

Student-led initiative inculcates research mindset in undergraduate medical students: A pilot study

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ABSTRACT

Background: Research competency is an essential trait of an Indian Medical Graduate, yet structured research training is underexplored in the MBBS curriculum. Students face an immense academic load, hectic schedules, and a lack of mentorship, leading to a poor research mindset and low participation despite interest. Therefore, a peer-led student research club was launched at a rural Indian Medical College to sensitize medical students and improve research skills. Peer-led interactive sessions inculcate a research mindset among undergraduate medical students. **Materials and Methods:** Four MBBS students with research experience designed and implemented a six-session peer-led voluntary course over three months under the mentorship of a faculty member, including interactive teaching, discussions, hands-on tasks, and self-directed assignments. Pre- and post-session questionnaires, the Attitude towards Research Scale, and open-ended feedback were used for evaluation. **Results:** Thirty-nine students initially enrolled, with 16 completing at least 80% of sessions and assignments. Qualitative feedback indicated improved confidence in reading scientific literature, framing research questions, and understanding methodology. Challenges reported were difficulties in finalizing research topics, the need for mentorship, and limited structural thinking. The session satisfaction scores ranged between 4.3 and 4.65. **Conclusion:** Structured, peer-led pedagogical interventions that promote cognitive engagement can significantly enhance students' research orientation. This model is scalable and contextual, aligns with the principles of active and peer learning, and offers a framework for integrating research competencies into the UG medical curriculum.

Keywords: Research mindset, Undergraduate students, Indian Medical Graduate, Medical Education

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INTRODUCTION

Research plays a vital role in advancing medical knowledge, driving the development of new medications, procedures, and tools that enhance diagnosis and treatment. "Critical thinker" and "Researcher" are two recently introduced attributes for Indian Medical Graduates (IMGs).¹ While these initiatives are relatively recent, medical history is rich with discoveries by students, including insulin, the sinoatrial node, and heparin, demonstrating significant scientific contributions.² Consequently, the necessity of integrating research early into the undergraduate curriculum should be viewed as an indisputable priority rather than a matter of debate.

It is known that medical research is valued in postgraduate courses in countries such as the United States and the United Kingdom and is often incorporated into medical curricula there. In the Indian medical system, however, for the Bachelor of Medicine, Bachelor of Surgery (MBBS) degree, there is no compulsory research component.^{3,4} Amidst the extensive syllabus of medical education and a grades-focused examination system, it is common for students to refrain from participating in research-related projects.^{5,6} Alhad et al have noted that a student-led model in the Indian context is justified because it overcomes the mentorship gap and faculty time constraints often found in high-volume public hospitals. It creates a "safe space" for juniors to ask basic questions about research methodology without the fear of being judged by senior faculty, effectively utilizing social and

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cognitive congruence to demystify complex statistical and ethical concepts.⁷

Research is a systematic process that involves critical thinking, identifying problems, refining the study design, data collection, analysis, interpretation, ethical conduct, and publication.⁸ This process enhances students' critical thinking and problem-solving skills, which are vital throughout their careers as healthcare professionals. Introducing healthcare students to research early on is a key strategy for fostering their interest and positive attitude toward it.⁹

Integrating a robust research component into India's formal undergraduate medical curriculum is imperative to address existing gaps and elevate the quality of medical graduates.^{10,11} Despite a significant percentage of students recognizing its importance, participation in research and output remain

