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Original Article

The Effect of Peer Assessment and Online Feedback on Learning Outcomes and Academic Motivation Among Undergraduate Anesthesiology Students

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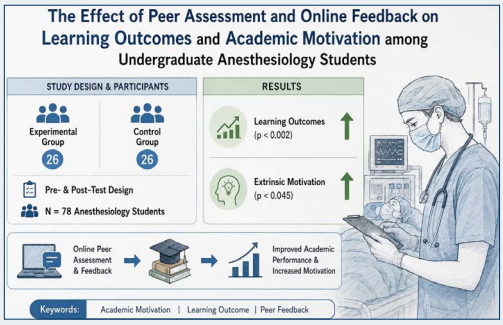
Abstract



Introduction: Feedback, one of the essential components of learning-oriented assessment, has received a lot of attention recently. However, there is some controversy surrounding the importance and value of peer feedback. The current study was carried out to learn more about how online peer assessment and feedback impact academic motivation and learning outcomes in undergraduate students of anesthesiology.

Methods: This study had a pre- and post-test structure and was a semi-experimental intervention. The research population consisted of all undergraduate anesthesiology students at Ahvaz Jundishapur University of Medical Sciences. Each intervention group had twenty-six students, as did the control group. To assess the learning outcome, both a researcher-made and Harter's academic motivation questionnaire were utilised. Participants received the internet link to the pre-test questionnaire and began the intervention ten days before the training workshop. Ten days after the intervention ended, the post-test was also administered online. The SPSS version 25 program was used for data analysis.

Results: Based on the results of the paired t-test, the average learning outcome in the pre-test compared to the post-test in the experimental group had a significant increase ($P<0.001$, $d=0.94$). Based on the results of the independent t-test, the post-test means of learning outcomes ($P<0.002$, $d=0.66$) and extrinsic motivation ($P<0.045$, $d=0.62$) of the experimental group had a significant increase compared to the control group.

Conclusion: These findings suggest that the implemented intervention, likely involving online peer assessment and feedback, has positively impacted both academic performance and extrinsic motivation among the participants.

Introduction

In recent years, the integration of information and communication technologies (ICTs) into higher education has profoundly influenced various aspects of the academic process, including academic writing, professional learning, and peer feedback support.[1,2] Among these advancements, peer assessment—a practice in which students evaluate their classmates at the same educational stage—has emerged as a transformative approach, enhancing the evaluation process traditionally performed by teachers.[3] Peer assessment not only enables students to develop critical evaluation skills but also fosters a deeper understanding of the subject matter by engaging them in the review process. Feedback, a vital component of peer assessment, empowers students to self-evaluate and refine their assignments based on constructive input from peers.[2,4,5] Recently, online

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peer assessment and feedback have gained traction as innovative methodologies. This approach allows students to evaluate, provide feedback, and complete assignments in a collaborative online environment, eliminating the need for face-to-face interactions.[6] While some students possess inherent motivation for learning, others require external factors to nurture their academic engagement.[7-10] Strong academic motivation is closely associated with improved learning outcomes, while low motivation often leads to suboptimal performance.[8] Despite extensive research on peer assessment and online feedback globally, most studies focus on the process rather than on measurable outcomes, such as learning and motivation.[9]

Furthermore, limited studies have explored these practices in the field of anesthesiology, where cognitive and decision-making skills are vital in critical and non-critical situations.[10] Learning outcomes are a collection of knowledge, abilities, attitudes, and understanding that an individual acquires as a result of successfully completing a particular set of experiences related to higher education.[11] However, motivation is the most important factor that guides behaviour toward accomplishing the objective and promoting learning. Accordingly, intrinsic motivation inspires an individual to try to accomplish their potential talents and skills. In contrast, extrinsic motivation is a condition that occurs as a result of external stimuli and supports individuals' conduct.[12,13] Motivation, a critical driver of learning, encompasses intrinsic motivation—stemming from an individual's internal desire to realise their potential—and extrinsic motivation, influenced by external stimuli.[7] Studies highlight that motivation enhances learning, fosters creativity, reduces anxiety, and promotes better academic outcomes. Learning is facilitated, communication improves, anxiety is decreased, and creativity increases when motivation is present in the learning and training processes. who are highly motivated to learn more effectively and achieve better academic results.[14] Strong motivation increases learning, whereas low motivation decreases learning, according to the findings of some studies.[15] No research has yet examined the impact of online peer assessment and feedback on anesthesiology students in Iran, representing a significant research gap.

