Research Article

Artificial Intelligence Enhanced Collaborative Learning Among Medical and Non-Medical Students – A Comparative Cross-Sectional Study

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Abstract

Introduction: The integration of Artificial Intelligence into educational methodologies, particularly AI-enhanced collaborative learning (AI-ECL), has garnered significant attention in recent years. AI promises to transform educational experiences by enhancing critical thinking and problem-solving skills.

Objective: This study aimed to evaluate and compare the experiences, perceptions, and outcomes of AI-ECL among undergraduate medical and non-medical students in various colleges in Lahore, Pakistan.

Methods: A comparative cross-sectional study was conducted with 195 undergraduate students, including 101 medical and 94 non-medical students. Data were collected through a pre-tested self-administered, closed ended proforma and analyzed using descriptive statistics and chi-square tests to assess differences between the two groups.

Results: The findings revealed that a majority of medical (85.1%) and non-medical (80.9%) students reported using AI tools for learning or assignments. Medical students were more likely to trust AI with personal data and believed in its significant role in the future of education (92.1% vs. 77.7%). Significant differences were noted in AI usage for medical studies ($p < 0.001$) and trust in AI handling personal data ($p = 0.019$). However, both groups expressed similar confidence in using AI for learning.

Conclusion: AI-ECL was positively perceived by both groups, but medical students showed higher acceptance and trust. Addressing these trust issues is essential, along with ensuring AI tools meet the specific needs of different disciplines to enhance educational outcomes.

Keywords: Artificial intelligence, Collaborative learning, Education

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Introduction

The integration of artificial intelligence (AI) into educational methodologies has garnered substantial attention, particularly in enhancing collaborative learning. AI-enhanced collaborative learning (AI-ECL) makes use of intelligent design to facilitate and optimize students' collaborative efforts. It provides personalized support, real-time feedback, and adaptive learning strategies. These technological inno- vations promise to transform the educational experiences by fostering deeper understanding, critical thinking skills and problem-solving skills in students.[1]

The use of AI in education spans a variety of areas, including intelligent instruction system, flexible learning environments and collaborations. AI powered tools are capable of analyzing student interactions, identifying learning gaps and providing customized interventions.[2] Such systems are especially valuable in collaborative learning environments, where they can mediate and enhance group outcomes, ensure equitable participation, and incorporate student contributions.[3] Defined as the instructional use of small groups to promote students working together to maximize their own and each other's learning, Collaborative learning has been shown to enhance academic achievements, interpersonal skills, and self-esteem.[4,5] It has shown to encourage active participation, fostering a sense of community, enabling critical thinking and communication skills.[6]

Medical education, with rigorous curriculum and high stakes, presents unique challenges and opportunities for collaborative learning. Medical students often participate in problem-based learning (PBL) and clinical simulations that require

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group work and peer learning.[7] The adoption of AI-ECL in medical education could enhance this collaborative learning, leading to more personalized and efficient learning pathways.[8] In contrast, nonmedical students, who may have a wide variety of academic and learning environments, may experience different AI-ECL impacts due to differences in curriculum, learning styles, and educational objectives.[9]

Despite the growing literature on AI in education, comparative studies examining the impact ofAI-ECLon student populations are scarce. In particular, there is a lack of empirical evidence comparing medical student experiences and outcomes with those of non-medical students in AI-advanced collaborative learning environments. This study aimed to fill this gap by conducting a comparative cross-sectional study to examine how AI-ECL affects the learning outcomes, engagement, and administration of these two different sectors.

Understanding the unique effects of AI-ECL on student populations can provide valuable insights for educators and policymakers. By tailoring AI-ECL services to the specific needs of different disciplines, educational institutions can improve academic achievement and better prepare students for their professional careers. Furthermore, this study contributed to the growing body of knowledge about AI in education, highlighting the potential and challenges of integrating advanced technologies into collaborative learning environments.

Methodology

A comparative cross-sectional study was carried out in medical and non- medical colleges of Lahore to evaluate the impact of AI enhanced collaborative learning among undergraduate students. A non-probability consecutive sampling technique was used for participants in study after obtaining ethical approval from Institutional Review Board.

A sample size of 195 undergraduate students was calculated to achieve an absolute accuracy of ±5% with 95% confidence interval having an expected response rate of 85.8%.[10] Inclusion criteria of this survey included undergraduate students. Graduates and staff were excluded in order to maintain a focus on undergraduate group.