Table 1: Learning objectives and expected outcomes for each session conducted

<i>Session</i>	<i>Objective</i>	<i>Outcomes</i>	<i>Evaluation attributes (KSA)</i>
1	To sensitize medical students to the role of curiosity in cultivating research interest and to train them in mindfully reading research papers to conduct effective literature searches.	Participants will be able to nurture curiosity to cultivate a research mindset, comprehend research articles, and conduct a literature search to identify research gaps.	Knowledge: Participants' existing concepts of research/curiosity.
2	To sensitize medical students to advanced features for identifying keywords, classifying papers, and the MeSH framework, and to teach them how to critically read a research paper.	Participants will be able to understand and practice advanced features of PubMed and perform a thoughtful reading of a research paper.	Knowledge: Keywords, authentic sites, special features of PubMed, and importance of critical reading. Skills: Presentation, critical review, selecting the right words, active reading, and reflections. Attitude: Curiosity and observation.
3	To sensitize medical students to various study designs and the process of framing a research question, including a brief introduction to conceptual and theoretical frameworks.	Participants will be able to understand types of study designs, learn to frame a research question, and understand theoretical and conceptual frameworks as a prerequisite for a research proposal.	Knowledge: Types of designs, contextual knowledge, scientific terminology, and evidence-based approach. Skills: Applying correct design, critical thinking, analytical skills, and creativity.
4	To assess students' understanding of study design, data collection, and data analysis; to sensitize them to various parts of a research proposal; and to train them to write a research proposal.	Participants will be able to explain the most appropriate study design for a given project, describe the components of a research proposal, and draft one based on a provided format.	Knowledge: Applicability of study design, research fundamentals, components, and ethics. Skills: Applying the best possible study design, critical thinking, analytical skills, presentation, and communication. Attitude: Identifying feasibility, open-mindedness, and adaptability.
5	Qualitative Research: Guest Lecture		
6	To explore different sampling methods, understand the concept of biases, and provide a foundation in biostatistics.	Participants will be able to explain sampling methods, understand and apply methods to overcome bias, and comprehend the basics of data analysis, data types, and normal distribution.	Knowledge: Available sampling methods, potential biases, and basics of biostatistics. Skills: Applying the right sampling method and methods to overcome biases. Attitude: Building knowledge and application over the foundation.

low¹² Enhancing this aspect will ensure Indian medical graduates meet international standards and contribute to advancing healthcare worldwide. This integration is key to preparing physician-scientists who can innovate and respond to emerging public health challenges.

Following that, we decided to initiate a peer-led activity to inculcate a research mindset during the undergraduate program at a medical college.

MATERIALS AND METHODS

Study Setting

In a tertiary care teaching hospital where teachers have multiple responsibilities, a student-led model helps fill the gap in guidance. It creates a comfortable space where juniors can ask basic research questions freely without feeling judged. With these peer-teaching fundamentals in mind, a core team of four medical students from different academic years was formed to establish a research club to foster a research mindset among undergraduate medical students. The pioneers were those with some prior experience in conducting research independently and as part of teams.

After a series of discussions among themselves and with a faculty mentor, a plan was drafted, with the details in Table 1. Following the initial planning, permission was sought from the Dean of the medical college and the Associate Dean of Student Affairs. The Institutional Ethics Committee was informed and subsequently granted a waiver, as the proposal was classified as an internal academic activity. The idea was presented to all medical students in the college, who were informed by the core team members about the purpose and expected outcomes of this activity. They were also told that this was a non-mandatory activity, open to students of all years of the undergraduate medical course.

The research club was formed with the following objectives:

- To sensitize students to the world of research, enhancing critical thinking, developing research skills, and encouraging a deeper understanding of research.
- To provide a platform where students can explore, analyze, and discuss academic research articles.
- To serve as a forum where students, regardless of their prior experience with research, can come together to learn and grow in a collaborative setting.

The first phase of the activity was to introduce undergraduate

Table 2: Description of the session-wise self-directed activities

Session 1:	Participants were tasked with identifying a topic of their interest, searching for five related articles, and reading and analyzing these papers as taught in the session.
Session 2:	Each participant was required to select one paper, read it thoroughly, annotate key points and ideas, and analyze the content.
Session 3:	Each participant was required to formulate an appropriate research question, building upon their previous work.
Session 4:	The purpose of these two sessions was to provide a broader perspective, motivating students to initiate their own projects, explore relevant literature, and develop research proposals. Also, in alignment with the guest lecture (Session 5), students were encouraged to identify components of qualitative research
Session 5:	
Session 6:	Participants were required to perform sample size calculations relevant to their research question and to apply appropriate statistical methods.

medical students to basic concepts of research methodology and initiate them to be curious and generate research ideas.

Sessions

Over three months (September 17 to December 17, 2024), students conducted five systematically planned sessions along with an additional expert lecture focused on qualitative research (Total 6 sessions). Each session was developed with clearly defined objectives, specific learning outcomes, and a structured self-directed learning component.

