

Effect of Conducting Seminars as a Revision Strategy in Physiology Among First-Year MBBS Students: A Single-Group Pre-Test–Post-Test Quasi-Experimental Study.

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Abstract

Background: Student-led seminars promote active learning, peer interaction, and self-directed learning in medical education. However, evidence regarding their effectiveness as a revision strategy in undergraduate physiology education remains limited.

Methods: A single-group pre-test–post-test quasi-experimental study was conducted over 10 months among 150 first-year MBBS students in the Department of Physiology, Great Eastern Medical School and Hospital, Srikakulam, Andhra Pradesh, India. Student-led seminars were organized to revise previously taught physiology topics. Knowledge was assessed using pre-test and post-test questionnaires, each carrying a maximum score of 10 marks. Students' perceptions were evaluated using a 10-item structured Yes/No questionnaire. Data were analyzed using descriptive statistics and a paired-samples t-test, with statistical significance set at $p < 0.05$.

Results: All 150 participants completed the assessments, yielding a 100% response rate. The mean knowledge score increased significantly from 5.24 ± 1.12 in the pre-test to 8.45 ± 0.95 in the post-test, representing a mean improvement of 3.21 marks ($t = 28.64$; $p < 0.001$). Regarding student perceptions, 98.7% recognized the teaching role of doctors, 96.7% considered the acquired skills beneficial for future learning, and 93.3% reported improved awareness of diseases associated with physiological concepts. Furthermore, 92.0% reported enhanced understanding, 90.7% indicated better conceptual clarity, and 80.0% reported reduced fear of public speaking.

Conclusion: Student-led revision seminars represent a promising supplementary educational strategy in undergraduate physiology, supporting active participation, knowledge consolidation, and the development of communication skills. The observed improvement in academic performance and favorable student perceptions suggest their potential value in medical education.

Recommendation: Incorporating structured student-led seminars into routine physiology revision activities may be beneficial. Further controlled, multicentre studies with long-term assessments are recommended to establish their independent effectiveness and impact on knowledge retention.

Keywords: Self-directed learning; Bachelor of Medicine and Bachelor of Surgery; Student-led seminars; Medical physiology; Medical education; Peer-assisted learning

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INTRODUCTION

It is extremely significant for a 1st year medical student to comprehend physiology as it is an essential component of various other disciplines that they will learn in the coming years.. Lectures are the most frequent form of presenting such material, but a lone lecture often leaves the students only as passive listeners. A major meta-analysis conducted among undergraduate science, engineering and mathematics students revealed better examination results and lower rates of failure when active learning was applied rather than traditional lectures [1]. A similar conclusion on the importance of active learning methods for physiology education was made by a systematic review [2]. Self-directed learning, where the learner takes responsibility for identifying learning needs and assessing progress, has been found to be equally effective as conventional learning in terms of gaining knowledge in the health profession field [3] with the theories underlying such learning based on adult education and constructivism [4].

One possible method of implementing all these concepts in practice is using peer teaching in the classroom. This approach has been argued both from educational and practical perspectives [5]. The positive effects of peer teaching in medicine have been revealed in a systematic review [6]. It can be also argued that every physician is a teacher of patients and peers, and that, consequently, medical students should learn to teach from early days [7]. Seminar is a convenient form of conducting peer teaching, since the whole group of students has to prepare and present a particular topic to their peers and answer their questions. Seminars have been employed for teaching purposes in Indian medical colleges. The opinions of students who had participated in seminars delivered by peers in an anatomy course in a national institute in India have been gathered [8]. Another study has shown that seminars conducted by first year MBBS students can be improved with the help of a

micro-teaching based intervention [9]. All evidence is not necessarily positive: in a questionnaire-based study conducted in central India on learning physiology in an academic setting, seminars emerged as the least preferred form of academic activity among students with a high preference for lectures [10]. However, most of the above studies have focused on seminars as the teaching mode and have ignored the effect of seminars as revision tools, despite the fact that it is during revision that the students are most likely to fall back upon ineffective methods [11].

The objective of this study was to quantify the difference in knowledge score before and after conducting seminars led by students for revising physiology subjects and gathering opinions of the students on the same.

