextual learning are effective. (4) In physiology, case-based teaching has been shown to stimulate critical thinking and link theoretical knowledge to practical application. (5) Students have expressed a preference for clinical examination sessions over experimental ones, indicating a gap in engagement with traditional practical formats. (6) Although case-based questions are commonly used in theoretical assessments, adapting this approach to practical assessments in physiology could significantly enhance students' clinical reasoning and decision-making skills.

The value of gathering student feedback on teaching, learning, and assessment methods is well-documented in recent research. Feedback is a crucial tool for refining educational practices and ensuring that they effectively foster student learning. For instance, a study on project-based learning emphasized how teachers struggle to coordinate teaching, learning, and assessment activities. The study found that student feedback during the course allowed teachers to adjust their methods to better achieve learning objectives, thereby improving the overall effectiveness of the teaching approach. (7) Moreover, continuous feedback, not just at the end of a course, has proven beneficial. Mid-term feedback sessions, where students can share their learning experiences and suggest improvements, have been particularly effective in fostering an environment of continuous improvement. (8) Therefore, incorporating student feedback into the evaluation of teaching and learning methods is essential for enhancing their effectiveness. This approach not only helps educators refine their practices but also empowers students by valuing their input in the educational process.

METHODS:

Hundred first year MBBS students at a government medical college in Uttarakhand participated in the study. As part of their undergraduate human physiology practical curriculum, different experimental and haematology practicals as well as clinical examinations are taught. The common practice of assessment of these practical skills is usually through a long and short questions in both clinical and haematology domains. The questions are mostly direct, and the student is expected to perform the practical and then answer the viva questions of the examiners. This method though effective, assesses only 2 specific practical questions in each domain and often misses out the many other practical skills and applications of those skills in actual practice. We designed our assessment in such a way that each domain assessed 3-4 practical skills or application of the skills. The traditional style of questions was also there but were reduced in total marks to accommodate for the case-based questions. For example: Instead of simply measuring blood pressure, students were presented with a case of a patient with hypertension. They would be required to interpret the blood pressure readings, understand the underlying physiological mechanisms, and suggest some basic management strategies. Annexure 1 gives sample case based practical questions.

At the conclusion of 4 assessment exams including semester, pre professional and professional examination, voluntary written

feedback, both subjective and objective, were collected from the students. The objective feedback metrics included: Clarity of Instructions, Relevance of Clinical Scenarios, Integration of theory and practical knowledge, Development of Critical Thinking, Real-World Application, Difficulty Level, Feedback and Guidance, Preparation and Resources and Overall Experience rated on a Likert scale 1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree. The subjective feedback metrics included open ended questions like: "What did you find most beneficial about the case-based practical exam format?", "What challenges did you face during the case-based practical exam?", "How could the case-based practical exam format be improved?", "Do you have any additional comments or suggestions regarding the case-based practical assessment?". The feedback form is given in Annexure 2

RESULTS:

The data was analysed to determine the overall perception of the students regarding the key aspects of the exam. The objective feedback responses of the students are summarised in Table 1. Majority of the students perceived the clinical scenarios presented as relevant to the physiology concepts, requiring integration of knowledge from both Theory and Practical concepts and it encouraged critical thinking and problem-solving skills. Only 46% agreed that difficulty level of the case-based practical exam was appropriate.

Table 1: Summary of Objective feedback (N=100)

Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The instructions for the case-based practical exam were clear and easy to understand.	1	10	35	37	17
2. The clinical scenarios presented were relevant to the physiology concepts studied.	1	2	24	59	14
3. The exam required integration of knowledge from both Theory and Practical Physiological concepts.	0	0	27	55	18
4. The exam encouraged critical thinking and problem-solving skills.	0	2	32	53	13
5. The scenarios helped me understand the real-world application of physiological principles.	0	2	37	50	11
6. The difficulty level of the case-based practical exam was appropriate.	2	10	42	35	11
7. I received constructive feedback and guidance during/after the assessment.	0	4	40	45	11
8. The resources provided (e.g., study materials, practice cases) were helpful in preparing for the exam.	0	7	31	52	10
9. Overall, I found the case-based practical exam to be an effective way of assessing my clinical application skills.	0	3	37	45	15

The subjective feedback was collected through open-ended questions aimed at understanding the students' perceptions of the benefits, challenges, and suggestions for improving the case-based practical exam format. Table 2 succinctly captures the key themes, their prevalence among the student responses, and representative quotes for each theme, providing a clear overview of the subjective feedback. The responses were categorized into common themes based on the feedback provided by the students and are given below.

1. Benefits of the Case-Based Practical Exam:

- Clinical Knowledge Enhancement:** Students frequently mentioned that the case-based exam format helped them enhance their clinical knowledge. Phrases like "clinical exposure," "clinical knowledge," "real-world scenarios," and "critical thinking" appeared consistently.
- Practical Application:** The format was seen as beneficial for applying theoretical knowledge in a practical setting. Students

appreciated the opportunity to integrate theory with practical work.

- Critical Thinking and Problem Solving:** Several students highlighted that the exam encouraged them to think critically and solve problems, which they found valuable.
- Relevance to Future Exams and Professional Practice:** A few students noted that the case-based format was helpful for preparing for future exams and real-world medical practice.

2. Challenges Faced During the Case-Based Practical Exam:

- Time Management Issues:** Many students mentioned that managing time during the exam was challenging, indicating this as a significant area of concern.
- Difficulty in Differentiating Cases:** A recurring issue was the difficulty in differentiating between similar cases, which added complexity to the exam.
- Preparation and Knowledge Gaps:** Some students felt they lacked sufficient preparation or knowledge to perform well, indicating a need for better pre-exam guidance.
- Clarity of Instructions:** A few students found the instructions unclear, leading to confusion during the exam.