The sessions blended didactic instruction with group discussions and interactive exercises, ensuring meaningful hands-on engagement for participants. Selected articles from reputable journals, carefully chosen to suit learners across different academic levels, were used to facilitate understanding. Furthermore, the expert lecture on qualitative research enriched the program by broadening participants' perspectives and strengthening their grasp of research methodologies (Table 2). Pre-session preparations and on-site sessions were supervised by the faculty with experience in health professions education. A diagram of the module's workflow is shown in Figure 1.

The entire module was divided into the following sections:

Pre-Session Preparations and Participant Expectations

Before the first session, a Google Form was circulated to collect participants' expectations for the research club activities and their research backgrounds. Most students joined the Journal Club to enhance their research skills, prepare for postgraduate education, and develop critical thinking and analysis. Many aimed to improve their presentation and discussion skills while staying up to date on current medical literature. A key area of interest was understanding research methodology, along with presentation skills, writing and summarising articles, and improving literature search techniques.

Session Structure and Participation

Detailed session plans were prepared to ensure alignment with specific objectives, learning outcomes, and competencies expected of an Indian Medical Graduate (IMG). Each session, lasting 1.25 to 1.5 hours, was conducted on the institute's premises after regular teaching hours. Participation was entirely voluntary, with no prerequisites. However, it was pre-decided that participants must attend at least 80% of the

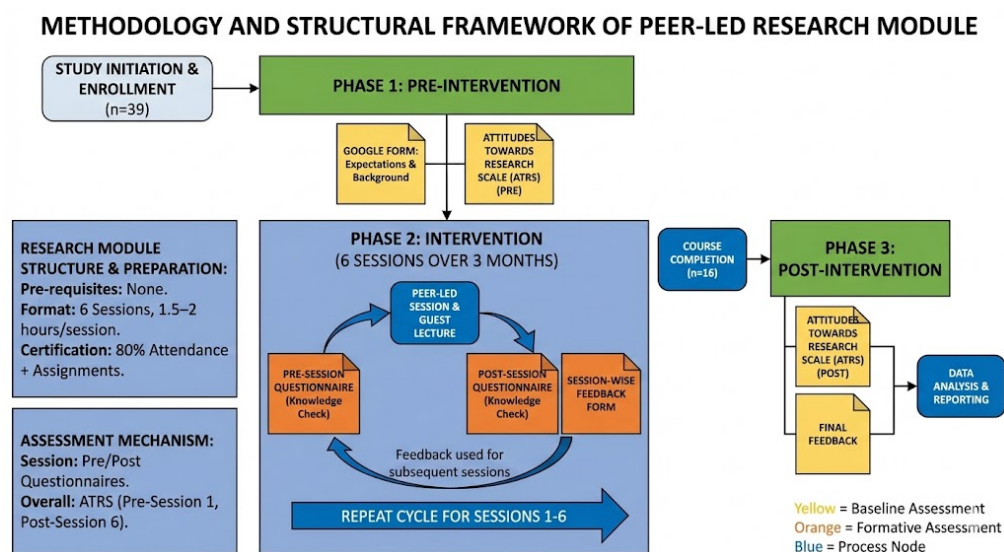


Figure 1: Diagrammatic representation of the workflow of the entire module

sessions and submit their assignments within the stipulated time frame to qualify for a certificate of completion for the series. On average, each session was attended by 15 to 20 students.

Assessment and Feedback Mechanism

To assess the effectiveness of each session, pre- and post-session questionnaires were developed to align with the session-specific objectives. At the start of the first session and after the final session, participants completed the "Attitude Towards Research Scale" questionnaire to evaluate changes in their perception of research.

The Attitudes Toward Research Scale¹³ (ATR Scale; Papanastasiou, 2005) was developed to measure students' attitudes toward research (ATR). Across a sample of undergraduate students, item development processes, and exploratory factor analysis, a 32-item measure was produced across 5 constructs: Research usefulness, Research anxiety, Positive attitudes, Relevance to life, and Difficulty of research. Items were rated using a 7-point Likert scale.

