

Effect of Peer-Assisted Learning on Enhancing Clinical Research Skills Among Medical Students: Students' and Tutors' Perceptions

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Purpose: Research methodology is an essential part of evidence-based medicine. Many educational programs include clinical research methodology within their curriculum. Moreover, students' preferences for learning methods are different than before, as they now prefer alternative methods, such as peer teaching. Peer-assisted learning enhances students' tutoring skills. Thus, the current study aimed to evaluate the effect of peer teaching on enhancing clinical research skills.

Participants and Methods: Peer-assisted learning was evaluated during a four-week online research methodology course designed for medical students at King Abdulaziz University. A total of 121 students' and 38 tutors' attitudes and perceptions of peer teaching were evaluated using a self-administered questionnaire. The effectiveness of peer teaching was assessed using pre- and post-course knowledge tests. Chi-square was used to assess the association of qualitative data, and Mann-Whitney *U*-test and Wilcoxon rank test were used as nonparametric tests for the variables that were not normally distributed.

Results: The post-course knowledge score was significantly higher than the pre-test score. Students had a positive perception of peer-assisted learning. Over 90% of the students preferred peer-assisted learning to traditional teaching. Similarly, the tutors had significantly positive perceptions of peer-assisted teaching. Younger students who had higher post-test mean knowledge scores had a good perception of peer teaching.

Conclusion: The current study demonstrates students' and tutors' positive perceptions of peer-assisted learning as well as the effectiveness of peer learning. Medical schools should pay more attention to students and prepare them for peer-teacher roles.

Keywords: peer-assisted learning, medicine, clinical, methodology, education

Introduction

Research methodology is one of the most dynamic and important fields in medicine. It is widely considered that research is the cornerstone of evidence-based medical practice.¹⁻³ Recently, Dalbhi et al conducted a cross-sectional study in Saudi Arabia to investigate physicians' difficulties with conducting clinical research. They found that the difficulty score decreased among physicians who had attended more research methodology workshops.⁴ Thus, many educational institutes have included clinical research methodology courses in their curriculum.⁵ However, medical students may face problems managing their time between their busy academic schedules and conducting clinical research.⁶⁻⁸ Moreover, during the past decade, the learning attitudes and preferences of medical students have changed, as studies

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have shown that they no longer like didactic teaching methods. Instead, they prefer interactive learning, self-directed learning, and peer-assisted learning (PAL) approaches.^{9,10} Taken together, this prompts the need to explore effective ways of teaching this challenging subject by creating a conducive learning environment.

International interest in PAL in medical education has been increasing for more than a decade.¹¹ PAL is defined as the practice of students teaching other students.¹² A systematic review showed that PAL achieves learner outcomes that are comparable to those produced by faculty-based teaching and it has beneficial effects on students' and tutors' learning outcomes.¹³ Additionally, students report that they have more emotional support and reassurance from their senior peers.¹⁴

A study that was conducted to determine students' perceptions of PAL found that they recognize the unique and important role of PAL in undergraduate medical education and its importance for their professional development.¹⁵ However, another study showed a divergence in students' responses about implementing PAL into the curriculum in the form of peer-led seminars. The study found that most of the learners did not trust their peers in the teaching process.¹⁶ However, it is worth mentioning that the majority of the student tutors reported experiencing personal and professional development, and that they improved their collaborative, communication, tutoring, and presentation skills as well as their confidence.¹⁶

Although the Saudi government strongly encourages research by providing financial support and national and international opportunities,^{17,18} the level of research productivity is still expected to rise. Given the fact that the effectiveness of using PAL in elective courses has not been extensively studied, this study aimed to evaluate its effect on enhancing clinical research skills. Taking into consideration that PAL is a two-way process, the perceptions of the students and the tutors regarding their experience of PAL in clinical research methodology courses was also assessed. This is the first study in Saudi Arabia to evaluate the influence of PAL on research skills and students' and tutors' opinions.

