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The Clinical Case Sandwich: An Innovative Lecture Delivery Model to Enhance Student Engagement in Preclinical Pathology

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ABSTRACT

OBJECTIVE: To explore students' perceptions of a modified pathology lecture format in which each session opened with a clinical case and returned to the same case at the end; named as the "Clinical Case Sandwich" technique.

METHODOLOGY: A cross-sectional mixed-methods study was conducted at the College of Medicine, Gulf Medical University, Ajman, UAE, after one academic year of pathology teaching using this format within a system-based modular curriculum. Forty-three Higher Diploma in Preclinical Sciences students completed a validated questionnaire. Thirteen 5-point Likert-scale items assessed engagement, clinical and examination relevance, learning impact, and satisfaction. Two open-ended questions captured students' comments. Quantitative data were summarized using descriptive statistics and displayed through frequency plots and a heat map. Free-text responses were reviewed to identify recurring ideas, and Word-It-Out word-cloud software was used to visually summarize commonly occurring terms.

RESULTS: Responses were strongly positive. Eighty-two percent agreed that the cases improved engagement, 95% felt the approach would help them in their clinical years, and 86% believed it would support examination performance. Overall, 83% reported satisfaction and 93% recommended adoption by other faculty. Qualitative comments suggested that the format made lectures more interactive, clinically meaningful, and easier to follow, with the opening case creating curiosity and the closing discussion consolidating learning.

CONCLUSION: Opening and closing pathology lectures with a clinical case was well received and was perceived to strengthen student engagement, understanding, and clinical relevance. This simple lecture modification may help preclinical students connect pathology mechanisms with clinical reasoning.

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INTRODUCTION

The way medicine is taught shapes the way physicians eventually think, and few decisions in curriculum design carry more weight than how a lecture is delivered. Although several tools exist for evaluating teaching portfolios, peer observation, self-evaluation student ratings remain the most widely used and pragmatically useful indicator, applied both formatively to refine practice and summatively to inform institutional decisions.[1,2,3] What those ratings repeatedly surface is a familiar tension: lectures are efficient, but they also often leave students passive.

The literature has long debated whether the limitation lies in the lecture itself or in the way it is delivered. Active learning approaches generally outperform conventional didactic teaching, and yet the lecture is unlikely to disappear from medical education any time soon.[4] The pragmatic question, then, is not whether to lecture, but how to lecture better. One line of work has emphasized tailoring delivery to learners' preferences, drawing on frameworks such as Gardner's Multiple Intelligences on the principle that variety in presentation accommodates variety in cognition.[5,6]

A second, and more directly clinical, line of work points to case-based learning (CBL), now well established across the health professions. CBL has been shown to improve clinical knowledge, sharpen reasoning, and support transfer of theory into practice, particularly when integrated with structured didactic input rather than offered as a stand-alone substitute.[7,8,9] A

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complementary lens comes from Gagné's nine events of instruction, which structures a teaching encounter around capturing attention, presenting content, eliciting performance, and providing feedback — events that map naturally onto what we know about how attention and memory actually behave in a classroom.[10]

What is less well described is how to operationalise these insights inside an ordinary lecture hall, with a single instructor, a fixed time slot, and a sizeable group of students. In this study we describe a deliberately simple modification: each pathology lecture opens with a clinical scenario, the relevant disease processes are taught, and the lecture closes by returning to the same scenario for diagnosis and discussion. The case acts as a frame, creating a cognitive puzzle at the start, threading basic and clinical science through the middle, and consolidating learning at the end. We evaluated this model with preclinical medical students to determine its perceived effect on engagement, comprehension, and clinical relevance.

