

Effect of Integrated Teaching on Learning of Ischemic Heart Disease Pharmacology: A Quasi experimental, Pre-test-Post-test Study

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Abstract

Background: Ischemic heart disease (IHD) is a leading cause of morbidity and mortality worldwide, and its pharmacological management is a core competency for the Indian Medical Graduate under the Competency-Based Medical Education (CBME) curriculum. Traditional discipline-wise didactic lectures on IHD pharmacology are often taught in isolation from pathology and clinical medicine, which may limit conceptual understanding and clinical application.

Objectives: To evaluate the effect of an integrated teaching session on IHD pharmacology on student's knowledge scores and to assess the students perception of, and satisfaction with, this teaching-learning method, among undergraduate medical students.

Material & Methods: A quasi-experimental Pre-test-Post-test study was conducted among undergraduate medical students at a tertiary care teaching hospital. A structured, pre-validated questionnaire was administered via Google Forms, comprising of 23 multiple-choice questions (MCQs) on IHD pharmacology. Questionnaire was administered before (pre-test), followed by the ATCOM (Attitude, Communication, and Ethics) sessions. The post-test, using the same questionnaire, was administered after the final an integrated teaching session. Post-test respondents additionally completed an 8-item, 5-point Likert-scale questionnaire assessing perception of the session and two open-ended feedback items. Pre-test and post-test knowledge scores were compared using an independent-samples t-test. A p-value <0.05 was considered statistically significant.

Results: A total of 345 unique responses were analysed (188 pre-test, 157 post-test). Mean knowledge scores were significantly higher after the integrated session (post-test: 19.67 ± 2.76 ; pre-test: 16.80 ± 4.22 ; $p < 0.001$). Neither gender ($p = 0.93$) nor prior exposure to integrated teaching ($p = 0.84$) significantly influenced post-test scores. All eight perception items received a mean Likert score $\geq 4.0/5$, with 80–88% of students agreeing or strongly agreeing that the session was well organised, improved conceptual and pharmacological understanding, enhanced confidence, and was preferable to conventional lectures. Qualitative feedback highlighted student-teacher interaction, clinical case correlation, and demonstration-based learning as the most valued features, with requests for more case-based MCQs and visual aids (mind maps, flow-charts).

Conclusion: An integrated teaching session on IHD pharmacology was associated with significantly improved knowledge scores and was well received by students, supporting its wider incorporation into the pharmacology curriculum alongside conventional lectures.

Keywords: Integrated Teaching; Ischemic Heart Disease; Pharmacology Education; Competency-Based Medical Education; Student Perception; Medical Undergraduates.

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Introduction

Ischemic heart disease (IHD) is a major cause of illness and death worldwide. [15] Every medical graduate needs a solid understanding of its pharmacological management, including antianginal, antiplatelet, thrombolytic, and lipid-lowering therapy. Traditionally, pathology, pharmacology, and medicine have taught this

content separately, often at different points in the course. This separation can fragment students' understanding and make it harder for them to apply pharmacology knowledge to real clinical problems. In 2019, the Medical Council of India (now the National Medical Commission) introduced the Competency-Based Medical Education (CBME)

curriculum. CBME requires integration across subjects – both within a year (horizontal) and across years (vertical) – so that graduates become competent clinicians, communicators, and lifelong learners. [1,3,9,10] Many institutions have adopted integrated teaching sessions that combine pathophysiology, pharmacology, and clinical correlation in a single class to meet this goal. Students have generally responded well to this case-based, cross-disciplinary approach. [1,11]

However, whether integrated teaching actually improves test scores is less clear. One study using the Kirkpatrick model found significant knowledge gains in physiology, anatomy, and biochemistry after integrated sessions. [4] In contrast, a study of integrated teaching for rational pharmacotherapeutics among Indian medical students found high satisfaction but no significant rise in post-test scores, [2] showing that students can enjoy a teaching method without necessarily learning more from it. In problem-based pharmacology learning, test performance has also been shown to depend as much on individual student characteristics as on the teaching method itself. [5] By contrast, case-based learning in pharmacology has separately been shown to improve both knowledge and clinical-application scores compared with lectures alone. [12,13]

Given these mixed findings, and the importance of IHD pharmacology in the curriculum, we designed this study. We aimed to measure how one integrated teaching session on IHD pharmacology affected students' knowledge scores, and to explore student perception of the session using a Likert-scale survey with open-ended feedback.

