



## Research Paper

## General surgery educational resources for Jordanian medical students



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## HIGHLIGHTS

- There are various and diverse general surgery educational tools available to medical students.
- The educational process has been influenced by new distance learning technologies.
- Medical students continue to prefer conventional face-to-face instruction and receive higher scores as a result.
- Medical students and curriculum underutilize artificial intelligence.

## ARTICLE INFO

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## ABSTRACT

**Background:** To outline the resources deemed most beneficial to medical students during their general surgery clerkship, as well as to examine their link to students' general surgery scores and the usage of artificial intelligence in general surgery study.

**Methods:** A retrospective survey of Jordanian medical students from six universities was done between March and June 2023 using a 7-item questionnaire covering questions concerning general surgery study methods and scores. Descriptive statistics were used to evaluate demographic data. Chi-square is used to evaluate categorical data, with a  $P$  value  $<0.05$  deemed significant.

**Results:** The average age of respondents was 23.3 years, and 54.2 % of the respondents were females, 47.8 % were from Mutah University. Most students (48.2 %) relied on tutor lectures. Students who studied through instructor lectures had the highest grades (9 % excellent, 17 % very good), followed by students who studied using surgery textbooks (6.8 % and 14.6 %, respectively). The relationship between the study method and academic achievement was statistically significant ( $P < 0.05$ ).

**Conclusions:** Traditional face-to-face learning with instructor lectures and surgery textbooks is still the most efficient approach to attain the greatest scores. Medical students are still underutilizing artificial intelligence.

## Introduction

Medical students now have access to a wealth of educational resources. Over the last three decades, the use of technology in surgical education has advanced from audio cassettes to digital high-quality videos [1] Aside from traditional general surgery textbooks, there are

numerous alternative resources available, such as free-access medical libraries and websites, databases, educational channels, and tutors' lectures. However, undergraduate medical education is still mostly offered through traditional interaction with classmates [2].

Recent and ongoing improvements in information technology bring opportunities and difficulties in surgical education, and may assist

Abbreviations: AI, artificial intelligence.

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students in developing problem-solving, social networking, and collaborative tools and skill sets [3]. Numerous universities have been eager to incorporate contemporary communication and information technologies into medical education [4]. There have been studies that look at student utilization of simulators, emphasizing preceptor critiques, technique development, and technology, but there has been little research into studying resources investigation [5]. This could create an organizational structure for incorporating e-learning with conventional teaching to improve the learning process. Blended learning was defined in 2006 as a combination of face-to-face instruction and computer-mediated instruction [6]. The concept of artificial intelligence (AI) was initially introduced in the 1950s. It took >50 years for AI to revolutionize applied sciences, including medicine [7]. It is quite possible that the incorporation of AI into the surgical training process will spread as both the area of surgery and technology continue to progress.

We evaluated the use of accessible material to help optimize learning and materials for medical student education. The purpose of this study was to assess medical students' utilization of general surgery resources and their link to their grades.

## Methods

This was a retrospective observational survey-based study of general surgery medical students from six Jordanian medical schools: Mutah University, The University of Jordan, Yarmouk University, Jordan University of Science and Technology, Hashemite University, and Balqa Applied University, conducted between March and June 2023. Inclusion requirements comprised medical students or graduates who had received their general surgery scores. Students in the basic preclinical phase were excluded.

The authors designed a 7-item survey questionnaire (Fig. 1) based on their years of expertise educating and instructing medical students and surgical residents, as well as recent research findings on the most successful learning methodologies. The questionnaire includes demographic questions, study resources utilized during the rotation such as instructors' lectures, major general surgery textbooks (Schwartz, Sabiston, Bailey), rapid review books (Lecture Notes, Rapid Surgery), previous lectures and summaries, general surgery scores, and the use of AI in general surgery learning. It was delivered electronically to

### General Surgery Resources for Jordanian Medical Students

- Please check each box next to the appropriate answer
- Your answers are confidential.