METHODOLOGY

We conducted a cross-sectional mixed method study to assess the effectiveness of a new lecture delivery model in pathology teaching at Gulf Medical University (GMU), Ajman, UAE. The survey questionnaire was administered at the end of one full academic year (fall and spring semester) after teaching pathology in system based modular curriculum. The lecture modification involved introducing a clinical scenario at the start of the lecture. The lecture is then delivered where the pathology of the disease in clinical scenario is discussed. Afterwards, at the end of the lecture the same clinical scenario is shown, and students are asked about diagnosis followed by a short discussion on the link between basic medical and clinical sciences to consolidate student learning. This approach has a potential advantage of collaborative and facilitated learning rather than passive learning as argued for lecture-based teaching. An example of the clinical case scenario (start of the lecture) along with diagnosis and explanation of the case (end of the lecture) is shown as Supplementary File 1. We named this technique as the "Clinical Case Sandwich" technique. College of Medicine at GMU has two parallel undergraduate medical programs. One is called Higher Diploma in Preclinical Sciences (HDPCS) program and the other is Bachelor of Medicine and Bachelor of Surgery (MBBS) program.

A structured, self-administered questionnaire was developed after reviewing relevant literature. The questionnaire was piloted with 15 students from MBBS (preclinical years) to ensure validity and clarity. Modifications to the questionnaire were made based on the feedback from MBBS students. Subsequently, the validated questionnaire was administered to all enrolled HDPCS students (preclinical years) after experiencing the clinical scenario-based lecture model in pathology for one full academic year in a system based modular curriculum. The sample size of HDPCS students was 43.

Importantly, for final data analyses, only data from HDPCS students was used. Thus, the inclusion criteria were HDPCS students aged 18 years or older who provided written informed consent. The ethical approval from institutional review board was obtained (Ref. no. IRB-COM-STD-98-MAR-2024). Students outside this batch or those unwilling to participate were excluded. Participation was voluntary, and confidentiality of responses was maintained. The questionnaire administered for survey included both close-ended and open-ended questions (Figure 1). Thirteen close ended questions based on 5 point-Likert-scale to assess the pedagogical method were used and are coded as: A1-A2 (perceived suitability and engagement), B1-B2 (perceived clinical and examination relevance), C1-C5 (perceived impact on learning and academic understanding) and D1-D4 (student satisfaction and acceptance of the method). Whereas open-ended questions are intended to capture qualitative insights from participants (Figure 1).Quantitative data from a 5-point Likert-scale was analyzed using descriptive statistics, including frequencies and percentages from participant responses and heatmap of participant responses. Qualitative responses were thematically analyzed using Word-It-Out software that generated word clouds to highlight keywords and themes.

Thus, this mixed-method approach ensures a comprehensive analysis of responses from participants to generate evidence for the new lecture delivery model.

RESULTS

The data analysis is grouped based on the coding of the survey questionnaires and is presented below.

A. Perceived suitability and engagement

82% of the participants agreed or strongly agreed that the clinical scenario helps them engage better in the lecture. In addition, 68% of the participants felt that it better suits their learning when a scenario is shown at the start and end of the lecture (Figure 2, 3).

B. Perceived clinical and examination relevance

86% of the participants agreed or strongly agreed that the clinical cases will help them integrate their learning for better solving questions in exams. 95% of the participants agreed or strongly agreed that it will also help them in their clinical years (Figure 2, 3).

C. Perceived impact on learning and academic understanding

79% of the participants agreed or strongly agreed that the clinical case helped them navigate and learn better the lecture. 88% of the participants agreed or strongly agreed that it helped them put more attention on the content in the lecture. 81% of the participants agreed or strongly agreed that it helped them better understand the lecture content. 88% of the participants agreed or strongly agreed that the clinical case is aligned with learning objectives. 83% of the participants agreed or strongly agreed that this new teaching method will help students improve grades (Figure 2, 3).

Figure 1: Graphical analysis of the responses from participants of the study on survey questionnaire.

