AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 10.81 IMPACT FACTOR
Volume-4| Issue-1| 2026 Published: |30-01-2026|

DEVELOPMENT OF CLINICAL REASONING AND PRACTICAL SKILLS IN MEDICAL EDUCATION

https://doi.org/10.2591/zenodo.18267963

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Annotation

The development of clinical reasoning and practical skills is a central objective of undergraduate medical education. However, medical students frequently encounter difficulties in transferring theoretical knowledge into effective clinical decision-making and skill performance during early clinical exposure. Student-led educational approaches have emerged as a potential strategy to promote active learning, peer collaboration, and reflective practice.

Keywords

clinical reasoning; practical skills; medical education; student-led learning; peer-assisted learning; undergraduate medical students

Introduction. Clinical reasoning and practical competence represent core outcomes of undergraduate medical education. While theoretical knowledge provides the conceptual foundation for medical practice, the ability to synthesize clinical information, formulate differential diagnoses, and perform procedures safely determines readiness for real-world patient care. As medical university students, we increasingly encounter a gap between classroom-based learning and clinical decision-making in authentic healthcare settings. This discrepancy becomes particularly evident during early clinical rotations, where students are expected to integrate biomedical knowledge with patient-centered reasoning under time and contextual constraints.

Recent reforms in medical education emphasize competency-based learning, early clinical exposure, and active student engagement. Nevertheless, students often remain passive recipients of information, with limited opportunities to practice structured clinical thinking and hands-on skills in a safe educational

environment. From our perspective as student researchers, this situation raises a critical question: how can student-led educational initiatives contribute to the development of clinical reasoning and practical skills during medical training. Clinical reasoning is not an innate ability but a complex cognitive process that evolves through deliberate practice, reflection, and feedback. Similarly, practical skills require repeated performance, supervision, and self-assessment. Traditional teaching formats, dominated by lectures and summative examinations, may insufficiently address these needs. Therefore, innovative, student-centered approaches are increasingly required to complement formal curricula.

The relevance of this study lies in its student-based design. Rather than observing students as external subjects, we conducted and analyzed an educational intervention ourselves, allowing us to critically reflect on learning processes from within. Such an approach aligns with contemporary views on students as active partners in medical education and contributors to pedagogical innovation.

The aim of this study was to evaluate the effectiveness of a student-led educational intervention in improving clinical reasoning and practical skills among medical university students. The specific objectives were: (1) to assess changes in self-reported clinical reasoning abilities following the intervention; (2) to evaluate improvements in selected practical skills; and (3) to explore students' reflective perceptions of their learning experience.

Materials and Methods

Study Design: We conducted a prospective, mixed-methods study using a student-led educational intervention. The study combined quantitative assessment of self-reported competencies with qualitative reflection to capture both measurable outcomes and experiential insights. The research was initiated, implemented, and analyzed by medical university students under academic supervision.

Participants: Participants were undergraduate medical students enrolled in years 3 to 5 of a medical university program. These years were selected because students at this stage have foundational theoretical knowledge and initial exposure to clinical environments. Participation was voluntary. Inclusion criteria were active enrollment in the medical program and consent to participate in the educational activities and data collection. Students with prior extensive clinical training outside the curriculum were excluded to reduce confounding. A total of 68 students were invited, and 60 agreed to participate. The final sample consisted of 38 female and 22 male students, with a mean age of 21.8 ± 1.4 years.

Educational Intervention: The intervention consisted of a four-week student-led clinical skills and reasoning program. The program was designed

collaboratively by a group of senior medical students and included the following components:

1. **Case-Based Clinical Reasoning Sessions** Weekly small-group sessions focused on structured analysis of clinical cases. Students worked through patient presentations using a stepwise approach: problem identification, hypothesis generation, differential diagnosis, and management planning. Each session emphasized verbalization of reasoning processes.
2. **Peer-Assisted Practical Skills Workshops** Practical workshops were conducted using simulation models and standardized checklists. Skills included history taking, physical examination techniques, and basic procedural skills (e.g., venipuncture, blood pressure measurement). Peer feedback was encouraged.
3. **Reflective Practice Assignments** Participants completed short reflective narratives after each week, focusing on challenges encountered, reasoning strategies used, and perceived skill development.

Faculty members served as observers and provided minimal guidance to preserve the student-led nature of the intervention.