After each session, a feedback form was circulated, and responses were analyzed. Key conclusions from the feedback were shared with participants in subsequent sessions to ensure continuous improvement and engagement.

Following the final session, a thematic analysis was conducted on the responses to the open-ended feedback questions. This analysis was performed by the mentoring professor, who has qualitative expertise. The research team subsequently reviewed the findings, and any interpretive discrepancies were resolved through consensus discussions.

RESULTS

Details of Participants

A total of 39 students from the second, third, and final professional years initially enrolled in the course, of whom 16 completed it. Among the participants who completed the course, 6 were male, and 10 were female. Yearwise, the cohort included 9 students from the 2nd Professional Year, 4 from the 3rd Professional year, and 3 from the final professional year.

Attitude Towards Research Scale (ATRS)

Data from the ATR scale were analyzed to evaluate changes in participants' attitudes toward research following the session (N = 13).

At baseline (pre-session), participants demonstrated a fundamentally positive attitude toward research, yielding a mean total score of 167.08 (SD = 16.92), well above the scale's neutral midpoint of 128. Following the session (post-session), the mean total score increased slightly to 170.15 (SD = 23.36). A paired-samples t-test indicated that the overall change in composite scores was not statistically significant, $t(12) = 0.61$, $p = 0.55$.

Multidimensional Sub-Scale Analysis

An independent analysis of the five ATR sub-scales revealed

a nuanced shift in participant perceptions following the session. While the perceived professional utility of research improved, there were marginal declines in intrinsic enjoyment and perceived relevance to daily life. Additionally, participants reported slight increases in both anxiety and perceived difficulty. This pattern reflects a common pedagogical phenomenon in methodology training: as participants gain a more realistic understanding of the complex rigors of research, their apprehension and sense of difficulty naturally rise. Crucially, however, this increased awareness of the challenges involved did not diminish their appreciation for the subject; rather, it was accompanied by a stronger recognition of its professional value.

Feedback and Qualitative Analysis

The open comments of participants who completed the entire course were thematically analyzed. The aim was to extract qualitative insights and correlate them with the quantitative metrics from responses. The comments were primarily focused on (a) Key takeaways from the event, (b) Additional suggestions/comments, (c) Reasons for difficulty in progressing with research, and (d) Correlation between participation, satisfaction, and perceived learning.

Table 3 combines the major themes from key takeaways, additional comments, and participants' challenges. It summarises each theme with a brief description and a representative quote to illustrate the participants' perspectives. It provides a comprehensive view of learning outcomes, suggestions, and barriers experienced during the sessions. Additionally, the feedback form included a series of questions rated on a 1–5 Likert scale, as shown in Figure 2.

The Correlation Analysis

The correlation analysis reveals that Learning Relevance is the strongest driver of Overall Satisfaction ($r = 0.65$). While Session Attendance shows a moderate association with satisfaction ($r = 0.40$), its association with learning relevance is notably weaker ($r = 0.27$). This suggests that while participation helps, the perceived value of the content itself is the primary factor in student happiness.

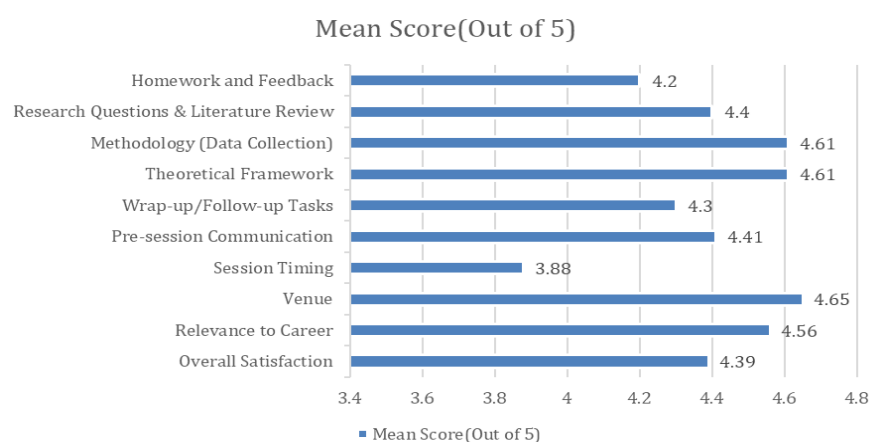
When the recommendations were analyzed, it was found that participants reported that session timing and flexibility had increased the interactive components in each session. They also recommended implementing structured mentorship and providing support for topic finalization. Follow-up sessions focused on narrowing research questions and writing a framework were also suggested.