Data were collected with the help of pre-tested and self-administered, closed ended proforma which was distributed through google forms. The performa was adopted from similar previous studies and consisted of questions based on biodata of the participants like name, age, year of study, knowledge and attitude towards AI resources, use of AI in personalized patient care environments, health systems and public health scenarios, impact of AI on medical profession, ethics of AI utilization and AI in medical education.[11]

Collected data were entered and analyzed using SPSS software version 23.0. For descriptive analysis, mean and standard deviations were calculated while percentages and frequencies were given for categorical variables. Chi square tests were used for categorical variables and p-value (<0.05) was considered significant

Results

A total of 195 undergraduate students participated in this study. 101 participants were from medical fields and 94 from non-medical fields. The ages of the participants ranged from 17 to 32 years, with an average age of 21.59 years (SD = 2.465). Most participants fell between the ages of 18 and 24 years. No significant differences in the age distribution

Table 1: *Comparison of Medical and Non-Medical Students' Perspectives on the Use of AI in Education and Learning, Highlighting Non-Significant Differences*

Variables		Field of Study	Frequency (n)	Percentage (%)	P value
Use of AI Tools for Studying or Completing Assignments		Medical	86	85.1%	0.424
		Non-Medical	76	80.9%	
Confidence in Using AI tools for Learning		Medical	74	73.3%	0.427
		Non-Medical	64	68.1%	
Improvement in understanding complex subjects		Medical	80	79.2%	0.077
		Non-Medical	64	68.1%	
Engagement in AI-Based Collaborative Learning vs. Traditional Methods	AI-Based Collaborative Learning	Medical	57	55.9	0.875
	Traditional Methods	Medical	44	43.1	
		Non-Medical	42	44.7	
Potential Replacement of Traditional Classroom Learning with AI	Believe AI can replace	Medical	48	47.1%	0.803
	Believe AI can't replace	Non-Medical	43	45.7%	
		Medical	53	52.0%	
		Non-Medical	51	54.3%	

were observed between the medical and non-medical undergraduate students. Table 1 and Table 2 provide a summary of the demographic characteristics and key results of this study.

Out of the 195 participants, 162 undergraduate students (83.1%) reported using AI tools for studying or completing their assignments. This included 86 medical students (85.1%) and 76 non-medical students (80.9%). A chi-square test revealed no statistically significant difference between the two groups (p = .424).

A total of 138 students (70.8%) expressed confidence in using AI tools for learning, including 74 medical students (73.3%) and 64 non-medical students (68.1%). The difference between the two groups was not statistically significant (p = .427).

Of the respondents, 144 students (73.8%) believed that AI tools helped them understand complex subjects. This included 80 medical students (79.2%) and 64 non-medical students (68.1%). However, this difference was not statistically significant (p = .077).

A total of 109 students (55.9%) engaged in AI-based collaborative learning, including 57 medical students and 52 non-medical students. In contrast, 86 students (44.1%) preferred traditional methods of learning. The chi-square test indicated no significant difference between the two groups (p = .875).

A total of 91 students (46.7%) believed that AI could replace traditional classroom learning, while 104 students (53.3%) disagreed. This distribution was consistent across both medical and non-medical students, with no significant difference (p = .803).

Significant differences were observed in the use of AI tools specifically for medical studies. Among the respondents,

Table 2: *Comparison of Medical and Non-Medical Students' Perspectives on the Use of AI in Education and Learning, Highlighting Significant Differences*

Variables	Field of Study	Frequency (n)	Percentage (%)	p-value
Use of AI Tools for Medical Studies	Medical	81	80.20%	<0.001
	Non-Medical	36	38.30%	
Trust in AI Tools for Handling Personal Data	Medical	50	49.5%	0.019
	Medical	31	33.0%	
Role of AI in Future Education	Medical	93	92.10%	0.005
	Non-Medical	73	77.7%	

81 medical students (80.2%) reported using AI tools for medical studies, compared to 36 non-medical students (38.3%). This difference was statistically significant (p < .001).

Asignificant proportion of medical students (49.5%) trusted AI tools for handling personal data, compared to 33.0% of non-medical students. This difference was statistically significant (p = .019).