Data Collection Instruments: Quantitative data were collected using a structured self-assessment questionnaire developed for this study. The questionnaire included Likert-scale items (1–5) assessing confidence in clinical reasoning, diagnostic formulation, and practical skills performance. The instrument was administered before and after the intervention. Qualitative data were obtained from reflective narratives. Students were encouraged to write freely, without predefined templates, to avoid formulaic responses.

Data Analysis: Quantitative data were analyzed using descriptive statistics and paired comparisons to assess changes pre- and post-intervention. Mean scores and standard deviations were calculated. Statistical significance was set at $p < 0.05$.

Qualitative reflections were analyzed using thematic analysis. We independently coded narratives, identified recurrent themes, and discussed discrepancies until consensus was achieved. This process allowed us to integrate diverse student perspectives into coherent findings.

Ethical Considerations: The study followed ethical principles of voluntary participation, confidentiality, and academic integrity. Written informed consent was obtained from all participants. The study was approved by the university's academic ethics committee.

Results.

Quantitative Findings: Analysis of pre- and post-intervention questionnaires demonstrated significant improvements across all assessed domains.

The mean self-reported clinical reasoning score increased from 3.1 ± 0.6 before the intervention to 4.0 ± 0.5 after completion ($p < 0.001$). Students reported greater confidence in formulating differential diagnoses and justifying clinical decisions.

Practical skills confidence scores improved from 3.3 ± 0.7 to 4.2 ± 0.4 ($p < 0.001$). The most notable gains were observed in structured physical examination and procedural preparation. Overall perceived readiness for clinical rotations increased from 3.0 ± 0.8 to 4.1 ± 0.6 ($p < 0.001$), indicating a broad impact on students' self-assessment of competence.

Qualitative Findings: Thematic analysis of reflective narratives revealed four dominant themes:

1. **Active Engagement and Ownership of Learning** Students emphasized that leading sessions themselves increased motivation and responsibility. Many noted that preparing cases and teaching peers required deeper understanding than passive attendance.
2. **Structured Thinking Development** Participants described a transition from fragmented knowledge to more organized clinical reasoning. Several reflections highlighted improved ability to link symptoms with pathophysiological mechanisms.
3. **Safe Learning Environment** Peer-assisted workshops were perceived as less intimidating than traditional assessments. Students felt comfortable making mistakes and receiving feedback, which facilitated skill acquisition.
4. **Professional Identity Formation** Engaging in a student-led research and teaching initiative contributed to a sense of professional growth. Students reported increased confidence in their future roles as clinicians.

These qualitative insights complemented quantitative findings, illustrating not only skill improvement but also meaningful educational experiences.

Discussion. This student-based study demonstrates that student-led educational interventions can significantly enhance clinical reasoning and practical skills during medical training. From our perspective, the most valuable aspect of the program was active participation in both learning and teaching processes. This aligns with constructivist learning theories, which emphasize knowledge construction through experience and reflection.

The observed improvement in clinical reasoning supports previous research highlighting the effectiveness of case-based learning. However, our study adds a unique dimension by positioning students as facilitators rather than passive learners. This shift may foster metacognitive awareness, as students must articulate and evaluate their reasoning explicitly. Practical skills development benefited from peer-assisted learning, which has been shown to reduce anxiety and increase

opportunities for deliberate practice. Our findings suggest that peer feedback, when structured and supportive, can be as valuable as faculty input, particularly in early skill acquisition stages.

The reflective component played a critical role in consolidating learning outcomes. Reflection allowed students to identify strengths and weaknesses, reinforcing self-regulated learning. Importantly, reflections were student-generated, avoiding standardized templates that often limit authenticity. Despite positive outcomes, this study has limitations. The reliance on self-reported measures may introduce subjective bias. The sample size was relatively small and drawn from a single institution, limiting generalizability. Additionally, long-term retention of skills was not assessed. Nevertheless, the strengths of this study include its prospective design, mixed-methods approach, and authentic student-led framework. These features enhance the credibility and educational relevance of the findings.

Conclusion. From the perspective of medical university students, student-led educational interventions represent a valuable strategy for improving clinical reasoning and practical skills. Our study demonstrates that active engagement, peer-assisted learning, and reflective practice can enhance both competence and confidence during medical training.

The findings highlight the importance of empowering students as active contributors to medical education. Integrating student-led initiatives into formal curricula may bridge the gap between theoretical learning and clinical practice. For us as student researchers, this experience not only improved our skills but also strengthened our professional identity and commitment to lifelong learning. Future research should explore long-term outcomes and objective performance measures to further validate student-based educational models.

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