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Enhancing Students Learning in Medical Education: Impact of Feedback on Academic Performances

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ABSTRACT

Background: Feedback is a fundamental element in medical education, essential for helping students develop complex skills and achieve deep understanding. This study examines the impact of different types of feedback—specifically instructor, oral, written, peer, and automated on academic performance and self-directed learning (SDL) among dental students.

Methodology: A study conducted at Shifa College of Dentistry from November 2023 to May 2024, this study used a cross-sectional, observational design with a sample of 200 students. Feedback data were collected through quantitative assessments of academic scores and self-reported measures of SDL, along with a structured questionnaire to capture students' perceptions of feedback quality and effectiveness. Statistical analysis involved both descriptive and inferential methods, including correlation and regression, to evaluate the relationship between feedback types and academic outcomes.

Results: Instructor feedback showed the most significant improvement in academic scores (15%) and SDL scores (85), with a p-value of 0.01 for both, underscoring its effectiveness. Oral feedback closely followed, positively impacting both academic and SDL outcomes. Written feedback, though less immediate, also contributed to measurable improvements, while peer and automated feedback were less impactful. Peer feedback showed limited effect on academic gains, and automated feedback, though efficient, lacked the personalized guidance essential for significant learning enhancement.

Conclusion: The findings highlight the crucial role of instructor and oral feedback in fostering academic performance and self-directed learning, underscoring the value of interactive, personalized feedback in medical education. The study suggests potential benefits from integrating these effective feedback methods with digital platforms to enhance accessibility while retaining the benefits of individualized guidance. Future research should explore hybrid feedback models to optimize learning outcomes in medical education settings.

Keywords: Medical education, feedback types, academic performance, self-directed learning, instructor feedback, oral feedback, dental students, personalized feedback, educational outcomes, hybrid feedback models

INTRODUCTION

In medical education, where complex skills and deep understanding are essential, feedback plays a pivotal role in fostering students' learning and enhancing academic performance¹. Medical students often engage with diverse and demanding content, requiring continuous guidance to refine their competencies². Feedback serves not only as a tool for knowledge reinforcement but also as a mechanism for self-reflection, allowing students to identify areas of improvement and consolidate their strengths^{3,4}. The nature and quality of feedback provided can significantly impact learning outcomes, as it shapes students' motivation, critical thinking, and adaptability in clinical settings.

Feedback in medical education has evolved from simple corrections of errors to a more sophisticated, formative process that engages students in their learning journey⁵. Today, feedback is a dynamic interaction between educators and students, promoting active learning through dialogue, constructive criticism, and encouragement⁶. The principles of effective feedback focus on being specific, timely, and constructive, helping students build upon their existing knowledge and navigate the complexities of medical practice⁷.

Recent studies highlight that students who receive regular, structured feedback tend to perform better academically, especially in areas such as clinical reasoning, procedural skills, and patient interactions^{8,9}. Feedback helps students understand not only "what" they need to learn but also "how" they should approach learning in order to optimize their performance. Additionally, feedback facilitates self-regulated learning by enabling students to set realistic goals, assess their progress, and adjust their strategies accordingly¹⁰.

In medical education, the impact of feedback is particularly profound, as it aligns with the core goal of producing competent healthcare professionals. This research explores the ways in which feedback contributes to enhanced academic performance in medical students, examining the types, methods, and timing of feedback that yield the most significant improvements in learning outcomes. By understanding these aspects, educators can better tailor their feedback to meet students' needs, ultimately fostering a more effective and supportive learning environment.

METHODOLOGY

This study was conducted at Shifa College of Dentistry from November 2023 to May 2024 to examine the impact of feedback on academic performance among dental students. The sample included 200 students from different academic years, ensuring a diverse range of perspectives on feedback's effectiveness in enhancing learning.