Materials and Methods

Course Design and Course Training

In June 2020, a four-week elective online research methodology course was conducted for medical students at King

Abdulaziz University, Jeddah, Saudi Arabia. It was a full-day 4-week course to teach students about study designs, how to write a research paper, basic analysis, and publication while conducting their research. The objectives, schedule, content, and presentations of the course were developed by senior medical students and revised by professional faculty members. Moreover, the senior medical students (hereafter called tutors) had previous research experience and were formally trained to be a student tutor who acknowledged students' questions and concerns during the course. Upon successfully completing the course about clinical research, the students were considered research tutors. Each tutor was assigned a group of 4–5 students; together, these groups comprised the team of students for which the tutors wrote a full manuscript that answered a research question, while being supervised by a consultant physician (principal investigator). The course had an alternating format throughout the day, providing live video conferencing lectures on the different aspects of clinical research and small group sessions/workshops where student would apply and practice the knowledge given during lectures. Although some of the questionnaires given during the course collected students' or tutors' names, the students were told that all answers would be private and access to the data would be given to only few of this research's authors. Further, all the names were in code format and were treated in a highly confidential matter.

Study Aim, Design, and Participants

The study aimed to evaluate the effect of PAL on the students' clinical research skills and to assess not only the students' perceptions of PAL but also the peer tutors' opinions of the teaching process. This cross-sectional study was conducted among third-, fourth-, and fifth-year medical students who attended an elective online research methodology course during June 2020. The students who filled an application to join the course were recruited for this study. The total number of students who were accepted in the course was 177 students, 155 of them have completed pre- and post-course test, and 121 students have successfully completed the perception questionnaire.

Sample Size

The required sample size was determined by the OpenEpi software using the formula that calculates the percentage of the frequency in a population. At the 95% confidence level and with the hypothesized percentage of the

frequency of the outcome factor in the population being 50%, the required sample size was 120.¹⁹

Study Instrument

Before each session, the students had 10 minutes to take an electronic test with 20 multiple-choice questions that addressed their basic knowledge about clinical research. Each answer was rated as follows: 1 = the correct answer and 0 = “I don’t know” or the wrong answer (pre-test). Then, the teaching sessions began. These were followed by a post-test that was completed by the students, as shown in Figure 1.

At the end of the clinical research course, two self-administered questionnaires were given to the participants to assess their perceptions of PAL: one was for the students and the other was for the tutors. The questionnaires were adapted and modified based on previously published studies.^{16,20–22} Each questionnaire contained demographic data questions related to the students’/tutors’ perceptions of PAL. For the descriptive statistics, the responses to the items were scored on a Likert scale, with potential rankings ranging from 5 (strongly agree) to 1 (strongly disagree). Then, the answers were transformed into codes to calculate the total perception. The “strongly agree” and “agree” responses were coded as a score of 1, while the “neutral,” “disagree,” and “strongly disagree” responses were given a score of 0. Thus, the total score for the students’ and tutors’ questionnaires ranged from 0–20 and 0–7, respectively. If the score was more than 75% of the total possible score, it was considered a good perception; if less, it was considered a poor perception. In addition to this, an open-ended section was provided for both the tutors and students to allow them

to express their opinions about the strengths and weaknesses of peer learning.

Statistical Analysis

The data were collected, tabulated, and statistically analyzed using an IBM personal computer and IBM SPSS Statistics for Windows version 19 (IBM Corp., Armonk, NY, USA). For the descriptive statistics, the quantitative data were presented in the form of the mean, standard deviation, and range, and the qualitative data were presented in thematic forms. Analytical statistics were used to determine the possible association between the studied factors and the targeted outcome. The tests of significance included the following: (1) the chi-square test, which was used to examine the association between two qualitative variables; (2) Fisher’s exact test, which was employed for 2×2 contingency tables when the expected cell count of more than 25% of cases was less than 5; (3) the Mann–Whitney *U*-test (nonparametric test), which was used to compare two groups of quantitative variables that were not normally distributed; (4) the Kruskal–Wallis test, which was employed (nonparametric test) to compare three or more groups of quantitative variables that were not normally distributed; and (5) the Wilcoxon signed rank test (nonparametric test), which was used to compare two related groups of quantitative variables that were not normally distributed. A *p*-value of < 0.05 was considered statistically significant.