Long-term Impact

The intervention's long-term impact was demonstrated by a continued rise in independent research activity. In the 18 months after completing the course, six participants ($n=6$) moved from being guided learners to leading their own research projects. The projects covered different medical fields, indicating that the skills gained were applied across a range of clinical interests.

Table 3: Key takeaways, suggestions, and challenges based on the thematic analysis of the feedback of participants

Theme	Description	Representative comment
Understanding Research Fundamentals	Enhanced ability to read research papers, identify gaps, and frame research questions	"Engaging in research during MBBS develops a scientific temperament."
Clarity on Methodology and Proposal Writing	Improved understanding of research frameworks, sampling techniques, proposal structure, and ethical considerations	"Learned how to choose methodology and sample size."
Positive Feedback	Informative and well-structured sessions offering meaningful learning experiences	"The sessions offer valuable learning experiences."
Suggestions for Improvement	Need for more interaction, better mentorship, and increased engagement	"Better interaction can be carried out."
Topic Finalization Challenges	Difficulty narrowing down broad topics or forming specific research questions	"Not able to narrow down my ideas regarding the topic."
Need for Guidance	Lack of structured thinking, mentorship, or step-by-step support	"Still need reasonable thinking."
Limited Research Ownership	Passive involvement and insufficient initiative; need for stronger post-session support	"Enhance post-session mentorship."

**Figure 2:** Quantitative satisfaction analysis

DISCUSSION

This study demonstrates the effectiveness of a peer-led research club in inculcating a research mindset among medical students. It also highlights the role of such peer-led activities in enhancing research literacy and motivation in the Indian medical education context. The primary objective of assessing participants using the Attitudes Toward Research (ATR) scale, complemented by post-session feedback analysis (N = 18), was to determine the multidimensional impact of the training on perceptions of research methodology. While the overall composite ATR score demonstrated a slight, non-significant increase, integrating these findings with the qualitative and quantitative feedback provides critical insights into the participants' cognitive shift.

Our results show that a 3-month-long, 6-session peer-led learning program can substantially improve students' understanding of research fundamentals, including the basic attributes of a researcher, approaches to reading and analyzing a paper, search strategies, literature review, methodology, proposal writing, and biostatistics. These findings are supported by previous studies showing that early

exposure to research activities can foster critical thinking, analytical skills, and a scientific temperament among medical students.¹⁴⁻¹⁶ There is strong evidence that early involvement in research boosts both short- and long-term scientific engagement. It is also evident that students who participate in research during their early academic days are much more likely to stay involved in research later in their careers, often even choosing to pursue academic paths.¹⁷

The attrition from 39 initially enrolled students to 16 completers is attributed to the program's voluntary, after-hours design, which competes with a demanding medical curriculum. Although this resulting self-selection bias limits the study's broader generalizability, the substantial improvement in attitudes among the remaining participants preserves the internal validity of the peer-led pedagogical model.

The lack of statistical significance in the overall ATR score shift can be largely attributed to a sort of 'ceiling effect.' Participants entered the session with a high pre-session mean of 167.08, indicating highly favorable baseline views. This positive result was strongly corroborated by post-session quantitative feedback, in which participants rated

"Overall Satisfaction" at 4.39/5 and "Relevance to Career" exceptionally high at 4.56/5.

The increase in the ATR sub-scale for Research Usefulness in Profession aligns directly with qualitative themes extracted from the feedback. Participants noted that the session helped them realize that "engaging in research... develops a scientific temperament" and improved their awareness of research proposals and ethical considerations. Existing literature from the Indian medical education context also extensively supports this finding; structured exposure to research fundamentals, such as those emphasized by the Competency-Based Medical Education (CBME), significantly enhances students' perceived value of academic inquiry for their future clinical careers.^{18,19} A strong positive correlation ($r = 0.65$) between overall satisfaction and learning relevance further underscores that overall acceptance of the methodology improves when Indian medical students perceive the content as relevant to their careers.