3. Suggestions for Improvement:

- Provide More Information and Guidance:** A significant number of students suggested that additional information or guidance should be provided to help them navigate the cases better.
- Adjusting the Difficulty Level:** Many students recommended that the difficulty level be reduced to make the exam more manageable.
- Increase Time Allocation:** Time constraints were a common concern, with several students asking for more time to be allocated to the exam.
- No Changes Needed:** A few students felt that no changes were necessary, indicating satisfaction with the current format.

Table 2: Summary of Subjective Feedback Themes

Theme	Percentage of Students (%)	Representative Quotes
Clinical Knowledge Enhancement	~50%	"Provides early clinical exposure," "Helps to apply theory to practical use," "It enhances critical thinking."
Practical Application	~35%	"Beneficial for study report and findings," "Helps to apply theory to practical use"
Critical Thinking and Problem Solving	~25%	"It required critical thinking", "Mental reasoning increased"
Relevance to Future Exams and Practice	~20%	"I found a better way of preparing for further exams", "Helpful to integrate knowledge and make decisions in a more dynamic and realistic context."
Time Management Issues	~40%	"Time management was a major issue", "Could perform those in time"
Difficulty in Differentiating Cases	~30%	"Not able to differentiate between many similar cases"
Preparation and Knowledge Gaps	~25%	"Lack of knowledge made it difficult"
Clarity of Instructions	~15%	"Instructions were not clear enough"
Provide More Information and Guidance	~40%	"By providing a little more information", "Provide actual reports and images related to the case"
Adjusting the Difficulty Level	~35%	"By decreasing the level of the case"
Increase Time Allocation	~20%	"By providing some extra time"
No Changes Needed	~5%	"No need for any changes"
Additional Comments	~15%	"It is a good tradition and must be continued for the upcoming batches"

The feedback analysis reveals that the case-based practical exam format is generally well-received by students, particularly for enhancing clinical knowledge and encouraging critical thinking. The major challenges identified include time management issues and

difficulties in differentiating between similar cases. To improve the format, students suggest providing more information, adjusting the difficulty level, and increasing the time allocated for the exam. Despite these challenges, a significant portion of students believes that the format is beneficial and relevant for future medical practice.

DISCUSSION:

The study introduces an innovative approach to undergraduate medical education by integrating case-based scenarios into physiology practical exams, aiming to enhance students' clinical application skills. The feedback from students, gathered through both quantitative and qualitative methods, reveals that this novel format is generally well-received. Most students found the clinical scenarios relevant to the physiological concepts they studied, and they appreciated the opportunity to integrate theory with practice, which fostered critical thinking and problem-solving abilities. However, the study also uncovered challenges, particularly regarding the difficulty level of the exams, with only 46% of students finding it appropriate. While some students might find it average, others may find it difficult or super easy. This suggests a need for better alignment between the complexity of the cases and the students' preparedness.

In relation to existing literature, this study contributes to the growing evidence supporting case-based and problem-based learning (PBL) as effective methods for enhancing clinical reasoning skills in medical students. Clinical scenarios should mirror real-world cases that physicians encounter, integrating multiple physiological concepts and challenging students to apply their knowledge in solving clinical problems. Given the interconnected nature of physiology with other disciplines, case-based assessments should also include fundamental elements of pharmacology, pathology, and clinical medicine. This approach ensures a comprehensive evaluation of the student's ability to integrate and apply knowledge across various domains. The findings suggest that early integration of clinical scenarios into pre-clinical education could better prepare students for the complexities of real-world medical practice. This has significant implications for patient care, as it may lead to the development of more clinically proficient graduates.

This approach represents a significant departure from traditional physiology practical assessments, which typically focus on isolated tasks that may not fully capture the complexities of real-life clinical situations. The study's strengths include its use of a mixed-methods design, combining objective Likert scale-based feedback with open-ended subjective responses, providing a comprehensive picture of student perceptions. However, the study is limited by its reliance on just student feedback, a relatively small sample size from a single institution, and the absence of objective performance metrics to assess the long-term impact on clinical competence.

Despite its promising results, the study raises important questions about the balance between the difficulty of case-based exams and student readiness. Addressing these concerns will require further research to refine the approach, including studies that explore the underlying mechanisms through which case-based exams enhance clinical reasoning. Designing realistic, effective and educationally valuable clinical scenarios requires careful planning and a deep understanding of both physiological principles and clinical practice. Educators need to be trained in developing and facilitating case-based assessments based on the competencies required for a first-year medical student. This includes understanding how to guide students through the problem-solving process without providing direct answers. Case-based assessments must be designed to ensure that all students are evaluated fairly. This involves standardizing scenarios and grading criteria to maintain consistency. Additionally, future research should assess the impact of this training on students' performance in real clinical settings, potentially contributing to more effective medical education practices that bridge the gap between theory and practice.

CONCLUSION:

Transitioning from traditional physiology practical assessments to a case-based format can significantly enhance students' clinical application skills. By integrating real-world clinical scenarios, educators can better prepare students for the complexities of medical practice. While there are challenges in implementing this approach, the benefits in terms of enhanced clinical relevance, improved integration of knowledge, and development of critical thinking skills make it a

worthwhile endeavour. In conclusion, the study offers a promising approach to bridging the gap between pre-clinical knowledge and clinical practice in medical education. However, further research is needed to optimize this approach and confirm its effectiveness in diverse educational settings.

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