Results

Students’ Demographics

As shown in Table 1, 121 students completed the questionnaire that assessed their perceptions of PAL. Their

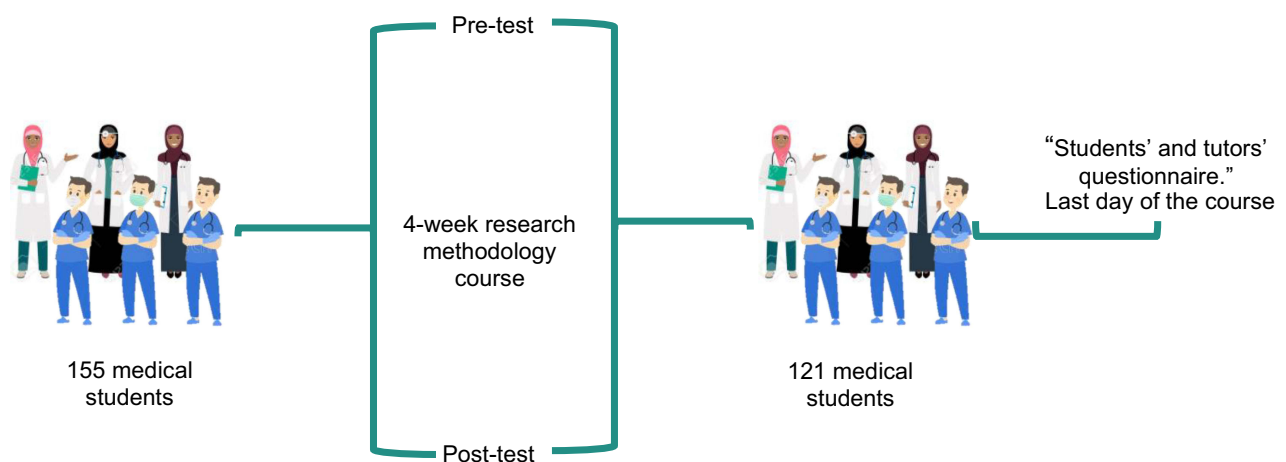


Figure 1 The methodology of the study.

Table 1 Students' Demographic Data (N = 121)

Characteristics		Frequency (Percentage)
Age/Year (Mean \pm SD)		22 \pm 1
Gender	Male	42 (34.7)
	Female	79 (65.3)
Nationality	Saudi	115 (95)
	Non-Saudi	6 (5)
Academic Year	Third Year	65 (53.7)
	Fourth Year	35 (28.9)
	Fifth Year	21 (17.4)
Previous Research Courses	Yes	7 (5.8)
	No	114 (94.2)
Previous Research Experience	Yes	42 (34.7)
	Data Collector	34 (80)
	Co-Author	8 (20)
	No	79 (65.3)
Research Methodology Preferences	Better when given by peer tutors	115 (95.0)
	Better when given via traditional teaching	6 (5.0)

Abbreviation: SD, standard deviation.

mean age was 22 ± 1 years, 79 (65.3%) were female and 42 (34.7%) were male, and 95% were Saudis. The academic year was distributed as follows: 53.7% were third-year students, 28.9% were fourth-year students, and 17.4% were in their fifth year.

The majority of the students (94.2%) had not taken a course in how to conduct scientific research. Furthermore, only one-third (34.7%) had previous research experience; of these, 80% had participated as a data collector and 20% had participated as a co-author. Most of the respondents (95%) reported that they thought that the research methodology course was better when given by students (ie, the peer tutors).

Students' Pre- and Post-Test Knowledge

A total of 155 students completed the pre- and post-tests that evaluated their knowledge of clinical research methodology before and after taking the course. The students' mean knowledge scores in the post-test were significantly

higher than those in the pre-test for all knowledge items (19 ± 4 vs 12 ± 5 , respectively, $p = 0.001$) (Figure 2).