Materials and Methods

Study Design and Setting: This quasi-experimental pre-test-post-test, questionnaire-based study, was conducted in the Department of Pharmacology at government medical college Jammu, a tertiary care teaching hospital.

The study evaluated an integrated teaching session on the pharmacological management of Ischemic Heart Disease, delivered jointly with correlation to pathophysiology and clinical medicine, including case-based discussion, ECG-based demonstration, and concept/mind-mapping exercises, as reported by participating students.

Participants and Sampling: The undergraduate medical students attending the IHD teaching module were invited to participate in the study on a voluntary basis. Responses were collected as two independent cross-sectional samples – a pre-test cohort surveyed before the integrated session and a post-test cohort surveyed after the session – using self-reported 'Test Type' labelling within the

response data; individual pre-post pairing was not performed, and the two samples were therefore analysed as independent, unmatched groups. After removing duplicate entries (identified by matching timestamp and email address across the two response files), 345 unique responses were available for analysis: 188 pre-test and 157 post-test.

Study Instrument: Data were collected using a structured, self-administered Google Forms questionnaire, comprising of four sections: (a) demographic details (roll number, gender, and prior exposure to integrated teaching); (b) a 23-item multiple-choice knowledge assessment covering the aetiology, pathophysiology, and pharmacological management of IHD, auto-scored by the platform; (c) an 8-item, 5-point Likert-scale questionnaire (Strongly Disagree to Strongly Agree) assessing organisation, conceptual and pharmacological understanding, confidence, clinical applicability, comparative effectiveness versus conventional lectures, and overall satisfaction, administered only to the post-test cohort; and (d) two open-ended items on the most useful aspect of the session and suggestions for improvement.

Statistical Analysis: Data were analysed using Python (version 3.0). Knowledge scores are presented as mean $\pm$ standard deviation, while categorical variables are presented as frequencies and percentages. Pre-test and post-test knowledge scores were compared using an independent-samples t-test. Post-test scores were also compared by gender and prior exposure to integrated teaching using the same test. Likert-scale responses were summarised using mean $\pm$ SD and the percentage of students who agreed or strongly agreed. Open-ended responses were grouped into common themes. A two-tailed p-value <0.05 was considered statistically significant.

Ethical Considerations: The study was conducted after obtaining approval from the Institutional Ethics Committee. Participation was voluntary, and informed consent was obtained electronically prior to survey completion. Responses were anonymised for analysis; email addresses collected for administrative deduplication were not used for any other purpose.

Results

Of 345 unique responses analysed, 188 (54.5%) were pre-test and 157 (45.5%) were post-test responses. The overall sample comprised 177 female (51.3%) and 168 male (48.7%) students; 261 (75.7%) reported prior exposure to an integrated teaching session in some form, while 84 (24.3%) did not (Table 1).

Table 1: Demographic characteristics of participants

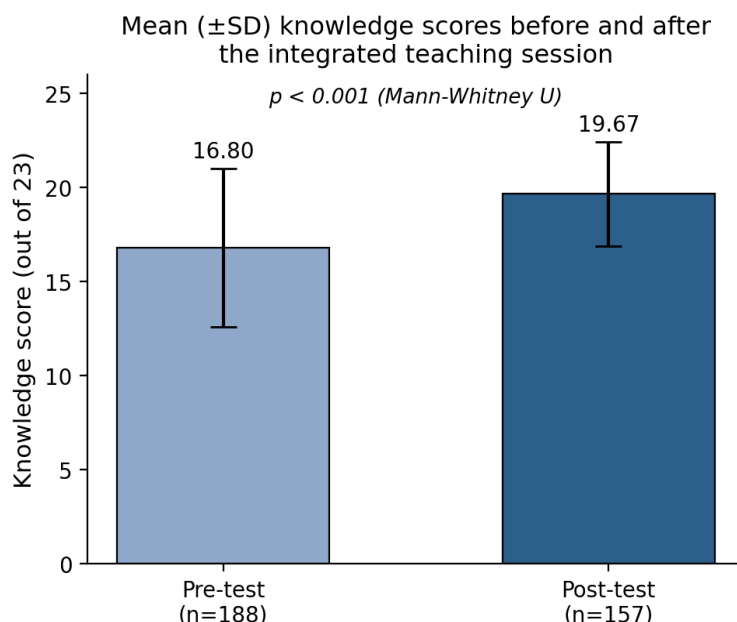
Characteristic	Pre-test (n=188)	Post-test (n=157)	Total (N=345)
Gender – Female, n (%)	93 (49.5)	84 (53.5)	177 (51.3)
Gender – Male, n (%)	95 (50.5)	73 (46.5)	168 (48.7)
Prior integrated-teaching exposure – Yes, n (%)	120 (63.8)	141 (89.8)	261 (75.7)
Prior integrated-teaching exposure – No, n (%)	68 (36.2)	16 (10.2)	84 (24.3)

Post-test knowledge scores were significantly higher than pre-test scores. The mean knowledge score increased from 16.80 ± 4.22 before the session to 19.67 ± 2.76 after the session. The mean

percentage score increased from 73.0% to 85.5%. This difference was statistically significant (independent-samples t-test, $p < 0.001$) (Table 2, Figure 1).