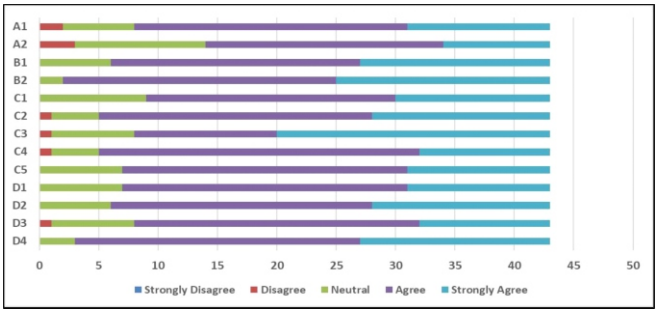
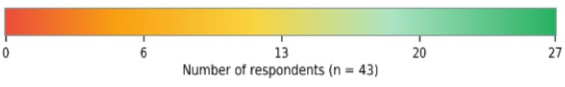


Figure 3: Heat-map of responses from participants on survey questionnaire

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A. Perceived suitability and engagement						
A1	I found the new method to be an engaging method to begin and end lectures.	0	2	6	23	12
A2	In my opinion, the method is better suited for a certain type of learner.	0	3	11	20	9
B. Perceived clinical and examination relevance						
B1	I am confident that the cases presented will be a good guide for my competitive examinations.	0	0	6	21	16
B2	I believe that the cases presented in the new method will be helpful when I go into my clinical years.	0	0	2	23	18
C. Perceived impact on learning and academic understanding						
C1	I am convinced that the method has helped me to progress in the knowledge of the lecture.	0	0	9	21	13
C2	I believe that the clinical cases used in this method will help me to understand where I should improve in the topic of the lecture.	0	1	4	23	15
C3	I believe that this method has brought a change in the understanding of the topic.	0	1	7	12	23
C4	In my opinion, the new method has addressed some of the learning objectives of the lecture.	0	1	4	27	11
C5	I truly believe that this method will help me improve my grades.	0	0	7	24	12
D. Student satisfaction and acceptance of the method						
D1	I am very satisfied with this new method of learning in the lecture.	0	0	7	24	12
D2	I feel like this new method makes the lectures more interactive.	0	0	6	22	15
D3	My interest in the subject has increased after the use of this new method.	0	1	7	24	11
D4	In my opinion, other teachers should also take up this method of teaching.	0	0	3	24	16



D. Student satisfaction and acceptance of the method

83% of the participants agreed or strongly agreed that students are satisfied with this new method of eaching. 86% of the participants agreed or strongly agreed that this new method makes the lecture more interactive. 81% of the participants agreed or strongly agreed that student interest in the lecture topic increased with this new teaching method. 93% of the of the participants agreed or strongly agreed that other teachers should also adopt this teaching method (Figure 2, 3).

The heatmap color scale ranged from red to green, where red represented lower response frequencies and green represented higher response frequencies. Intermediate colors indicated moderate response frequencies between the two extremes.

Qualitative analyses from participants' comments

One Strength

The analysis of one strength of the free response of the participants is shown in Figure 4a. 41 participants provided responses. Overall, the comments are encouraging and positive as well as some of the themes that emerged are: interactive learning; enhanced clinical reasoning; improved understanding; increased engagement and knowledge application. Better learning and clinical reasoning stands-out from the student's responses. Following are three examples of some of the responses from the participants.

- "Interactive and allows us to think more instead of just listening".
- "Makes us curious before the lecture so we pay attention to the lecture more for the diagnosis (answer)"
- "It helps in critical thinking of students"

One improvement

The analysis of one improvement of the free response of the participants is shown in Figure 4b. 39 participants provided responses. Overall, the comments are constructive and some of the themes that emerged are: overall satisfaction, no improvement needed; introduction of additional clinical cases, better structuring of clinical cases and time management. Following are three examples of some of the responses from the participants.

- "There should be more cases like this we can practice with at the end of the lecture"
- "It may be time consuming and not applicable for all students"
- It could be discussed more in class or possibly we could add one more case"

Figure 4: Word cloud analysis from word-it-out online software of the free responses in the survey questionnaire.