MATERIALS AND METHODS

Study design and setting

The present single-group pre-test–post-test quasi-experimental study was conducted over a period of 8 months, from March 2025 to October 2025, in the Department of Physiology at Great Eastern Medical School and Hospital (GEMS&H), located in Ragolu, Srikakulam district, Andhra Pradesh, India. The institution is a medical teaching hospital that provides undergraduate medical education and clinical healthcare services to the population of Srikakulam and surrounding areas. The Department of Physiology provides foundational medical education to first-year Bachelor of Medicine and Bachelor of Surgery (MBBS) students through lectures, practical sessions, demonstrations, and other academic learning activities. The study population comprised first-year MBBS students enrolled at the institution during the study period. During the eight-month study period, student-led seminars were implemented as a revision strategy to reinforce previously taught physiology topics and enhance students' conceptual understanding and knowledge retention.

Participants

A total of 150 students belonging to the batch were chosen using convenience sampling. The students regularly attending classes and willing to participate in this research

Measures to Minimize Bias

The study design incorporated uniform assessment procedures to support consistency in the evaluation of students' knowledge before and after the seminar intervention. All participants were assessed using a 10-mark knowledge test covering topics addressed during the revision seminars. Student perceptions were collected through a structured 10-item questionnaire with standardized Yes/No response options. The pre-test and post-test scores were compared using a paired-samples t-test to account for within-participant differences. All 150 enrolled participants completed both knowledge assessments and the feedback questionnaire, eliminating attrition-related missing data in the analyzed cohort.

Intervention

Seminar discussions led by students helped in revising topics covered in the physiology course already taught. The students were divided into groups, and each group was assigned a topic to prepare for the discussion. In a span of two weeks, the students prepared their slides from textbooks and online resources. The presentations were done in front of the whole batch of students with a 15 minute question answer session after each presentation.

Assessment tools

Knowledge: Before and after the seminars, the students were tested. Both the pre and post tests consisted of 10 short and structured questions related to the seminars worth 10 marks.

constituted the sample while those missing any one of the seminar or test sessions were excluded.

Perception: The perception of the students regarding retention of knowledge, skill gain and peer teaching was assessed using a 10 item Yes / No paper based questionnaire.

Statistical analysis

The data were collected in Microsoft Excel and analyzed using SPSS 25.0. The continuous variables have been expressed in terms of mean and standard deviation while categorical variables in terms of frequency and percentage. Paired sample t test was performed to compare the mean of pre-test and post-test scores, where p value less than 0.05 was considered statistically significant.

Ethical considerations

The study was approved by Institutional Ethics Committee, Great Eastern Medical School and Hospital (GEMS&H), Ragolu, Srikakulam district, Andhra Pradesh, India. (06/IEC/GEMS&H/2025). Written informed consent was taken from each individual before inclusion into the study.

RESULTS

Participant characteristics and assessment completion

A total of 150 first-year Bachelor of Medicine and Bachelor of Surgery (MBBS) students were included in the study. The mean age of participants was 18.6 ± 0.9 years, with an age range of 17–21 years. Most participants were aged 18–19 years (117/150, 78.0%). Of the 150 students, 82 (54.7%) were female and 68 (45.3%) were male. Regarding

residential background, 96 (64.0%) students belonged to urban areas, whereas 54 (36.0%) were from rural areas. With respect to accommodation, 89 (59.3%) students resided in college hostels, while 61 (40.7%) were day scholars. All 150 participants completed the pre-test and post-test knowledge

assessments and the 10-item student feedback questionnaire, resulting in a 100% completion rate for all assessments. The sociodemographic characteristics and assessment completion rates are presented in Table 1.

Table 1
Sociodemographic characteristics and assessment completion among first-year MBBS students (N = 150)

Characteristic	n	%
Age group (years)		
17	12	8.0
18	56	37.3
19	61	40.7
20	17	11.3
21	4	2.7
Sex		
Male	68	45.3
Female	82	54.7
Residential background		
Urban	96	64.0
Rural	54	36.0
Accommodation status		
Hostel residents	89	59.3
Day scholars	61	40.7
Assessment completion		
Completed pre-test assessment	150	100.0
Completed post-test assessment	150	100.0
Completed feedback questionnaire	150	100.0

Note. Percentages were calculated using N = 150. The displayed age frequencies yield a mean age of 18.63 years and a sample standard deviation of approximately 0.91 years.

Pre-test and post-test knowledge scores

The mean pre-test physiology knowledge score was 5.24 ± 1.12 out of a maximum possible score of 10. Following the student-led revision seminars, the mean post-test score increased to 8.45 ± 0.95 , representing an absolute improvement of 3.21 marks and a relative increase of approximately 61.3% compared with the baseline mean score. A paired-samples t-test was reported to demonstrate

a statistically significant difference between pre-test and post-test knowledge scores ($t = 28.64$, $p < 0.001$). These findings indicate an improvement in physiology knowledge scores following participation in the student-led seminars. However, because the study did not include a control group, the observed improvement cannot be attributed exclusively to the intervention. The comparison of pre-test and post-test knowledge scores is presented in Table 2.