Table 2: Comparison of knowledge scores before and after the integrated teaching session

Parameter	Pre-test (n=188)	Post-test (n=157)	Statistic	p-value
Mean $\pm$ SD (out of 23)	16.80 ± 4.22	19.67 ± 2.76	t-test	<0.001
Median (IQR)	18 (14–20)	20 (19–22)	–	–
Range	3–22	5–22	–	–
Mean percentage score	73.0%	85.5%	–	–

**Figure 1: Mean ($\pm$ SD) knowledge scores before and after the integrated teaching session (independent-samples t-test, $p < 0.001$).**

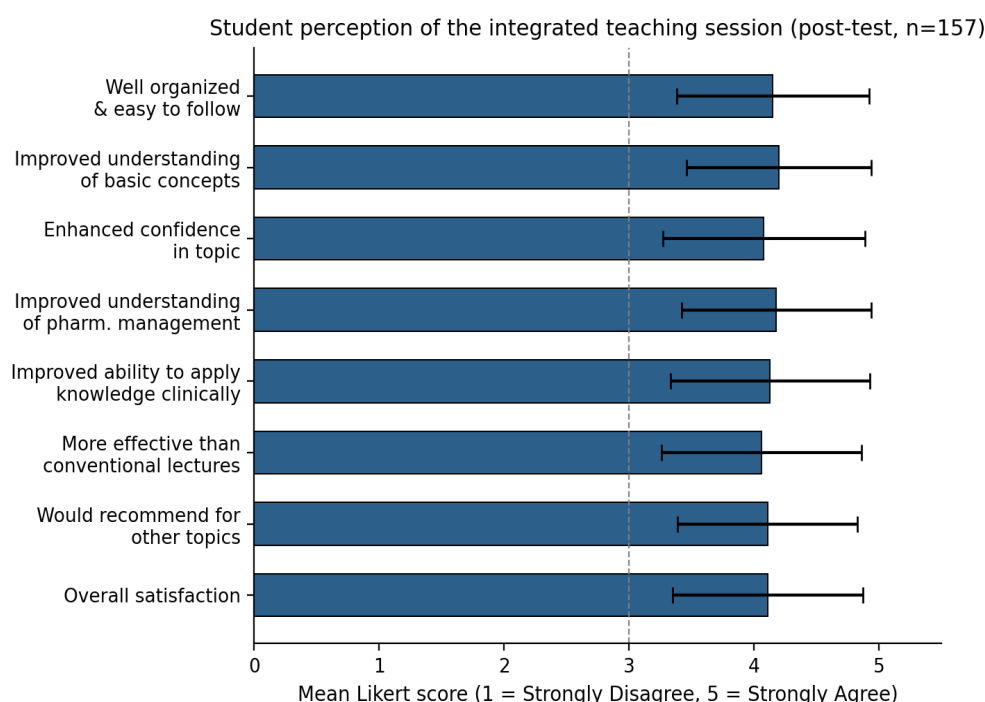
Within the post-test cohort, knowledge scores did not differ significantly by gender (male: 19.47 ± 3.21 vs female: 19.85 ± 2.29 ; $p = 0.93$) or by prior exposure to integrated teaching (previously exposed: 19.69 ± 2.81 vs not previously exposed: 19.50 ± 2.42 ; $p = 0.84$).

On the 8-item post-session perception questionnaire ($n = 157$), all items received a mean Likert score of 4.06–4.20 out of 5, with 80.3–

87.9% of students responding 'Agree' or 'Strongly Agree' (Table 3, Figure 2). The highest-rated items were improved understanding of the pharmacological management of IHD (87.9% agreement) and improved understanding of basic pathophysiological concepts (86.6% agreement); the lowest-rated item was perceived confidence in the topic (80.3% agreement), though still reflecting predominantly favourable perception.