Age:

Gender:  Male  Female

Academic Year:  4<sup>th</sup>  
 5<sup>th</sup>  
 6<sup>th</sup>  
 Graduate

University:

Choose the learning source on which you relied the most during your general surgery studies:  
 (Select only one):

- Major surgery textbooks (Schwartz, Sabiston, Bailey),  
 Quick review surgery books (Recall, Lecture notes)  
 YouTube educational channels  
 Internet sites (Up to Date, Web MD)  
 Instructors' lectures

Your score in general surgery:

- Excellent  
 Very good  
 Good  
 Fair

Have you tried artificial intelligence methods in your study?

- Yes  No

Do you believe that artificial intelligence will eventually replace the traditional book?

- Yes  No  I don't know.

Fig. 1. The study questionnaire.

participants through various social media student groups at all six universities. The participants were told to select the single most reliant technique of learning the general surgery curriculum.

Jordanian universities provide undergraduate medical education throughout a six-year duration. Surgical education and clinical training begin in the fourth year and last until the end of the program. Tutors instruct students during their general surgery rotation in lecture halls and clinics. The program comprises lectures, seminars, clinical skills, and case studies. Students are evaluated on a regular basis through quarterly exams and end-of-rotation evaluations and examinations.

The study was IRB-approved (Number: 1242023). Participation was entirely optional. SPSS version 26 (IBM Corp., Armonk, NY) was used to analyze completed questionnaires. The student demographic data was analyzed using descriptive statistics. The results were given as percentages, medians, or means. The Chi-square ( $X^2$ ) test was used to compare categorical data. The significance level was chosen at  $P < 0.05$ .

## Results

A response rate could not be calculated because the survey distribution could not be tracked. Non-response bias was reduced, however, by ensuring that the survey was disseminated by a diverse group of medical students across different channels. The average age of respondents was 23.3 years, and females made up 54.2 % of the total (Table 1). Mutah University had the most participants (47.8 %). Fourth-year students and graduates outnumbered sixth-year students (33.6 %, 33.8 %, and 27.6 %, respectively). Most students (48.2 %) relied on tutor lectures (Table 2), and most respondents (41.0 %) scored very good.

The Chi-square test was used to determine the relationship between the study method and the student's score, and the relationship between the study method and academic achievement was statistically significant if  $P < 0.05$ , indicating that students who relied on teachers' lectures and surgery books had the best academic achievement (Table 3).

It is obvious that 45 (9 %) of the students who studied through instructor lectures obtained an exceptional score; 85 (17 %) received a very good grade; and 82 (16.4 %) received a good grade. This means that students who studied through instructor lectures had the highest grades. Following that were students who studied using surgery textbooks, with 34 and 73 students achieving both excellent and very good grades, representing 6.8 % and 14.6 %, respectively.

Students who relied on medical platforms and websites received 11 excellent grades and 25 very good grades, while students who relied on YouTube channels received the fewest number of high grades, with 12 and 19 students receiving excellent and very good grades, respectively.

AI tools were used by 136 participants (27.2 %), compared to 364 participants (72.8 %) who had never used AI throughout their general surgery rotation.

**Table 1**  
Participants' demographics.

Age	Minimum	Maximum	Mean
	19	30	23.33
Gender	Male (%)	Female (%)	
	229 (45.8 %)	271 (54.2 %)	
University	N	%	
Mutah University	239	47.8	
University of Jordan	52	10.4	
Jordan University of Science and Technology	57	11.4	
The Hashemite University	73	14.6	
Balqa Applied University	34	6.8	
Yarmouk University	45	9.0	
Year			
4th	193	38.6	
6th	138	27.6	
Graduate	169	33.8	

**Table 2**  
Participants resources for studying general surgery and their scores.

	N	%
Study source		
Instructors' lectures	240	48.0
Surgery books	154	30.8
Medical websites	53	10.6
YouTube channels	48	9.6
Others	5	1.0
Total	500	100
Score		
Weak	1	0.2
Fair	46	9.2
Good	146	29.2
Very good	205	41.0
Excellent	102	20.4
Total	500	100

## Discussion

Many students are abandoning traditional face-to-face classroom learning techniques, and the COVID-19 pandemic has accelerated this tendency [8]. Students' educational resource selection was influenced by characteristics such as accessibility and perceived information quality [9]. The documented potential benefits of using online educational tools range from increased knowledge acquisition, reduced demands on teaching time, improved interaction, and immediate communication outside of the time-limited classroom to access to a network of geographically dispersed experts and institutions. On the other hand, the traditional technique has limitations in terms of the level of open communication between lecturers and students, insufficient time for interaction, impoverished illustrations, and a strict timetable [10].

