Research Article

Investigating the effectiveness of artificial intelligence in developing personalized learning pathways for medical students.

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Abstract

Background: Investigating the effectiveness of AI in developing personalized learning pathways for students involves exploring how AI can tailor educational content to meet individual needs. By analyzing students' learning patterns, strengths, and weaknesses, AI can recommend customized resources and learning strategies. This approach can improve engagement and learning outcomes by providing targeted support. Additionally, the investigation should assess how well AI adapts to diverse learning styles and paces. Understanding these factors is crucial to determining AI's role in enhancing personalized education. This study conducted at King Edward Medical College investigates the effectiveness of AI in developing personalized learning pathways for students.

Objectives: To analyze the effectiveness of AI in developing personalized learning pathways benefitting medical students.

Methods: A cross-sectional study was carried out using an online questionnaire which was filled by 91 students. It consisted of demographical data, rate of utilization of AI, and effects of usage of outcomes of AI on learning methods. The results were analyzed using SPSS version 24. Chi-Square test was applied considering a p -value of <0.05 as significant.

Results: 91 students filled out the online questionnaire. 51 percent of the students found AI effective for assisting personalized learning of the student. Out of the 91 students, 74 percent of the students faced difficulty with traditional learning methods which showed the need to integrate AI into personalized learning. 47 percent of students use AI for choosing orientation and growing professionally.52 percent of students use AI for decision making and 74 percent of students feel that AI will improve their patient-centered care.

Conclusion: Our study explores the effectiveness of artificial intelligence in developing personalized learning pathways and how medical students can benefit from it and improve their academics as well as their diagnostic abilities.

Keywords: Artificial Intelligence, personalized learning

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Introduction

Artificial Intelligence (AI) is a new field of study that originated in mid mid-twentieth century. It is used as a facilitating tool for an effective decision-making process. It does this by focusing on generating algorithms imitating human thinking.[1]In past years, AI has played a crucial role in medical training and has been used by many institutions. By freeing doctors from clinical documentation and quality measurement as well as enhancing the value of practice-based learning, AI has the potential to augment the most foundational aspect of high-quality care: the doctor-patient relationship"[2]

Personalized learning has an instructional approach optimized for the needs of each learner. It leads to customized learning paths with proficiency-based progress.[3]The boost of artificial intelligence (AI) and machine learning (ML) together with advances in big data analysis, has unfolded novel perspectives to enhance personalized education in numerous directions.[4]Administration in medical education involves the process of planning, organizing, directing, and controlling resources (human, financial, and physical) within an institution to achieve specific goals and objectives. It includes various activities such as curriculum development, faculty training, student assessment, and budgeting. Administrative tasks are also time and resource-consuming and sometimes involve the participation of academic staff along with administrative ones.[5]

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The prevalence of the use of AI in medical curricula and personalized learning in South Asia is still emerging. It varies across different institutions and countries in the region. While some medical schools and educational institutions in South Asia have started incorporating AI into their curriculum, it is not yet widespread. In terms of personalized learning, the interest for using AI tools to create adaptive learning platforms that cater to the individual needs of medical students. As per a survey conducted among medical students, 76 percent supported the inclusion of AI in the medical curriculum. Progress in this area may vary depending on many factors. These include infrastructure, funding, and institutional readiness.[6]

Artificial intelligence offers personalized feedback, learning assistance has been the principal application in medical education.[7] Because exams were sensitive and the curriculum was not digitalized, there was little focus on curriculum review or student learning assessment. Data integrity must be guaranteed in light of big data tampering. To boost AI adoption, methodological advancements are needed to handle the technical challenges of developing an AI application and employ cutting-edge techniques to evaluate AI efficacy[8]. Medical professionals should take steps to better comprehend AI algorithms and make the most of them by including AI in their medical school curriculum. AI and information technology tools will help medical students make better diagnostics and improve their retaining capacity.[9] This arises the need to better incorporate AI into the medical field. Artificial intelligence has attracted a lot of attention lately, this is because it has the potential to completely transform the way medical students can learn.[10] One area of interest is the AI-powered personalized learning strategies.[11]These are tailored to the specific requirements, preferences, and learning styles of medical students.[12]This study aims to investigate how personalized learning platforms can optimize the efficacy of educational initiatives by using artificial intelligence to tailor them to the specific and individual learning styles of medical students. Considering the dynamic nature of healthcare, lifelong learning is essential to the practice of medicine. AI-enabled personalized learning guarantees access to