Students' Perceptions of Peer Teaching

Regarding the students' perceptions of the tutors' knowledge and skills, 94.2% agreed that the tutors' knowledge was appropriate for the required level of teaching, and 92.6% agreed that their tutor provided appropriate guidance that targeted their needs. Most of the participants (97.5%) thought that the tutor was approachable and happy to answer questions and that he/she created a welcoming learning environment. In general, 98.3% felt that they generally and adequately benefited from this experience/opportunity. Regarding the learners' general perceptions of peer teaching and mentoring, 97.5% thought that PAL is an effective teaching strategy and 90.1% preferred being taught by a peer tutor rather than via traditional teaching. Table 2 shows the answers regarding the students' perception of PAL.

As for the students' opinions about the PAL experience, 99% responded that they would recommend this course to colleagues. When further questioned about if PAL would be useful for other activities/skills, 118 (97.5%) answered "yes" for the research methodology course, 105 (86.8%) responded that they would prefer peer tutors to teach them clinical skills, and 108 (89.3%) answered "yes" regarding extra-curricular activities. The other perceptions are shown in Table 3. Furthermore, the students' most frequent opinions about the strengths and weaknesses of PAL are shown in Figure 3.

Regarding the participants' perceptions of PAL, 110 of the students had a good perception (90.9%), while only 11 students had a poor perception. As shown in Table 4, a significantly higher percentage of students who were younger, in the third year, and who had a higher post-test mean knowledge score had a good perception of peer teaching. On the other hand, a non-significant relationship was found between the perception of peer teaching and the participants' gender, experience of previous research, and pre-test mean knowledge score.

Tutors' Demographic Data

The mean age of the tutors who participated in the PAL course was 22 years, three-quarters were female, and half were in the fifth academic year (Table 5). Most of the participants (97.4%) had engaged in previous courses in how to conduct scientific research, and 89.2% had previously attended the four-week methodology research course. The mean number of studies that they participated

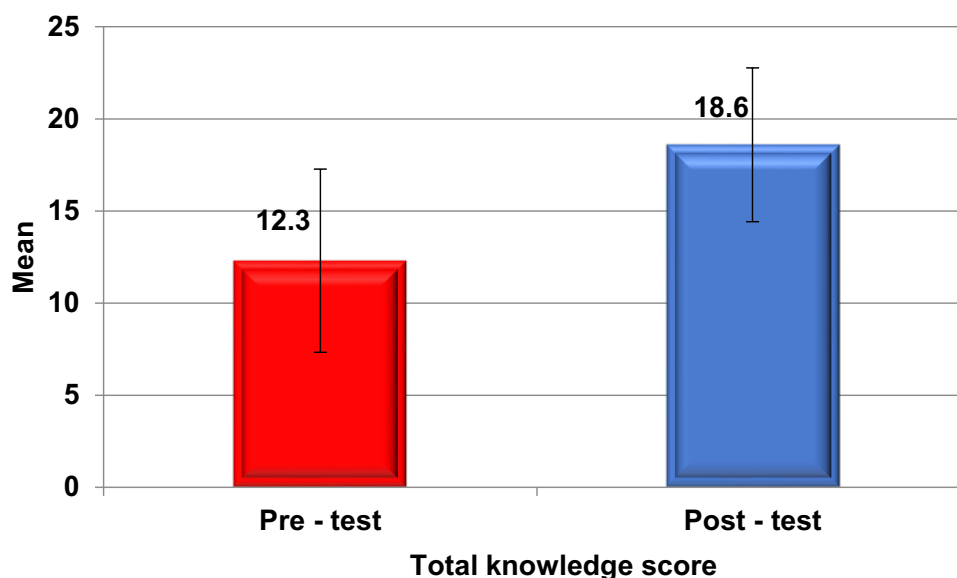


Figure 2 Mean (standard deviation) of the total knowledge score in the pre- and post-tests Wilcoxon signed rank test = 8.81, p -value = 0.001.

in was 3 ± 1 . All of the tutors thought that this course was better when given by students.

Tutors' Perceptions of Peer Teaching

As for the tutors' perceptions of the teaching and mentoring experience, 94.7% reported that they had the opportunity to consolidate their own knowledge, 92.1% said that being a peer tutor increased their confidence in their teaching and presentation skills, and 84.2% reported that they had a better understanding of teamwork and roles within the team (Tables 6 and 7).

Interestingly, 65.5% of the tutors thought that being a peer teacher was a good idea. The strengths and weaknesses of the PAL experience from the tutors' point of view are shown in Figure 4, and "having better communication skills" was the most frequently reported strength (44.7%).