This study was performed to examine the effect of peer assessment and online feedback on academic motivation and learning outcomes among undergraduate anesthesiology students for a variety of reasons. This research was conducted because cognitive and decision-making processes are of utmost significance in the field of anesthesiology, both in critical and non-critical conditions,[16] and because the majority of studies conducted abroad on online peer feedback have considered only the process of peer feedback, neglecting its outcomes, e.g., learning.[3] Additionally, no studies have been carried out in Iran to date on students studying this subject. In this manner, we hope to highlight the significance of examining this novel educational approach during the COVID-19 pandemic, which is likely to reduce academic motivation in this challenging environment.

Methods

This study was a quasi-experimental intervention that utilised a pre- and post-test design.

Participants

The research population consisted of 60 students from the Bachelor of Anesthesiology program who met the inclusion criteria and provided informed consent. The inclusion criteria were as follows:

- Enrollment in at least two semesters of the program.
- Willingness to participate in the study and complete all required assessments.

Exclusion criteria included:

- Withdrawal of consent at any stage.
- Failure to complete the pre- or post-test assessments.

Participants' demographic characteristics, including age, sex, marital status, and academic standing, were recorded and summarized. The average age of participants was 22.3 ± 1.8 years, with 40% male and 60% female students.

Randomization and Bias Mitigation

Randomization was not performed in this study because the workshop-based intervention grouped students by enrollment status. To mitigate potential biases:

- The intervention and control groups were matched based on academic level and prior coursework.
- Blinded peer assessment was utilized to reduce subjective evaluation biases.
- Assignments and scenarios were standardized for all participants to ensure consistency.

Intervention Technique

All students were provided with a pre-test via an online link, consisting of three questionnaires: demographic data, Harter's standard academic motivation questionnaire, and a learning outcomes assessment.

After the workshop, a WhatsApp group was created for participants in both the intervention and control groups. While WhatsApp was used for communication and assignment submissions, steps were taken to ensure accessibility and uniform participation:

1. All students were confirmed to have access to WhatsApp prior to the study.
2. Instructions and deadlines were communicated through multiple channels, including email and in-person announcements.
3. Technical support was made available to resolve any connectivity issues.

Assignments, based on a clinical scenario involving a pregnant woman in the recovery area, were drafted following the workshop's guidelines. In the intervention group, participants were anonymously paired for peer review, while in the control group, feedback was provided solely by the instructor. Peer and instructor evaluations were used to refine the final reports, which were graded

using a standardized checklist.

Data Collection Tools

In this study, an instrument developed by the researcher was utilised to assess the level of student report writing, which was evaluated as a learning outcome. This instrument was developed from the manual for cataloguing medical record forms. They were provided by the medical vice-president, the office for hospital management and clinical service excellence, the department of statistics and medical information technology, and the national committee for statistics management and health information technology at the Ministry of Health and Medical Education of Iran. This checklist consists of 56 questions to which "Yes" or "No" answers were given. Each "No" response received 0 points, while each "Yes" response received 1 point. A student's score could range from zero to fifty-six. Higher scores correspond to higher-quality assignments in terms of learning outcomes. Five faculty members and instructors from Ahvaz Jundishapur University of Medical Sciences, eight faculty members and instructors from Mazandaran University of Medical Sciences, and three faculty members and instructors from Babol University of Medical Sciences examined the checklist to make sure its contents were accurate. The content validity ratio was also used to ensure the content validity of the research instruments. In accordance with the Lawshe table, the cut-off Content Validity Ratio (CVR) was determined to be 0.49 by the total of 15 experts. Furthermore, all the items were kept because, in the opinion of the experts, the average was higher than 0.49. The retention of all the items was confirmed once again after the content validity index, which was calculated for added emphasis, was higher than 0.79 for all the items. The reliability of the instrument was assessed using the internal consistency method and Cronbach's alpha coefficient.