The most notable finding emerges from comparing the ATR affective sub-scales (Anxiety and Difficulty) with the qualitative feedback. Following the session, participants' scores reflecting Research Anxiety and Research Difficulty indicated slightly higher levels of stress and perceived complexity.

The qualitative feedback contextualizes this as a "reality check." When asked for the reasons for difficulty in progressing with research, participants cited "broad interests," an inability to "narrow down ideas," and a lack of "structured thinking." As participants transitioned from a superficial understanding to actively confronting the complexities of methodology (e.g., choosing sample sizes, theoretical frameworks, and identifying research gaps), they moved from unconscious incompetence to conscious incompetence. This can, in some ways, be explained by the Dunning-Kruger Effect, wherein the more a person knows, the less confident they are of their understanding, since knowing a subject also entails the realization of its true depth.²⁰

This divergence, where research is viewed as highly useful but simultaneously anxiety-inducing, is well-documented theoretically by Papanastasiou,¹³ who demonstrated that "usefulness" domains are grouped entirely separately from "anxiety" domains. Practically, within the Indian context, this is corroborated by recent multicentric and cross-sectional studies indicating that while over 90% of medical students acknowledge the importance of research, the transition from theoretical knowledge to practical application often causes anxiety due to recognized barriers like time management, formulating a research question, and methodological intimidation.^{21,22}

The realization of research difficulty, coupled with the reported "Limited Research Ownership" in the qualitative feedback, highlights a critical need for post-session support. Participants explicitly requested "structured mentorship" and "more interaction." While the didactic elements (e.g.,

Methodology and Theoretical Frameworks) received high ratings (4.61/5), the anxiety shown in the ATR scale reflects the daunting prospect of pursuing a project independently.^{21,23} As highlighted by recent studies, helping students transition from passive learners to confident researchers requires sustained, structured mentorship to navigate an already demanding undergraduate curriculum.^{24,25}

Future iterations of this program must address the lower-rated logistical elements (e.g., Session Timing: 3.88/5) and implement follow-up workshops specifically focused on narrowing research questions, hence to some extent relieving the anxiety and perceived difficulty highlighted in the scale, and fostering the self-directed learning required for successful medical research. The long-term impact of the intervention was reflected in continued independent scholarly engagement that extended beyond the formal course period.

This shift from supervised participation to independent project leadership suggests that the curriculum effectively fostered research self-efficacy, which is a critical predictor of long-term academic productivity in medical education. This aligns with existing literature suggesting that structured research modules in undergraduate medical education (UME) do not merely produce task-specific skills but rather cultivate a "researcher identity" that persists across various clinical interests.^{17,26}

LIMITATIONS AND RECOMMENDATIONS

This study has several limitations. The sample size was small with high attrition, participation was voluntary, and the intervention was limited to a single institution, potentially affecting generalizability. The short follow-up period precludes assessment of long-term impact on research productivity or career choices. Additionally, self-selection bias may have resulted in a cohort already inclined toward research. Based on participant feedback and analysis, future iterations should incorporate more interactive sessions, flexible scheduling, and structured mentorship, especially in the early stages of topic selection and proposal writing. While this pilot study showed positive immediate results, future research should track students over several years across multiple institutions. This would help determine if early exposure truly leads to long-term achievements, such as publishing in medical journals or choosing a career as a physician-scientist.

CONCLUSION

To conclude, this study provides promising evidence that structured, student-led research clubs can significantly enhance research skills, attitudes, and motivation among medical undergraduates in India. Such initiatives represent a practical step toward bridging the research gap in Indian medical education and preparing future clinicians for evidence-based practice.

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PEER-REVIEWED CERTIFICATION

During the review of this manuscript, a double-blind peer-review policy has been followed. The author(s) of this manuscript received review comments from a minimum of two peer-reviewers. Author(s) submitted revised manuscript as per the comments of the assigned reviewers. On the basis of revision(s) done by the author(s) and compliance to the Reviewers' comments on the manuscript, Editor(s) has approved the revised manuscript for final publication.