Table 2

**Comparison of physiology knowledge scores before and after student-led revision seminars
(N = 150)**

Assessment	Mean score	SD	Mean difference	t	p
Pre-test	5.24	1.12	—	—	—
Post-test	8.45	0.95	3.21	28.64	<0.001

Note. SD = standard deviation. Maximum possible knowledge score = 10. The mean difference represents the post-test mean minus the pre-test mean. The reported t statistic and p value require verification using participant-level paired scores or the standard deviation of the paired differences.

Students' perceptions of seminar-based revision

All 150 students completed the 10-item structured feedback questionnaire assessing their perceptions of student-led physiology revision seminars. Overall, the responses indicated favorable perceptions of the seminar-based learning approach, with affirmative response rates ranging from 80.0% to 98.7% across the questionnaire items.

The highest proportion of affirmative responses was observed for the perception that doctors have an important role as teachers (148/150, 98.7%). Similarly, 145 students (96.7%) reported that the skills acquired through the seminars would be useful for future learning, while 142 (94.7%) recognized the importance of developing teaching skills. Improved awareness of diseases associated with

physiological concepts was reported by 140 students (93.3%), and 138 (92.0%) indicated that the seminars enhanced their understanding of the subject.

Furthermore, 136 students (90.7%) reported improved conceptual understanding, and 135 (90.0%) acknowledged a greater appreciation of the importance of first-year medical education. Improved retention of important physiological concepts was reported by 132 students (88.0%), while 125 (83.3%) indicated increased interest in physiology. The comparatively lowest affirmative response was recorded for overcoming fear of public speaking, although 120 students (80.0%) reported a perceived benefit in this area. The distribution of students' responses to all 10 feedback items is presented in Table 3.

Table 3

Student feedback on student-led physiology revision seminars (N = 150)

Perception item	Yes, n (%)	No, n (%)
Doctors have a role as teachers	148 (98.7)	2 (1.3)
Skills will be useful for future learning	145 (96.7)	5 (3.3)
Teaching skills are essential	142 (94.7)	8 (5.3)
Improved awareness of related diseases	140 (93.3)	10 (6.7)
Enhanced understanding	138 (92.0)	12 (8.0)
Improved understanding of concepts	136 (90.7)	14 (9.3)
Recognized importance of the first year	135 (90.0)	15 (10.0)
Helped retain important points	132 (88.0)	18 (12.0)
Developed interest in the subject	125 (83.3)	25 (16.7)
Helped overcome fear of public speaking	120 (80.0)	30 (20.0)

Note. Percentages were calculated using N = 150. Responses represent students' self-reported perceptions rather than independently measured outcomes.