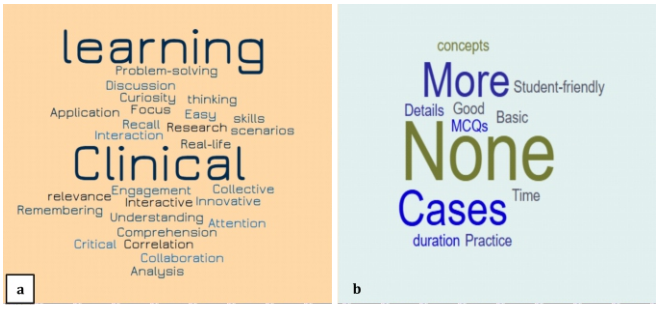


Figure Legend: a) one strength of the new lecture delivery method from participant free responses. b) one point of improvement of the new lecture delivery method from participant free responses.

Figure 5: Conceptual and implementation framework of 'The Clinical Case Sandwich'

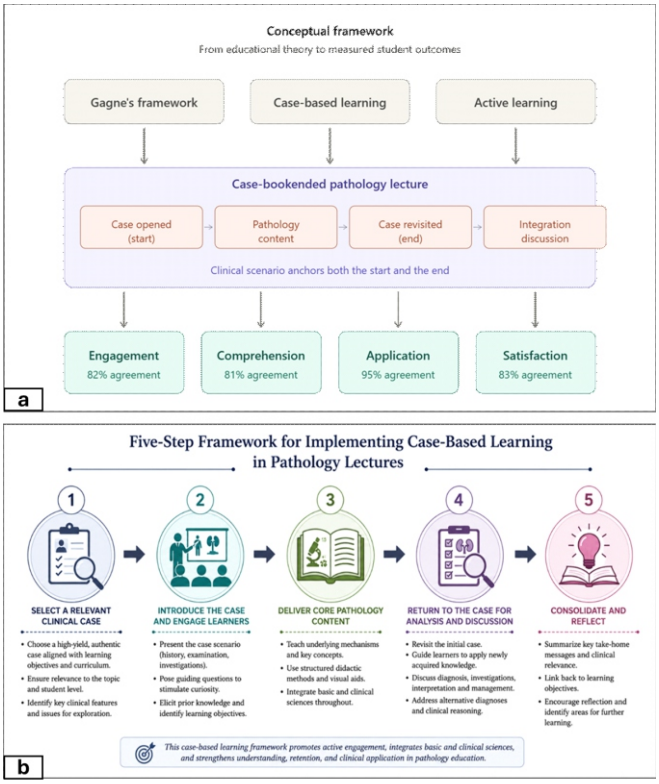


Figure Legend: a) Conceptual framework of 'The Clinical Case Sandwich' b) Implementation framework of 'The Clinical Case Sandwich'.

DISCUSSION

Our students endorsed the modified lecture model on every domain we measured, and the pattern of their responses tells a coherent story. The case-as-frame approach was perceived as more engaging, more aligned with clinical work, and more useful for examinations than a conventional pathology lecture. The qualitative comments suggest why. Students described becoming "curious before the lecture," paying closer attention "for the diagnosis," and thinking actively rather than

transcribing. These are precisely the cognitive states a well-designed teaching event is supposed to create.

This pattern fits the broader debate about lectures and active learning. Critics of the lecture format are not wrong about its risks: passivity, drift, the slow erosion of attention across forty-five minutes. But the evidence increasingly suggests lectures fail when they are inert, not because they are lectures.[4] Our findings sit comfortably within that view. A relatively small structural change — booking the session with a case — shifted student perception substantially, without the staffing or scheduling costs of a full flipped-classroom redesign.