current and pertinent educational resources for medical students. It promotes ongoing professional growth and allows them to make the most of their time and resources. Students can enhance patient outcomes, increase diagnostic accuracy, and make well-informed decisions by incorporating AI-driven insights in medical practice.

Methods

A cross-sectional study was conducted among the students of King Edward Medical University, Lahore. A nonprobability consecutive sampling technique was applied. Sample size of 91 students is calculated by using a 95 percent confidence interval, 10 percent absolute precision with expected percentage prevalence of response rate as 51 percent for investigating the affectivity of artificial intelligence in developing personalized learning pathways for medical students. A self-generated questionnaire was circulated using different social media platforms among the participants. The questionnaire consisted of three parts: demographical data, utilization of artificial intelligence among the medical students and outcomes of using artificial intelligence on assisted learning abilities of the students. The results were analyzed using SPSS version 24. Chi-Square test was applied considering a p -value of <0.05 as significant.

Results

A total of 91 students filled the survey form, having mean age of ~22 years with 18 years as minimum age and 29 years as maximum age with SD of 1.44. Among these 91 students, 46.2 % were females (n 42) and 53.8% were males (n 49). Out of sample size of 91 students, 90.1 % were students of MBBS (n 82) and 9.9% were students of Allied Health Sciences (n 9). A questionnaire was filled out by 91 students to check the use of AI in developing personalized learning pathways for medical students. Related to the effectiveness of personalized learning paths in improving learning outcomes, 57.1% of the students experienced the effectiveness (n 52). Others didn't find any affectivity. Almost half 52.7%of the students agreed to the point that AI is helpful for effective decision-making making while 47.3% students never used this tool for better decision-making because they were either unaware or didn't feel the need to use this.74.7% students claimed that they felt AI learning pathways improved patient-centered care. While remaining 25% didn't feel this changes. When students were asked about use of AI driven learning tools for continuous professional development 47 students claimed that they used this opportunity and get benefited while 44 never used at all. When students were asked about real-time feedback and progress tracking in their learning pathway. 43 students said that they track their progress while 48 didn't. When results were obtained, Chi Square test was run to check the use of AI in Medical Students due to increased challenges with traditional learning Methods. Out of 91

Table no 1: *Frequency table of variables assessed during analysis.*

Statement	Frequency		
	No	Yes	Total
Personalized Learning Effectiveness	39	52	91
Use of AI driven learning tools for decision making	43	48	91
AI Learning Path effects on Patient Centered Care	23	68	91
Use of AI Driven tools for Professional development	44	47	91
Real Time Feedback and Progress Tracking in Learning	48	43	91
Use of AI Driven Learning Tool For Self-Assessment	46	45	91

Table no 2: *relation between use of AI and challenges faced with traditional learning methods*

		Challenges with traditional method		Total
		No	Yes	
Use of AI Learning tool in Medical education	No	5	15	20
	Yes	6	65	71
Total		11	80	91

students, 65 (71%) students faced difficulty with traditional learning method so they incorporated use of AI in their studies for better understanding. 6(6.5%) students didn't face challenges with traditional learning methods but they did use AI. 15 (16.4%) students faced challenges with traditional methods but never used AI in their education. 5(5.4%) students neither faced challenges nor used AI in Medical Education. P value of this test was 0.059 which is >0.01 so it is significant.

33 out of 91 students agreed that AI driven skill development improved their critical thinking. 21/91 did not agree that AI improved their skill development and critical thinking.13/91 used AI driven skill development tools but did not affect their critical thinking. 24/91 of the students improved their skill development through AI-driven tools but didn't learn any skill. P value of this test was 0.85 which is not significant.