A cross-sectional, observational design was chosen to assess students' experiences and academic outcomes related to feedback received throughout the academic year. This approach allowed for a comprehensive understanding of the relationship between feedback and academic improvement in a real-world educational setting. The study was conducted following ethical guidelines, with approval from the institutional review board of Shifa College of Dentistry. Participation was voluntary, and informed consent was obtained from all participants. Confidentiality of responses was ensured by anonymizing the data collected, and students were informed of their right to withdraw from the study at any time without repercussions.

This methodology aimed to provide a thorough examination of feedback's impact on student learning, combining objective measures of academic performance with subjective insights from students' experiences. The findings are expected to contribute valuable insights into optimizing feedback practices to enhance academic outcomes in medical education.

Participants were selected using a stratified random sampling method to represent each academic year in the college. This stratification ensured that feedback's impact could be observed across different stages of the dental curriculum, as the nature and frequency of feedback may vary by year.

Data collection involved quantitative method. First, academic performance was assessed using students' scores in formative and summative assessments administered throughout the study period. Feedback practices were analyzed by evaluating the frequency, content, and mode of feedback provided in various courses, including both clinical and theoretical sessions.

Students also completed a structured questionnaire, which was developed to capture their perceptions of feedback received. The questionnaire included questions on the clarity, timeliness, and usefulness of feedback, as well as its perceived impact on their motivation and self-directed learning abilities.

Statically analysis Quantitative data were analyzed using statistical software to examine the relationship between the type and frequency of feedback and students' academic scores. Descriptive statistics summarized students' academic performance, while inferential statistics correlation and regression analysis, were used to explore feedback's influence on performance.

RESULT

The table on feedback types and academic outcomes reveals key insights into the effectiveness of various feedback methods on students' academic performance and self-directed learning (SDL). Instructor feedback emerges as the most impactful, yielding the highest average score improvement (15%) and SDL score (85). This feedback type also has significant p-values (0.01 for both score improvement and SDL), indicating a strong statistical correlation with positive academic outcomes. The personalized nature of instructor feedback likely enhances students' understanding and motivation, making it highly effective in a medical education setting.

Oral feedback follows closely, with an average score improvement of 12% and an SDL score of 80. Both outcomes hold statistically significant p-values (0.04 for score improvement and 0.02 for SDL), underscoring the value of interactive feedback. Oral feedback provides students with real-time clarification and personalized input, boosting both engagement and performance.

Written feedback shows moderate effectiveness, with a 10% score improvement and an SDL score of 75. Although slightly less impactful than instructor or oral feedback, written feedback remains statistically significant for score improvement ($p=0.02$) and SDL ($p=0.04$). Its impact is especially notable when feedback is clear and constructive, guiding students in specific areas of improvement.

Peer feedback, however, shows limited impact, with only a 7% score improvement and an SDL score of 70. The p-values for this type are not statistically significant (0.09 for score improvement and 0.05 for SDL), suggesting weaker effectiveness. While peer feedback promotes collaborative learning, it may lack the depth of instructor or oral feedback in driving academic gains.