When asked about the future role of AI in education, 166 students (85.1%) believed that AI would play a significant role. Specifically, 93 medical students (92.1%) and 73 non-medical students (77.7%) held this view, with a statistically significant difference between the groups (p = .005).

Discussion:

Artificial intelligence has gained popularity in recent years and there has been a rise in interest in researching its possible educational uses.[12] Growing amount of interest has been generated recently by the emergence of artificial intelligence in healthcare, with potential uses in numerous medical fields.[13] The study's results provided an in-depth look into the perceptions and experiences of both medical and non-medical students regarding the use of artificial intelligence (AI) in their classrooms. The data showed a number of important themes that illustrated the benefits and drawbacks of incorporating AI into educational environments.

A significant majority of both medical and non-medical students believed that AI positively impacted their grades, with medical students showing a higher level of agreement (78% vs. 64%). This suggested that students recognized the benefits of AI in enhancing their academic performance. Additionally, a substantial proportion of students from both groups agreed that AI adapted to their learning pace and style, indicating that AI technologies were effectively personalized and responsive to individual needs. Similar studies conducted revealed that the students who use AI machine learning as adduced from the various studies, can benefit from a better and more comprehensive learning experience. AI uses machine learning to assess capabilities and needs, and then uses the results of that analysis to develop and distribute personalized or customized content, that increases learning by ensuring higher uptake and retention.[14]

Trust in AI with personal data presented a notable divide, especially among non-medical students. While medical students were almost evenly split on this issue, a majority of non-medical students did not trust AI with their personal data (67% no). This discrepancy highlighted a critical area for further investigation and improvement, as trust is a fundamental component in the acceptance and successful integration of AI in education. A study conducted in Turkey stated that nearly half of the participants agreed that they could protect their professional confidentiality when using artificial intelligence applications (44.7%); whereas, 16.1% argued

that artificial intelligence in medicine might cause violations of professional confidentiality.[15]

Both groups of students recognized the significant role that AI will play in future education, with medical students showing a stronger consensus (92% vs. 78%). This high level of agreement underscored the perceived importance of AI in shaping the future of learning and suggested a readiness among students to embrace AI-driven educational tools. A study conducted in Canada had similar views that AI will revolutionize medicine in near future.[16] The willingness to recommend AI tools to others was high among both medical (86%) and non-medical (81%) students, reflecting a positive overall attitude towards AI. Furthermore, a slight majority of students found AI more engaging than traditional learning methods, though the difference was not pronounced (57% medical vs. 52% non-medical). This indicated that AI had the potential to make learning more interactive and interesting. A study conducted by Indonesian researchers got similar results that almost 61.7% students found learning with the use of AI far more interesting.[17]

Opinions on whether AI could replace traditional learning methods were mixed. A slight majority of both groups disagreed with the notion that AI could fully replace traditional learning, with 52% of medical and 54% of nonmedical students expressing this view. This suggested that while AI was a valuable supplementary tool, there remained a belief in the importance of traditional educational methods. On the contrary, a professor at the University of Extremadura in Spain conducted a study that revealed that AI enhanced collaborative learning enables students to work together to explore and understand concepts, enabling a more profound understanding that can be achieved with traditional teaching methods.[18]

Medical students reported higher usage of AI for their studies compared to non-medical students, particularly in the context of medical studies (81% vs. 38%). This difference may be attributed to the specific applications and advantages of AI in the medical field. Both groups found AI relatively accessible, though medical students reported a higher ease of accessi- bility (81% vs. 70%). Similarly, a majority of students from both groups found AI easy to use, with medical students again showing a slightly higher agreement (64% vs. 62%). Our study provided information regarding the use of AI enhanced collaborative learning among medical and non- medical students, but limitations such as false responses on the part of the students, a very limited number of sample size, methodological constraints and lack of basic information of the respondents.

Conclusion

The results highlighted a generally positive perception of AI among students, particularly in terms of its impact on grades and adaptability to learning styles. However, issues of trust, particularly regarding personal data, remained a significant barrier. The recognition of AI's future significance suggested a readiness to adopt these technologies, provided that concerns about trust and the balance between AI and traditional methods were addressed. Improving engagement, accessibility, and ease of use will be crucial in maximizing the potential of AI in education. Future research should focus on understanding and mitigating trust issues and exploring ways to enhance the integration of AI with traditional educational methods.

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