Discussion

Several studies of medical education have suggested that PAL is an acceptable and beneficial education strategy. Students can develop new skills and knowledge through active learning and support from their senior peers.²³ A previous study conducted at Birjand University of Medical Sciences that examined the educational methods supported the concept that PAL is more effective for students' learning and knowledge retention.²⁴ Participation in PAL is considered an effective and efficient way to introduce and foster core professional skills that may not be included in formal medical professional curricula.^{25,26} Learning with peers can also

create a safer learning environment, which lacks the barriers that exist between the tutor and students to some extent.^{27,28}

Tutors or senior students can also provide motivation for younger students more than senior staff, which will eventually affect the educational process.¹⁰ In the PAL environment, students are more familiar with the learning requirements of their senior peers,^{23,29,30} and senior students can provide them with information, good quality demonstrations, and feedback for every task and clinical skills station.¹⁰

In the present study, the PAL that was given during the research methodology course had a significant effect on the students' knowledge. This observation can be explained in different ways. Because of the proximity of the students and peer tutors, the tutors are more likely to understand which concepts the students may find difficult, and they can explain them to the students in a simpler way. This social proximity is thought to enable the students to express their difficulties more comfortably, to feel relaxed, and to gain confidence through observing a peer in a teaching role.^{29,30}

Moreover, this study found that students with a good perception of PAL had significantly better post-test results compared to those who had a poor perception. A comfortable educational environment and satisfactory learning style may be the main factors of these high scores.^{31–33} The idea of peer teaching has spread widely in the past few decades.³⁴ As PAL has a long history, students have been engaged in different activities/courses that are supervised by their senior peers, and the fact that

Table 2 Students' Perceptions of Peer-Assisted Teaching (N = 121)

Studied Variables	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Percentage of Agreement	
	No.	%	No.	%	No.	%	No.	%	No.	%		
Peer Tutors' Knowledge												
The tutor's knowledge was appropriate for the required level of teaching	71	58.7	43	35.5	4	3.30	1	0.80	2	1.70	94.2	
The tutor provided appropriate guidance that targeted my needs (eg, how to enhance my academic writing)	77	63.6	35	28.9	6	5.00	1	0.80	2	1.70	92.6	
Peer Tutors' Attitude												
The tutor is approachable and happy to answer questions	108	89.3	10	8.30	2	1.70	1	0.80	0	0.00	97.5	
The tutor creates a welcoming learning environment	104	86.0	14	11.6	1	0.80	2	1.70	0	0.00	97.5	
Overall, I feel that I adequately benefited from this experience/opportunity	93	76.9	26	21.5	2	1.70	0	0.00	0	0.00	98.3	
Peer-Teaching Preferences												
Peers can perform well in the role of tutors	76	62.8	39	32.2	3	2.50	3	2.50	0	0.00	95	
Peer-assisted teaching is more beneficial for the student than the tutor	41	33.9	32	26.4	42	34.7	6	5.00	0	0.00	60.3	
Learners' General Perceptions of Peer Teaching and Mentoring												
Peer-assisted teaching is an effective teaching strategy	85	70.2	33	27.3	2	1.70	1	0.80	0	0.00	97.5	
I prefer being taught by a peer tutor than via traditional teaching	80	66.1	29	24.0	11	9.10	1	0.80	0	0.00	90.1	
I am more willing to engage in sessions taught by a peer tutor than during traditional teaching	81	66.9	33	27.3	5	4.10	2	1.70	0	0.00	94.2	
I feel more confident learning from a peer tutor compared to traditional teaching	80	66.1	28	23.1	12	9.90	1	0.80	0	0.00	89.3	
The peer-assisted teaching that I received in this course is sufficient to prepare me to start my own research	58	47.9	48	39.7	11	9.10	4	3.30	0	0.00	87.6	
Interested in becoming a peer tutor	53	43.8	28	23.1	26	21.5	12	9.90	2	1.70	66.9	

they have tried and been involved in this way of teaching for different aspects has had direct and indirect effects on their general perception of the peer-teaching method. The popularity of this method among students may have unconsciously caused the students to overestimate PAL and this may have led to the high percentage of the good perception.