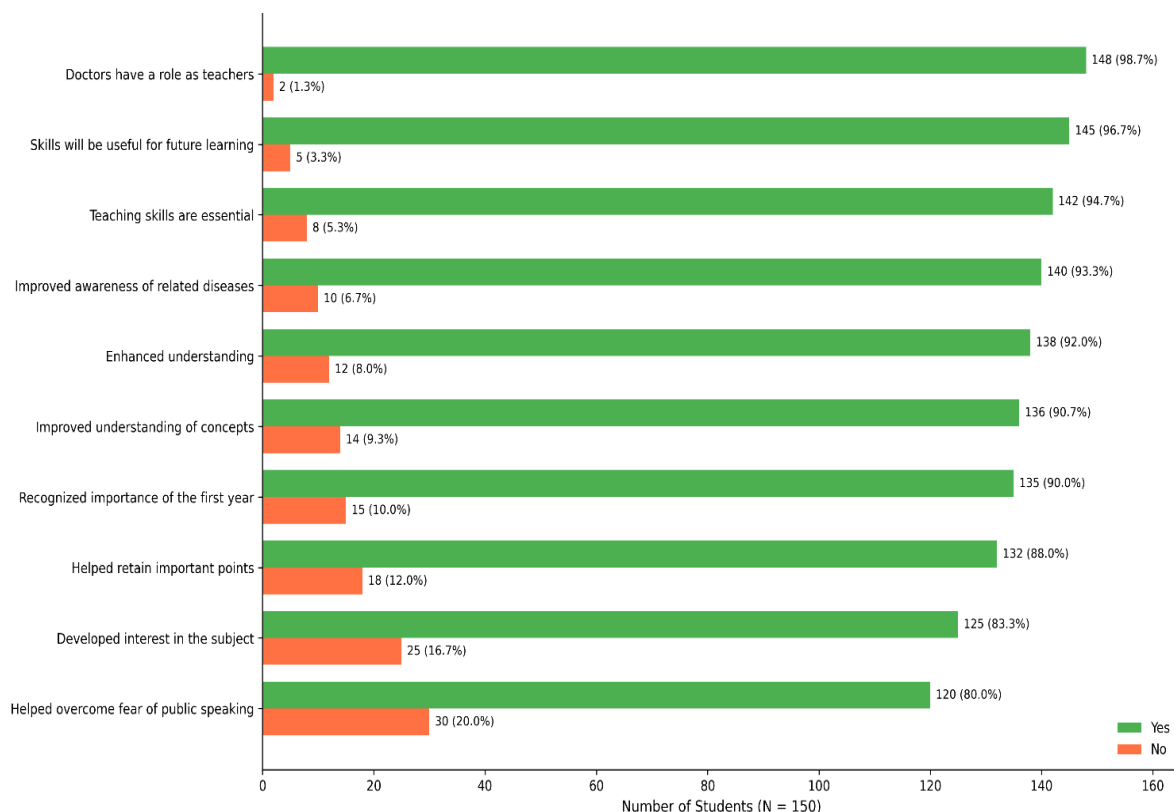


Figure 1: Student Feedback on Student Led Physiology Revision Seminars

DISCUSSION

In this single-group study, first-year MBBS students performed significantly better on a test of knowledge in physiology after participating in student-led revision seminars, and the majority of the students had a positive attitude towards the seminars. Scores increased from a mean score of 5.24 to a mean score of 8.45 out of 10. Improvements were also evident in terms of self-confidence, knowledge acquisition, and understanding the importance of teaching as a responsibility that is part and parcel of their medical profession. Given that there is no comparison group in the study design, these findings demonstrate a correlation rather than causation of the observed outcome.

Knowledge gain

There are several possible explanations for the increase in scores. The process of preparing for a seminar is likely to make learners organize information in their own language in order to teach it to someone else, a concept that is consistent with constructivist theories of learning [4]. Peer teaching sessions in the field of anatomy have been associated with active participation of students in the process of teaching [12]. Those who prepare for delivering a lecture tend to devote more time and effort into studying, an effect known as the protege effect [13]. Experimental research shows that just the expectation of having to teach someone improves memory retention in the learner [14]. Question and answer session at the end of the seminar also might have facilitated this effect, as students had to actively recall the information presented during the seminar.

While this literature is valuable, it should be interpreted cautiously. Systematic review of medical students as peer tutors demonstrated a range of perceived benefits of tutoring, however, there was no significant evidence for the impact of tutoring on the academic performance of tutors themselves [15]. At the same time, a meta-analysis

comparing peer teaching and faculty teaching shows similar outcomes [16], suggesting that peers can serve as credible sources of information.

Attitudes and professional skills

Almost all the students (98.7%) stated that all physicians were teachers, while 96.7% considered the development of these skills would be useful in the future studies. Both answers support the idea of the importance of introducing teaching skills during undergraduate education [7]. Moreover, 93.3% of the students found that the seminars enhanced their understanding of the diseases associated with the revising of physiology knowledge. It is well established that connecting basic sciences with clinical presentations is good for diagnostic skills [17]; thus, asking first-year students to do this during a seminar can be a modest start in developing this skill. This answer reflects the subjective opinion of the students and has not been assessed.

Confidence in public speaking

Eighty percent of the participants answered that the seminars helped them to overcome the fear of public speaking. This is the lowest score among all the ten items; it means that one fifth of the students did not get the same benefit and that maybe one seminar was not enough for some students. One study about micro-teaching in student seminars also showed the positive effects on the confidence of 1st year MBBS students [9]. Maybe repeated structured activities with faculty feedback will help other students to get the same benefits [18].

Generalizability

The generalizability of the present findings should be considered in relation to the institutional setting, participant characteristics, and educational context. This study was

conducted among 150 first-year MBBS students at a single medical institution in Andhra Pradesh, India, using convenience sampling. Therefore, the findings primarily reflect the experiences and learning outcomes of students exposed to a structured, student-led seminar intervention within this particular academic environment. Although the observed improvement in knowledge scores and favorable student perceptions suggest that seminar-based revision may be beneficial in comparable undergraduate medical education settings, differences in institutional resources, teaching practices, student motivation, curriculum structure, and faculty involvement may influence the effectiveness of this approach elsewhere.