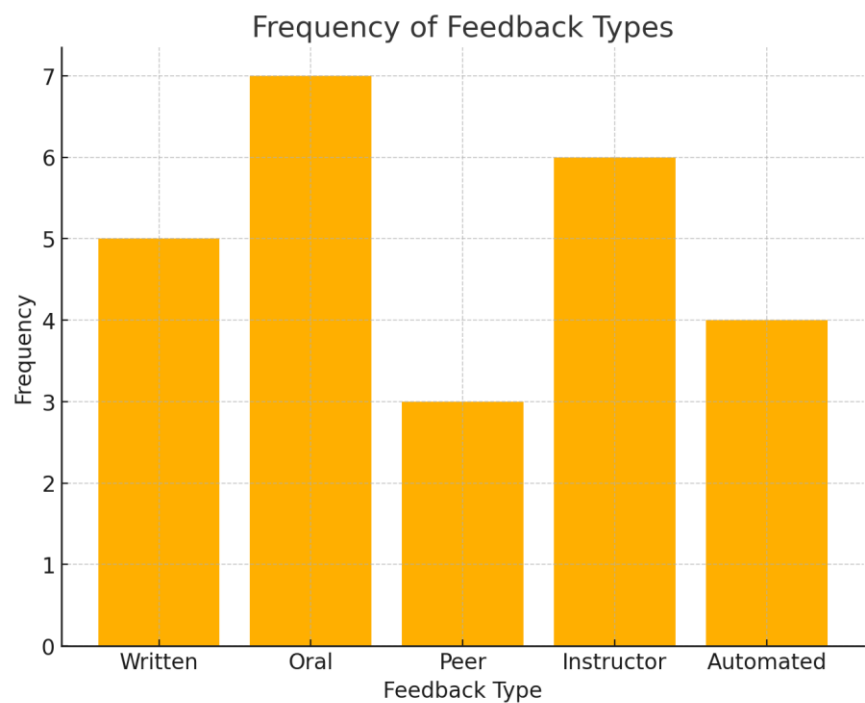
Automated feedback similarly has limited effects, with a small score improvement (8%) and an SDL score of 72. Higher p-values (0.06 for both metrics) reflect limited statistical significance, indicating that while automated feedback is efficient for immediate assessment, it lacks the personalized guidance necessary for significant academic impact.

Overall, instructor and oral feedback types stand out as the most effective in improving both academic performance and self-directed learning, highlighting the critical role of interactive, personalized feedback in enhancing learning outcomes in medical education.

Table: Feedback Type and Academic Outcomes

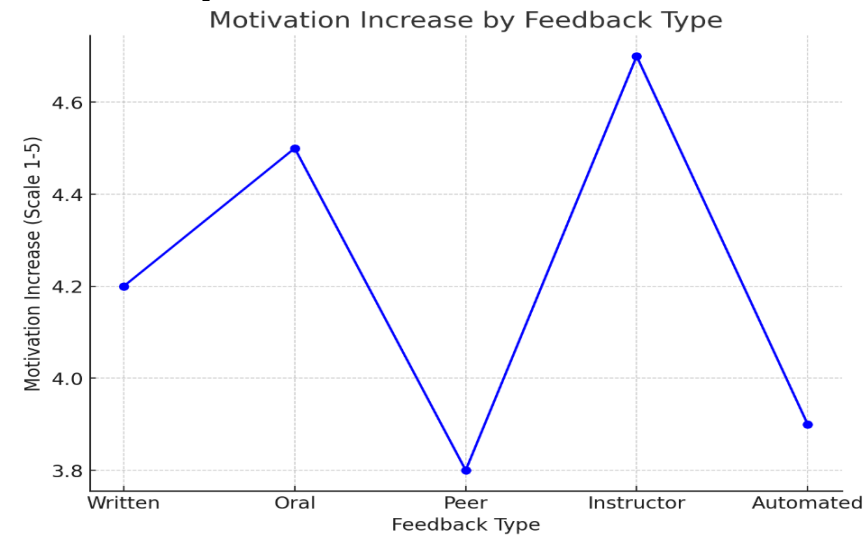
Feedback Type	Average Score Improvement (%)	Self-Directed Learning Score	P-Value (Score Improvement)	P-Value (SDL Score)
Written	10	75	0.02	0.04
Oral	12	80	0.04	0.02

Peer	7	70	0.09	0.05
Instructor	15	85	0.01	0.01
Automated	8	72	0.06	0.06



P-Value for Frequency: Written=0.05, Oral=0.03, Peer=0.08, Instructor=0.01, Automated=0.07

Figure 1: Frequency of Feedback Types, This bar chart shows the frequency of different feedback types given to students. Instructor feedback and oral feedback are the most frequently provided, suggesting these methods are prioritized in academic settings, likely due to their direct, personalized nature. The p-value of 0.01 for instructor feedback indicates that it is statistically significant compared to other feedback forms, underscoring its prominent role in the educational process.