This study set out with the aim of assessing not only the students' perceptions of PAL but also the peer tutors' opinions of the teaching process. The study found that the

majority of tutors had the opportunity to consolidate their knowledge. In accordance with the present results, previous studies of the psychology of memory retrieval have demonstrated that teaching deepens and enhances one's understanding of the content being taught. This could be related to the organization of the information in the tutor's mind and retrieval of the information during the teaching session.^{16,34}

It was also found that a considerable number of tutors felt confident. This was expected since each tutor

Table 3 Frequency Distribution of the Students' Opinions of Peer Teaching for Other Activities/Skills

Activities/Skills for Which Peer-Assisted Teaching Would be Useful	Yes		No	
	No.	%	No.	%
SMLE	92	76.0	29	24.0
USMLE	89	73.6	32	26.4
Research Methodology	118	97.5	3	2.50
Clinical Skills	105	86.8	16	13.2
Communication Skills	101	83.5	20	16.5
Faculty's Tutorials	8	81.0	23	19.0
Extra-Curricular Activity	108	89.3	13	10.7

Abbreviations: SMLE, Saudi Medical Licensure Examination; USMLE, United States Medical Licensure Examination.

completed a training course that contained theoretical knowledge about research, taught them how to deal with future situations that they might face during the course, and taught them how to be a good mentor. Additionally, periodical feedback was received from the students, which

helped the tutor to meet their learning needs and improve their teaching skills. Moreover, each student felt supported and prepared because they had a senior assistant and a consultant to review their academic writing and to acknowledge their questions. However, this outcome is contrary to some previous studies that found that peer tutors experience many concerns and struggle with anxiety about their ability to teach.^{34,35} One interesting finding is that more than three-quarters of the tutors reported that being a peer tutor made them consider an academic career in the future. This emphasizes the importance of PAL for tutors to pursue an academic teaching career.

The thematic analysis of the students' and tutors' feedback identified the strengths and weaknesses of their PAL experience. They reported many strengths of PAL. Most were related to the easy and useful communication between the tutor and students without any barriers; the closer the tutor to the students' age, the more they benefited. In addition, this helps the tutor to be more

Table 4 Factors Affecting Students' Perceptions of Peer Teaching

Characteristics		Perceptions of Peer Teaching		P-value
		Good Perception (N = 110)	Poor Perception (N = 11)	
Age/Years (Mean \pm SD)		21.6 \pm 1.05	23.6 \pm 1.02	0.001
Gender	Male	38 (34.5)	4 (36.4)	0.904
	Female	72 (65.5)	7 (63.6)	
Educational Level	Third year	63 (57.3)	2 (18.2)	0.014
	Fourth year	31 (28.2)	4 (36.4)	
	Fifth year	16 (14.5)	5 (45.5)	
Experience of Previous Research	Yes	39 (35.5)	3 (27.3)	0.746
	No	71 (64.5)	8 (72.7)	
Knowledge and Improvement Level	Knowledge Pre-Test			0.542
	(Mean \pm SD)	12.4 \pm 5.08	11.4 \pm 4.52	
	Knowledge Post-Test (Mean \pm SD)	19.1 \pm 3.24	13.4 \pm 7.52	0.006
	Improvement Level (Knowledge Post-Test- Knowledge Pre-Test)	6.7	2	

Abbreviation: SD, standard deviation.