Furthermore, the exclusive inclusion of first-year MBBS students limits the applicability of the findings to students in advanced medical training or other healthcare disciplines. The absence of a control group and long-term follow-up assessments also restricts conclusions regarding the independent effectiveness and sustained educational benefits of student-led seminars. Nevertheless, the intervention is compatible with active learning and peer-assisted learning principles, suggesting its potential relevance to medical institutions with similar curricular structures. Multicentre studies involving diverse student populations, different institutional settings, and controlled comparisons are necessary to establish the broader applicability and external validity of these findings.

Conclusion

The present study demonstrates that student-led revision seminars may serve as an effective supplementary teaching strategy in undergraduate physiology education. The statistically significant improvement in post-test knowledge scores, accompanied by favorable student perceptions, suggests that this approach may facilitate knowledge consolidation, conceptual understanding, active

participation, and the development of communication and teaching skills. By encouraging peer-assisted learning, collaborative discussion, and self-directed preparation, student-led seminars offer opportunities to reinforce theoretical knowledge while fostering essential professional competencies among first-year medical students. Incorporating well-structured student-led seminars into conventional physiology teaching programmes may therefore enrich the learning experience and promote greater student engagement.

Limitations

The present study has several limitations. First, the single-group pre-test–post-test quasi-experimental design lacked a control group, making it difficult to attribute the observed improvement in knowledge scores exclusively to the seminar intervention. Factors such as repeated exposure to learning materials, independent study, concurrent classroom teaching, and testing effects may have contributed to the improvement. Second, convenience sampling from a single medical institution limits the representativeness of the study population and restricts the generalizability of the findings to other educational settings. Third, the assessment of knowledge immediately following the seminar intervention did not establish whether the observed improvement was sustained over time. Fourth, the use of a self-reported questionnaire with dichotomous Yes/No responses may have introduced social desirability and response biases and limited the assessment of variations in student perceptions. Finally, the absence of objective assessments of communication, presentation, and teaching skills prevented a comprehensive evaluation of the professional competencies potentially developed through student-led seminars. These limitations indicate the need for controlled, multicentre investigations incorporating validated assessment instruments and longitudinal follow-up.

Recommendations

Based on the study findings, structured student-led seminars may be considered as a supplementary revision strategy alongside conventional physiology teaching methods. Medical educators should consider incorporating opportunities for collaborative preparation, peer teaching, interactive discussion, and faculty-guided feedback to encourage active student participation and reinforce previously acquired knowledge. Particular attention should be given to developing communication and presentation skills, as a proportion of students continued to report difficulties overcoming fear of public speaking.

Future research should employ randomized controlled or controlled quasi-experimental designs to determine the independent effectiveness of seminar-based revision compared with conventional revision strategies. Multicentre investigations involving larger and more diverse student populations are recommended to improve external validity. Additionally, delayed post-intervention assessments should be incorporated to evaluate long-term knowledge retention, while validated assessment instruments may provide a more comprehensive understanding of changes in students' learning experiences, confidence, and professional competencies.

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first-year MBBS students who actively participated in the seminars, knowledge assessments, and feedback sessions. Their enthusiastic involvement and valuable responses contributed significantly to the successful completion of this study.

List of Abbreviations

MBBS: Bachelor of Medicine and Bachelor of Surgery
GEMS&H: Great Eastern Medical School and Hospital
HOD: Head of Department
SD: Standard Deviation
SPSS: Statistical Package for the Social Sciences
IEC: Institutional Ethics Committee
p: Probability value
t: Student's t-test statistic

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Nil

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Data is Available on request.

Author Contributions

Dr. P. Jersey Shiny: Conceptualization, study design, literature review, development of study methodology, coordination of student-led seminars, data collection, interpretation of findings, and preparation of the original manuscript draft.

Dr. Naveen Bhartia Porwal: Supervision of the study, methodological guidance, academic oversight, critical evaluation of study findings, and critical revision of the manuscript for important intellectual content.

Dr. B. R. Sreedevi: Contribution to study planning, development and validation of assessment tools, supervision of educational activities, interpretation of results, and critical review and editing of the manuscript.

Dr. Y. Raghu Srinivas: Coordination of study implementation, data organization, statistical analysis, interpretation of findings, manuscript review and editing, and correspondence during the publication process.

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