The instrument utilised to assess academic motivation included two parts. The first part was a demographic information questionnaire to collect data such as age, sex, marital status, etc. The second part was Harter's standard academic motivation questionnaire, which contained 33 items. It was a modified form of the Harter scale (1980-1981) used to investigate students' academic motivation. As stated, Harter's main scale measures academic motivation with bipolar questions; i.e., intrinsic and extrinsic motivation in students. Student answers to each item can only include one of the intrinsic or extrinsic motivations. To create a standard scale that accounts for both intrinsic and extrinsic motivation equally, Leper et al. modified Harter's scale. Each item on this scale considers only one intrinsic or extrinsic motivational factor. The Likert scale underlies this survey (from never 1 to Almost Always 5). The minimum and maximum scores for this questionnaire are 33 and 165, respectively. The degree of academic motivation in this society is low if the questionnaire results range from 33 to 66. The degree of academic motivation is at an average level if the questionnaire's results fall between 66 and 99, and it is extremely good if the results are over 99.[17-19] Numerous studies, including those by Bahrani (2018), Zahiri and Rajabi (2018), and Hojjati et al. (2014), have put this instrument through psychometric evaluation. By using the SPSS program to determine Cronbach's alpha test in these investigations, a reliability score of 0.92 for this questionnaire was obtained.

Table 1. Participants' demographic information

Group		Age		Gender		marital status	
	N	M	SD	Male	Female	Single	married
Control	26	21.92	1.62	4	22	25	1
Experimental	26	21.65	1.09	5	21	23	3
		$P=0.537$		$P=0.734$		$P=0.298$	

N = Number, M = Mean, SD = Standard Deviation, P = P-value

Statistical Analysis

Quantitative and qualitative variables were presented by mean ± standard deviation and number (per cent), respectively. Kolmogorov-Smirnov test was used to check the normality assumption of the quantitative variables. Between- and within-group comparisons were made using independent and paired t-tests. All analyses were performed using IBM SPSS version 25, and P-values less than 0.05 were considered statistically significant.

Results

Demographic and baseline values between the study groups were revealed not to be statistically significant ($P>0.05$) (Table 1).

The Kolmogorov-Smirnov test showed that the distribution of variable scores was normal ($P>0.05$), and the results of Levene's test showed that the homogeneity of variance was maintained in the post-test ($P>0.05$) (Table 2).

Based on the results of the paired t-test, the average learning outcome in the pre-test compared to the post-test in the experimental group had a significant increase ($P<0.01$, d=0.96) (Table 3).

Based on the results of the independent t-test, the post-test means of learning outcomes ($P<0.01$, d=0.66) and extrinsic motivation ($P<0.05$, d=0.62) of the experimental group had a significant increase compared to the control

Table 2. Tests of normality and Homogeneity of variances

		Kolmogorov-Smirnova To check the normal distribution			Levene's Test of Equality of Error Variances	
Variable	Phase	Statistic	df	P	Levene Statistic	P
Learning Outcomes	Pre-test	.118	52	0.098	0.14	0.704
	Post-test	.134	52	0.061	0.162	0.689
Academic Motivation	Pre-test	.073	52	0.200	0.05	0.810
	Post-test	.097	52	0.200	0.050	0.824
Extrinsic Motivation	Pre-test	.083	52	0.200	0.01	0.891
	Post-test	.123	52	0.078	0.022	0.882
Intrinsic Motivation	Pre-test	.064	52	0.200	1.45	0.233
	Post-test	.082	52	0.200	3.651	0.062