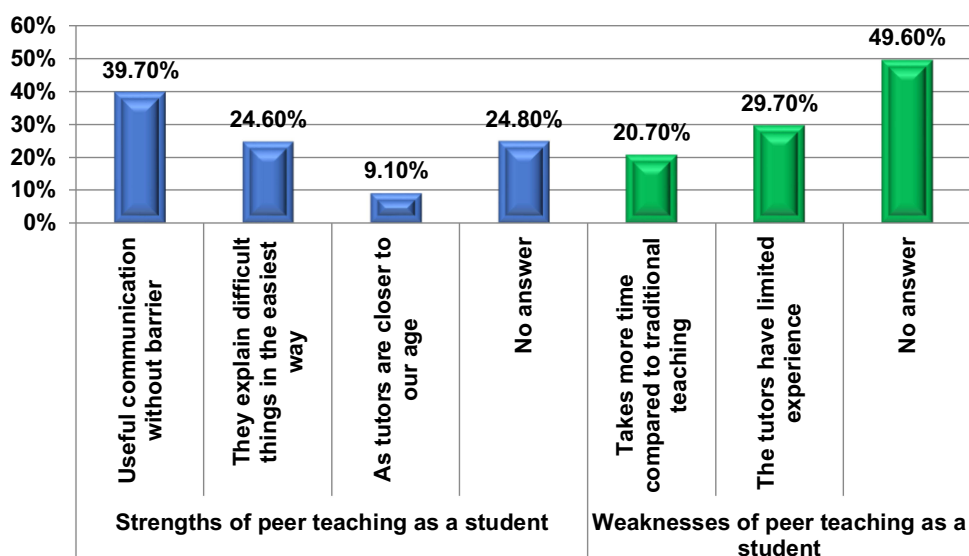


Figure 3 Percentage distribution of the students' most frequent answers to the open questions.

approachable and to explain complicated topics in a simpler way. Many studies of PAL have highlighted the same findings.^{13,21} This provides more insight into the special social atmosphere that PAL offers; that is, it

provides a more comprehensive support network than more traditional systems.²¹

However, the lack of experience is the most common weakness of PAL from both the students' and tutors'

Table 5 Tutor's Sociodemographic Data

Characteristics (n = 38)		
Age/Year	Mean \pm SD	22 \pm 1
No Previous Research Experience	Mean \pm SD	3 \pm 1
Gender	Male	8 (21.1%)
	Female	30 (78.9%)
Nationality	Saudi	38 (100.0%)
	Non-Saudi	0 (0.0%)
Academic Year	Fourth Year	18 (47.4%)
	Fifth Year	19 (50.0%)
	Sixth Year	1 (2.6%)
Previous Research Courses	Yes 37	(97.4%)
	Four-week methodology research course	34 (91.9%)
	Other research summer school	3 (8.1%)
	No	1 (2.6%)
Research Methodology Preferences	Better when given by peer tutors	38 (100.0%)
	Better when given via traditional teaching	0 (0.0%)

Abbreviation: SD, standard deviation.

Table 6 Frequency Distribution of the Tutors' Perceptions of Peer-Assisted Teaching and Mentoring

Studied Variables	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Percentage of Agreement
	No.	%	No.	%	No.	%	No.	%	No.	%	
I had the opportunity to consolidate my knowledge	25	65.8	10	26.3	2	5.30	1	2.60	0	0.00	94.7
Being a tutor has increased my confidence in my tutoring and presentation skills	21	55.3	11	28.9	6	15.8	0	0.00	0	0.00	92.1
I have a better understanding of teamwork and the roles within the team	17	44.7	14	36.8	6	15.8	1	2.60	0	0.00	84.2
I am a better role model to my peers	21	55.3	14	36.8	3	7.90	0	0.00	0	0.00	92.1
I have developed both personally and professionally	6	15.8	20	52.6	12	31.6	0	0.00	0	0.00	68.4
Being a tutor has made me consider an academic career in the future	15	39.5	18	47.4	5	13.2	0	0.00	0	0.00	86.8
I think the students benefited from my teaching and mentoring experience	10	26.3	9	23.7	5	13.2	8	21.1	0	0.00	50
I had support from faculty or other peers (eg, senior assistants)	23	60.5	14	36.8	1	2.60	0	0.00	0	0.00	97.4
Overall, I feel I was adequately prepared for this role	22	57.9	12	31.6	4	10.5	0	0.00	0	0.00	89.5
Peer teaching is more beneficial for the student than the tutor	16	42.1	18	47.4	4	10.5	0	0.00	0	0.00	89.5
Every medical student should learn how to teach	13	34.2	8	21.1	13	34.2	4	10.5	0	0.00	55.3

perspectives. Interestingly, this is a commonly cited concern about peer teaching in many studies.^{11,36} Indeed, it is usual for peer tutors to be less expert than senior staff, yet they do their best and prepare well to succeed in their role as a tutor.²² Therefore, the appropriate preparation and selection of tutors is required to ensure that students benefit from them.³⁷