Table 3: Student perception of the integrated teaching session (post-test, n = 157)

Item	Mean $\pm$ SD (/5)	% Agree + Strongly Agree
Well organised and easy to follow	4.15 $\pm$ 0.77	82.8%
Improved understanding of basic concepts (coronary circulation, pathophysiology, atherosclerosis)	4.20 $\pm$ 0.74	86.6%
Enhanced confidence in the topic	4.08 $\pm$ 0.81	80.3%
Improved understanding of pharmacological management	4.18 $\pm$ 0.76	87.9%
Improved ability to apply knowledge to clinical scenarios	4.13 $\pm$ 0.80	83.4%
More effective than conventional lectures	4.06 $\pm$ 0.80	84.1%
Would recommend for other pharmacology topics	4.11 $\pm$ 0.72	83.4%
Overall satisfaction	4.11 $\pm$ 0.76	84.1%

**Figure 2: Mean ($\pm$ SD) Likert scores for each perception item (post-test, n = 157).**

Qualitative analysis of open-ended responses identified several recurrent themes regarding the most valued aspects of the session: active student–teacher interaction and discussion (most frequently cited), integration of pathophysiology with pharmacological and clinical management, case-based and clinically correlated learning, use of visual aids such as mind maps and flow-charts, and hands-on demonstration (e.g., ECG interpretation). Commonly suggested improvements included incorporating more case-based multiple-choice questions and practice quizzes, increasing the frequency of interactive/small-group activities, greater use of visual aids, and adjusting session duration to sustain attention. Several students also requested that similar integrated sessions be extended to other pharmacology topics.

Discussion

This study found that an integrated teaching session significantly improved students' knowledge scores on IHD pharmacology, and that students were highly satisfied with the session across every aspect measured. These results support a core idea behind CBME: that integrating pathophysiology, pharmacology, and clinical medicine can improve both learning and student satisfaction. [1-3,9,10] Our findings match those of a similar study across physiology, anatomy, and biochemistry, which also found significant post-test gains alongside high satisfaction. [4] In contrast, Ambwani et al. found that although students preferred integrated teaching for rational pharmaco-therapeutics over conventional lectures, their post-test scores did not improve significantly, [2] showing that students liking a method does not always mean they learn more from it. Our stronger result may reflect differences in topic, session design, or sample size. It highlights why studies should measure both knowledge and satisfaction, rather than relying on

satisfaction data alone. Case-based pharmacology teaching in other settings has similarly produced measurable knowledge gains, not just positive feedback. [12,13] Post-test scores did not differ significantly by gender, suggesting that the integrated format worked equally well for male and female students. This fits with other evidence that structured, case-based teaching can narrow performance differences linked to learner background. [5] Prior exposure to integrated teaching also made no significant difference to scores, suggesting that the improvement we found came from this specific IHD session rather than from students past familiarity with the integrated format. More than 80% of students agreed with every statement about the session – covering organisation, conceptual and pharmacological understanding, clinical relevance, confidence, and preference over conventional lectures. This matches findings from other CBME-aligned sessions in Indian medical colleges, where students have valued early clinical exposure, small-group learning, and cross-subject correlation. [1,3,9-11]

Student–teacher interaction was the most valued feature in the open-ended feedback, consistent with the wider active-learning literature. Students specific requests for more case-based MCQs and visual aids such as mind maps and flow-charts are simple, low-cost changes for future sessions, similar to other low-cost teaching innovations shown to improve pharmacology learning elsewhere. [6]

Overall, these findings suggest that a well-designed integrated teaching session on a clinically important topic such as IHD pharmacology can improve both knowledge outcomes and student satisfaction at the same time. This supports continued institutional investment in integrated, case-based teaching, as required under CBME and reflected in broader international trends toward integrated pharmacology curricula. [14]

Limitations: This study has some limitations. First, the study used independent rather than paired pre- and post-test data, limiting assessment of individual knowledge gain. Its single-centre design, convenience sampling, and invalidated instruments may limit generalisability and measurement validity. Self-reported satisfaction data may also be subject to response bias. Future studies should use matched designs, validated tools, and multicentre sampling.

Conclusion

An integrated teaching session combining pathophysiology, pharmacology, and clinical correlation for Ischemic Heart Disease significantly improved student knowledge scores and was rated highly on every measure of student perception,

including organisation, conceptual clarity, confidence, clinical applicability, and preference over conventional lectures. These findings support wider use of integrated, case-based teaching in the pharmacology curriculum, in line with the goals of Competency-Based Medical Education, along with student-suggested improvements such as more case-based practice questions and visual learning aids.

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