Table 3. Differences between intra-group means and effect size of the Variable (Pre-test and post-test s)

	Experimental							Control						
	Pre-test		post-test		Intra-group			Pre-test		post-test		Intra-group		
	M	SD	M	SD	t	*P*	d	M	SD	M	SD	t	*P*	d
Learning Outcomes	30.38	8.33	37.81	7.04	-5.89	<0.001	0.94	29.54	8.10	28.77	6.11	-1.12	0.092	-0.10
Academic Motivation	108.4	11.65	108.3	9.87	-0.02	0.982	0.13	105.88	13.05	104.76	13.48	0.48	0.635	0.06
Extrinsic Motivation	48.69	5.70	49.38	4.22	0.35	0.726	0.13	47.58	4.76	46.11	6.02	0.01	0.928	-0.25
Intrinsic Motivation	59.62	6.50	58.92	6.91	-0.26	0.796	-0.10	57.33	8.73	58.65	9.34	-0.88	0.386	0.14

t=T-value, d=Effect Size d Cohen

Table 4. Differences between inter-group means and effect size of the Variables (experimental and control groups)

	Pre-test							post-test						
	Experimental		Control		inter -group			Experimental		Control		inter -group		
	M	SD	M	SD	t	*P*	d	M	SD	M	SD	t	*P*	d
Learning Outcomes	30.38	8.33	29.54	8.10	0.37	0.712	-0.10	37.81	7.04	28.77	6.11	-3.25	<0.002	0.66
Academic Motivation	108.4	11.65	105.88	13.05	0.65	0.519	-0.20	108.3	9.87	104.76	13.48	0.41	0.683	-0.3
Extrinsic Motivation	48.69	5.70	47.58	4.76	0.70	0.486	0.06	49.38	4.22	46.11	6.02	1.64	<0.045	0.62
Intrinsic Motivation	59.62	6.50	57.33	8.73	0.46	0.642	-0.10	59.92	6.91	58.65	9.34	0.11	0.906	-0.15

t= T-value, d= Effect Size dCohen

group (Table 4).

Discussion

The current study was carried out with the intention of examining the impact of peer assessment and online feedback on learning outcomes and academic motivation among undergraduate anesthesiology students. The findings revealed a significant difference in learning outcomes scores before and after feedback in the experimental group. This conclusion can be attributed in part to instructional interventions in which students received effective peer feedback. Giving peer feedback through interactions between students and the content has an indirect impact on learning outcomes, according to a study by Goh et al.[20] According to another study, Dooley et al. revealed that early and frequent peer feedback can give students the opportunity to develop crucial core competencies in education, including the self-regulated learning skills necessary to work in collaborative teams.[21] Latifi et al. demonstrated that students in three experimental conditions (peer feedback, peer advancement, and their combination) benefited more from peer learning, processes, high-quality argumentative essays, and dedicated learning than students in the control group (with no support).[22] Peer feedback is an effective teaching strategy for involving students in active learning, according to studies. Peer feedback is also referred to as a type of formative peer assessment that offers an average evaluation of learners' learning performance. Peer review in the classroom did not, however, improve final grades or performance in terms of student learning outcomes, according to a 2015 study by Crowe et al.[23] Likewise, Hattie and Timperley discovered that peer feedback typically provides relatively limited information about the work, hence its inability to increase interaction and comprehension.[24] The difference between the results of these studies could be attributed to varying intervention strategies and sample sizes. One possible reason for the effect of online peer feedback on students' learning outcomes is the online collection of research data. Online assessment and feedback are helpful resources for teamwork, introspection, and professional growth. They provide students with more time to reflect on the topic under discussion and help them in overcome time and space limitations.[1]