The main constraints of general surgery education online involve obtaining hands-on clinical and surgical skills, which may be difficult to learn through online instruction. Other limitations of Internet technologies in surgical training and other related medical disciplines include intellectual property rights, data overload, privacy, quality assurance, and challenges addressing particular clinical concerns. This was one of the motivations for introducing "blended" learning, which has been shown to be more effective than nonblended education, or at least equivalent, for building expertise in different health-professional training [11].

There were differing views on the optimum learning strategy for achieving the highest possible scores. A survey conducted by Yeh et al. found a considerable level of dissatisfaction with current study habits and a desire to try different study methods. The combination of large smart phone market coverage, a significant interest in audio files, and a constrained time frame makes podcast medical education a route worthy of future research and development [12]. In contrast to the recommended textbook, review books and online resources were shown to be significantly more frequently used throughout a clerkship, according to a different survey [13]. Another investigation found a link between using question banks to prepare for exams and better exam results [14].

Traditional in-person education was deemed more effective, more accessible, and free of technical difficulties and deception [15], and it remains the most popular [16]. This is consistent with the results of our survey. A plausible explanation for the inferior academic achievement of students who use these non-recommended outside resources could be related to the quality of the information and non-adherence to the core competencies of curricular educational activities.

AI is extremely beneficial for creating surgical procedure simulations, allowing students to practice skills in a controlled setting and gain a better grasp of the intricate undertaking of surgery [17]. AI can aid with the acquisition of surgical knowledge and practice. Machine learning, artificial neural networks, natural language processing, and

**Table 3**  
Statistical analysis of the significance of general surgery study method and achievement score.

Method	Grade					Total	$\chi^2$	P-value	df
	Weak	Fair	Good	Very good	Excellent				
Instructors' lectures	1	27	82	85	45	240	114.1	0.000	16
Surgery books	0	11	36	73	34	154			
Medical websites	0	2	15	25	11	53			
YouTube channels	0	5	12	19	12	48			
Others	0	1	1	3	0	5			
Total	1	46	146	205	102	500			

computer vision are the four core subfields of AI [18]. A substantial proportion of medical students (75.8 %) reported receiving no formal AI education during medical school [19], which is comparable with our findings (72.8 %).

The application of AI technologies in medicine has been limited thus far, owing to a lack of high-quality evidence demonstrating their additional value in daily clinical decision-making [20]. Physician awareness of the current state of AI technologies is equally limited, and a lack of professional training and critical appraisal of these technologies is an impediment for the next generation of physicians [21].

The self-assessment of background information is one of the study's limitations, and implementation produces bias because these aspects are not reviewed objectively.

## Conclusions

Traditional face-to-face instruction in general surgery is the most efficient and popular study method for attaining the highest possible scores since it combines educational fundamentals with accurate knowledge tested in previous years. Blended learning, which combines the benefits of classroom and distance learning, could be a valuable technique in building future curricula. Although medical students are aware of the potential benefits of AI, they have not received formal instruction on how to integrate AI into medical education.

## Ethical approval

The research is approved by the IRB in accordance with regulations of the School of Medicine at Mutah University. IRB number: 1242023.

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### Assistance with the study

None.

### Presentation

None.

## CRediT authorship contribution statement

**Mohammad Nebih Nofal:** Conceptualization, Supervision, Writing – review & editing. **Mahmoud Mousa Al Awayshish:** Methodology, Supervision. **Ali Jad Yousef:** Formal analysis, Writing – original draft, Writing – review & editing. **Ammar Masoud Alamaren:** Data curation, Resources. **Zaid Issam Al-Rabadi:** Formal analysis. **Dina Samer Hadad:** Data curation. **Yaqeen Ahmad Al-Rbaihat:** Data curation. **Yazeed Nabeel Al-Qusous:** Data curation.

## Declaration of competing interest

The authors disclose no conflicts of interest.

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