This study has several limitations. First, it included only medical students, which may have affected its applicability to other specialties. Second, the PAL experience occurred in an online setting, not in a formal setting. Third, the participants who had a positive experience of PAL were more likely to complete the surveys and may have exaggerated their responses

Table 7 Frequency Distribution of the Tutors' Opinions of Their Peer-Assisted Teaching Experience

Studied Variables	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Percentage of Agreement
	No.	%	No.	%	No.	%	No.	%	No.	%	
I felt comfortable in my role as a tutor	12	31.6	20	52.6	4	10.5	2	5.30	0	0.00	84.2
I learned a lot about teaching techniques	16	42.1	16	42.1	5	13.2	0	0.00	1	2.60	84.2
I learned a lot about the subject matter while teaching	23	60.5	11	28.9	3	7.90	0	0.00	1	2.60	89.5
Teaching was stressful and taxing	4	10.5	9	23.7	14	36.8	5	13.2	6	15.8	34.2
The feedback encouraged me to self-assess and improve my teaching	21	55.3	11	28.9	4	10.5	0	0.00	2	5.30	84.2

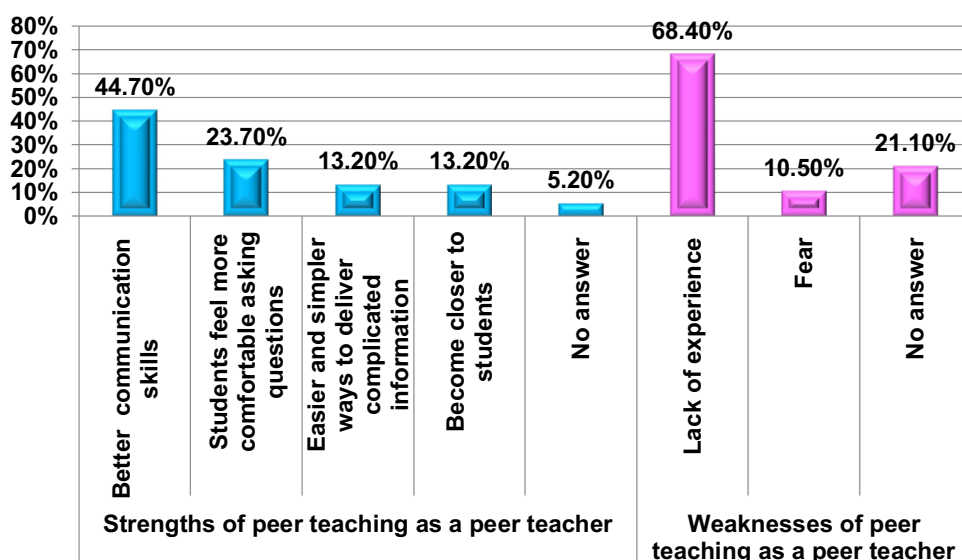


Figure 4 Percentage distribution of the tutors' most frequent answers to the open questions.

about the PAL activities. Finally, there is a lack of evidence about the long-term effect of PAL on their future career, including on their knowledge, skills, professionalism, and so on.

Conclusions

This study highlights the positive perceptions of PAL from the students' and tutors' perspectives. The majority reported that they developed personally and professionally from this experience. The findings also support the previous literature and encourage the use of PAL in medical education as a competency of the curricula. Every doctor is expected to teach future generations; therefore, medical colleges should pay more attention to the students, prepare them to be peer teachers, and give them every opportunity. Moreover, it would be interesting for future research to follow up the students and tutors to determine if their perceptions of the benefits of PAL change during their postgraduate years.

Abbreviation

PAL, peer-assisted learning.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval was obtained from The Unit of Biomedical Ethics at King Abdulaziz University

Hospital and each student signed an online consent form to participate in this study (reference no. 322-20). All participants provided informed consent and all methods were carried out in accordance with relevant guidelines and regulations.

Consent for Publication

Electronic consent was obtained from each participant included in this study.

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Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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Disclosure

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