The results of the present study revealed a noteworthy increase in academic extrinsic motivation within the experimental group compared to the control group. The utilisation of online peer assessment and feedback had a discernible impact on the academic extrinsic motivation of undergraduate anesthesiology students. Consistent with these results, Liu et al. demonstrated that the peer education group was more motivated and had a better learning attitude than the lecture-based group.[25] Peer acceptance and group membership were linked to a variety of motivational outcomes in high school, according to studies by King et al.[26] and Nichols et al.[27] In other words, the peer learning strategy might inspire more effective peer engagement, which improves students' willingness to study financial management and have greater collaboration with their peers. It has also been shown that peer assessment can increase team members' accountability to one another and aid in the development of problem-solving skills.[28] In contrast, a study conducted by Bietenbeck et al. found that, in elementary school, peer motivation did not yield any discernible impact on the motivation levels of classmates.[28] The divergence in the study populations, educational contexts, and subject expertise can contribute to differences in the outcomes between the current study and the present study. According to Elliot et al, peer relationships can influence people's behaviour negatively by putting pressure on them.[29] However, people can only feel motivated when they see their peers as an encouraging and positive group.[30]

While many of the studies mentioned earlier conducted their interventions face-to-face, the present study's intervention was carried out online. Due to the limited interaction within a single communication channel, there is a difference in the quality of peer relationships between those involving face-to-face communication and those involving only online communication. Those who communicate with their friends offline can do so through a variety of offline and online activities. Peer relationships that are more intimate tend to involve more self-disclosure, reciprocity, emotion, and interaction. Additionally, studying online without in-person interactions can result in stress and anxiety, which lowers motivation.[31,32] Studies on peer interactions and their impact on academic motivation during online learning remain incredibly scarce. However, the results showed no notable improvement in intrinsic motivation, a finding that warrants further exploration. One possible explanation is the nature of online learning and communication channels, which may limit opportunities for meaningful peer interactions. Studies have highlighted that online education can introduce stress and anxiety, reducing students' intrinsic motivation. Unlike face-to-face peer interactions, which allow for deeper reciprocity and emotional exchange, online platforms might lack the intimacy and immediacy needed to foster intrinsic motivation.

recognition—may have overshadowed intrinsic motivation, which relies on internal satisfaction and curiosity. The structured nature of online peer feedback might have inadvertently shifted the focus toward Additionally, the nature of extrinsic motivation—often tied to external rewards such as grades or peer extrinsic rewards.

Future Research Directions

Future research should explore strategies to enhance intrinsic motivation in online learning environments. Incorporating multimodal communication tools, such as video conferencing or hybrid learning models, could provide richer peer interactions and foster emotional connections. Studies should also investigate the role of personalized feedback and scaffolding in promoting intrinsic motivation alongside extrinsic rewards.

Moreover, longitudinal research is needed to assess the long-term impact of peer assessment on both learning outcomes and intrinsic motivation. Understanding how intrinsic and extrinsic motivational factors interact in different educational contexts will guide the development of more effective interventions.

By addressing these gaps, educators can better leverage the potential of peer feedback to improve academic performance while fostering both intrinsic and extrinsic motivation in diverse learning environments.

Conclusion

In conclusion, the study's findings point towards a positive impact of peer assessment and online feedback on learning outcomes and extrinsic motivation. These results contribute valuable insights for educators and institutions seeking effective approaches to enhance academic performance and motivation in the evolving landscape of education.

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Authors' Contribution

Conceptualization: Zahra Ranjbar, Masoumeh Albooghobeish, Sara Adarvishi, Kambiz Ahmadi Angali
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Competing Interests

The authors declare no conflict of interest.

Ethical Approval

All undergraduate anesthesiology students at Ahvaz Jundishapur University of Medical Sciences made up the research population for this study with the ethics code IR.AJUMS.REC.1400.710. All patients' information was stored confidentially.

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