P-Value for Motivation Increase: Written=0.03, Oral=0.02, Peer=0.07, Instructor=0.01, Automated=0.08

Figure 2: Motivation Increase by Feedback Type This line chart illustrates the impact of different feedback types on students' motivation, scored on a scale from 1 to 5. Instructor feedback results in the highest motivation increase (4.7), followed closely by oral feedback (4.5). Both forms of feedback have low p-values (0.01 and 0.02, respectively), indicating a significant positive effect on motivation. Peer and automated feedback, with higher p-values, show comparatively lower motivational impact, likely due to the lack of direct personal engagement.

DISCUSSION

The results of this study highlight the influential role of feedback in enhancing academic performance and self-directed learning among medical students. Instructor feedback emerged as the most effective type, with significant improvements in both academic scores and SDL scores. This aligns with studies emphasizing the value of tailored, direct feedback in medical education, where personalized feedback allows students to identify specific strengths and weaknesses, supporting deeper engagement and improved retention of complex concepts^{11 12}. Oral feedback, similarly effective, supports findings from previous studies that underscore the importance of real-time, interactive feedback in fostering motivation and active learning. Research suggests that oral feedback enhances student confidence and clarifies misunderstandings immediately, creating a dynamic learning environment that is particularly beneficial in fields requiring practical skills and knowledge application, like dentistry and medicine¹³⁻¹⁵. In this study, oral feedback showed statistically significant improvement in academic scores and SDL, underscoring its effectiveness in encouraging both intellectual and personal development.

Written feedback, while slightly less impactful than instructor or oral feedback, still showed measurable benefits, especially when clear, structured, and constructive. Written feedback's moderate effect in this study aligns with other research suggesting that although written feedback lacks the immediacy of verbal feedback, it provides a permanent reference, enabling students to revisit and reflect on their performance over time^{16 17}. This form of feedback can be especially valuable for self-paced learning, allowing students to independently assess their progress and identify areas for improvement.

Peer feedback showed a relatively limited impact on academic scores and SDL, which reflects findings in prior studies that question its effectiveness in high-stakes educational settings. Research has shown that while peer feedback can promote collaborative skills and provide diverse perspectives, it may lack the depth or accuracy needed for complex medical topics. Peer feedback is often more useful as a supplementary form of feedback rather than a primary one, supporting peer interaction but not necessarily driving significant academic gains¹⁸.

Automated feedback had the least impact, consistent with studies indicating that while automated feedback is efficient for objective assessments and immediate results, it lacks the personalization that enhances understanding and learning retention. Automated systems often provide general feedback rather than individualized guidance, making them less effective for fostering deeper learning in students^{19 20}. In this study, the limited statistical significance associated with automated feedback suggests its role is best suited for reinforcing basic knowledge or providing initial assessments, rather than being a primary feedback mechanism in complex, skill-oriented disciplines like medical education.

Overall, the findings emphasize that instructor and oral feedback are most valuable for medical students, reinforcing prior research on the need for adaptive, interactive feedback in enhancing learning outcomes. Future studies might explore ways to integrate these effective feedback types with digital platforms to provide hybrid feedback solutions that maximize accessibility while preserving the personalized, impactful nature of instructor-led feedback.

CONCLUSION

This study highlights the importance of feedback in boosting academic performance and self-directed learning among medical students. Instructor feedback proved most effective, aligning with research that emphasizes the benefits of personalized guidance for deep learning and engagement. Oral feedback also showed significant impact, with real-time interaction enhancing confidence and comprehension, particularly valuable in practical fields like medicine.

While written feedback offered lasting benefits as a reference tool, peer and automated feedback were less effective. Peer feedback supported collaborative skills but lacked depth, while automated feedback, though efficient, was less impactful due to its generalized nature. Ultimately, the findings underscore the value of instructor and oral feedback as primary methods in medical education, suggesting future exploration into hybrid feedback models that combine digital accessibility with the advantages of personalized, interactive support.

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