Table no 3: *Use of AI learning tools in skill development*

		AI driven learning tool skill development		Total
		No	Yes	
AI driven critical thinking skill	No	21	13	34
	Yes	24	33	57
Total		45	46	91

Discussion

The world is revolving around artificial intelligence. In today's age, everything is becoming organized using artificial intelligence so students need to learn about this intelligence and integrate it into their everyday life.[13] This study focuses on the fact that artificial intelligence has the ability to develop personalized learning pathways tailored to the specific learning styles and individual needs of medical students.[14] Our study investigates artificial intelligence's effectiveness in developing personalized learning pathways for medical students. Our research explores how artificial intelligence helps medical students make efficient decisions, provide improved patient-centered care, and improve their professional development chances.[15]

Traditional learning methods are tiresome and have a grinding effect on human brain. Traditional learning styles are effective yet make it very difficult to retain stuff in the long run.[16] This study looks into how artificial intelligence will help students overcome challenges faced with traditional learning methods. The results of our study suggest that around 71 percent of students faced difficulty with traditional learning methods indicating the need to integrate artificial intelligence into students' learning pathways. Our findings correlate with the findings of the study conducted by Kui and Shang Lu which states that compared with traditional learning blended learning can improve students' learning outcomes.[17]

Our quantitative analysis suggests that 61 percent of the students found AI effective for personalized learning in concordance with the study published by Muhammad Murat Civaner in 2022 regarding the perception of artificial intelligence in medical students. The study finds that students took artificial intelligence as an assistant that helps them gain rapid access to information and improve their patient- centered care.[18]

Around 47 percent of the students use AI for professional development while considering job opportunities and specialty orientation. This is contrary to the findings of a study conducted by Canadian students stating that the use of artificial intelligence discouraged medical students from choosing radiology as their specialty because they thought that artificial intelligence could displace radiologists in the future.[9]

Around 52 percent of the students claim to use AI for decision-making skills. This finding complements other studies showing that students felt AI would complement physicians' decision-making skills by synthesizing up-to-date medical protocols and evidence.

In our conducted study 74 percent of students believe that the correct usage of AI will improve patient-centered care in accord with the Western Australian study among medical students which showed that about 75 percent of the medical students agree that AI would improve their practice.[10] Our study will help medical students understand the importance of artificial intelligence in providing real-time feedback and progress tracking. This is the need of the hour to educate the students regarding the accurate usage of artificial intelligence to help them grow and prosper accordingly.

Our study has several limitations since it lacks a longitudinal design, and was conducted in the setting of King Edward Medical University only so lacks generalizability, and therefore the results cannot be applied to medical students globally. Our study does not address the bias due to the non-specificity of AI tools. The findings of our study correlate with many other studies indicating that the students put the data forward in an impartial way. There are chance of data being influenced by peers leading to bias in the results.

This area of artificial intelligence is highly beneficial for students to engage in active learning and polish their academic interests. By using artificial intelligence students can keep a record of their progress and choose their orientation. Workshops regarding AI and its usage in personalized learning should be conducted in medical schools and active participation of students should be ensured to make them get the most out of it. The teaching facility should be well equipped with knowledge of AI and how to integrate its specific tools into the curricula to encourage the students to use AI professionally. Lastly, there is a need for extensive research in this field to fully explore the role of artificial intelligence in learning pathways and its implications.

Conclusion

Our study concludes that artificial intelligence assists in crafting educational content that is personalized for each student and can be tailored to a student's learning progress and personality in real-time. It is useful in supporting digital communication, and tailored health tips, and has opened new ways for further research to identify the most effective artificial intelligence tool for medical education.ost effective Artificial Intelligence tool for medical education.

Authors Contribution
HRK, HKH: Conceptualization, Methodology, Writing original draft.
HRK, HKH, HZS: Data collection, Formal analysis and interpretation.
HRK, HKH, HZS, IG, IH: Study design, Review critically and Editing.

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