The improvement in perceived comprehension is also consistent with the case-based learning literature. Reviews of CBL across medical and allied health education report gains in clinical reasoning and knowledge transfer, particularly when cases are tightly coupled with didactic content rather than running in parallel to it.[7,8] Eighty-one percent of our students reported better understanding of lecture content, and 95% felt the cases would help them in their clinical years — figures that align with what others have shown for CBL in physiology and other preclinical disciplines.[9]

It is worth being precise about what the modification actually does. We did not abandon the lecture; we restructured it. The opening case generates a moment of unresolved tension that primes encoding of the material that follows. The closing case provides retrieval practice, asking students to apply what they have just learned to the original problem. This sequence maps cleanly onto Gagné's nine events, particularly gaining attention, stimulating recall of prior learning, eliciting performance, and providing feedback.[10] In other words, the modification is not novel pedagogy so much as a disciplined application of principles established to a familiar format.

The literature on learning preferences offers a softer but still useful lens on these results. Gardner's framework reminds us that any single mode of delivery will reach some students more effectively than others.[5,6] Anchoring abstract pathology in a concrete patient story is one way to broaden that reach: it provides a scaffold narrative for students who learn best through context and application, without disadvantaging those who prefer a more systematic approach.

Two cautions deserve attention. First, the success of any case-based modification depends heavily on the instructor. Effective delivery requires faculty who can construct clinically authentic cases, manage classroom dialogue, and time the discussion against the lecture's content load.[1] Faculty development is therefore not optional but central to scaling this approach. Second, our students flagged time management as the main improvement area. A case that runs long compresses the rest of the lecture; A case that is rushed loses its instructional value. Teachers adopting this model will need to rehearse the timing carefully and would benefit from a shared, peer-reviewed bank of pre-validated cases.

Several limitations should be appreciated. The study was conducted at a single institution with a modest sample of HDPCS students, and the outcomes rest on student perceptions rather than direct measures of learning such as examination performance or clinical assessment. Self-report data are vulnerable to social desirability and novelty effects, especially when a new method is introduced enthusiastically. Future work should compare matched cohorts taught with and without the case-frame model, follow students into their clinical years to test the predicted transfer benefit, and explore how the approach performs in larger MBBS classes, where group dynamics differ from those of a smaller HDPCS cohort.

We recommend that this study be validated in independent cohort of students to potentially help improve the learning and teaching in a system-based curriculum. We anticipate that incorporating the "Clinical Case Sandwich" technique would not only help in better pathology teaching but all basic medical sciences. Further educational studies are therefore warranted in basic medical sciences utilizing the "Clinical Case Sandwich" technique.

CONCLUSION

This study demonstrates that integrating clinical case scenarios into lectures significantly enhances student engagement, knowledge retention, and clinical relevance. We named it as the "Clinical Case Sandwich" technique.

Students overwhelmingly found the approach engaging, effective in improving their understanding, and beneficial for their future clinical practice. These findings align with existing research on active learning and case-based learning (CBL), reinforcing the idea that interactive teaching methods promote deeper comprehension and critical thinking. Moreover, incorporating clinical cases into lectures helps bridge the gap between theoretical knowledge and real-world medical practice, providing a more well-rounded learning experience.

Given the positive student response, this lecture model has the potential to enhance medical education at Gulf Medical University and beyond. The study also highlights the need for faculty development programs to ensure effective implementation and inclusivity for diverse learning styles. While the results strongly support adopting this method, further research is needed to assess its long-term impact on academic performance and clinical competence. Future studies could also explore how personalized learning strategies can be integrated to optimize the model for a wider range of learners, ensuring that medical education continues to evolve to meet the

needs of students and the healthcare field.

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CONFLICT OF INTEREST

Author declared no conflict of interest

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AUTHORS CONTRIBUTIONS

FK: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable.

KA: Conception, Design of the work, Acquistion, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

MA: Conception, Design of the work, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.

AA: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable.

DATA SHARING POLICY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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