

## IMPACT OF FORMATIVE ASSESSMENT WITH IMMEDIATE FEEDBACK ON STUDENT PERFORMANCE IN MEDICAL SCHOOL

Madiha Akhwand<sup>1</sup>, Juneda Sarfraz<sup>2</sup>, Altaf Qadir Khan<sup>3</sup>, Bilqis Hassan<sup>4</sup>, Fatima Muhammad Khan<sup>5</sup>, Saadia Rehman<sup>6</sup>

Received : 15/04/2026  
Received in revised form : 07/06/2026  
Accepted : 12/06/2026

### Keywords:

Formative assessment; immediate feedback; academic performance; medical students; medical education; knowledge retention

### Corresponding Author:

Dr. Juneda Sarfraz,  
Email: juneda\_sarfraz@yahoo.com

DOI: 10.47009/jamp.2026.8.3.287

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Acad Med Pharm  
2026; 8 (3); 1636-1641



<sup>1</sup>Assistant Professor, Department of Medical Education, Rawal Institute of Health Sciences, Islamabad, Pakistan.

<sup>2</sup>Associate Professor, Department of Public Health, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan.

<sup>3</sup>Professor, Department of Psychiatry and Behavioural Sciences, Queens Medical College, Ihsan Mumtaz Hospital, Lahore, Pakistan.

<sup>4</sup>Associate Professor, Department of Medical Education, Northwest School of Medicine, Peshawar, Pakistan.

<sup>5</sup>Assistant Professor, Department of Medical Education, Northwest School of Medicine, Peshawar, Pakistan.

<sup>6</sup>Assistant Professor, Department of Dental Education, Abbottabad International Medical Institute, Abbottabad, Pakistan.

### ABSTRACT

**Background:** Formative assessment can help to diagnose gaps in learning in the middle of the learning process, and immediate feedback can help students fix misconceptions before summative assessments. But there is little evidence on its effectiveness in undergraduate medical education in Pakistan. **Objective:** To determine the impact of formative assessment with immediate feedback on medical students' academic performance. **Materials and Methods:** The quasi-experimental comparative research was carried out in the Rawal Institute of Health Sciences, Islamabad from January-June 2025. Eighty-five medical students were randomly divided into two groups: an immediate feedback group (n = 43) and a conventional feedback group (n = 42). All participants took baseline, immediate post-test, delayed post-test and final examinations. Structured explanatory feedback was provided immediately following formative assessments to students in the intervention group. A questionnaire with the 5 point Likert scale was used to measure student perceptions. **Results:** Baseline scores were comparable between the immediate-feedback and conventional-feedback groups ( $61.40 \pm 7.62$  versus  $60.80 \pm 8.01$ ;  $p = 0.724$ ). The immediate-feedback group achieved significantly higher immediate post-test ( $78.60 \pm 7.24$  versus  $69.70 \pm 8.16$ ), delayed post-test ( $75.20 \pm 7.51$  versus  $66.50 \pm 8.27$ ) and final examination scores ( $77.30 \pm 7.10$  versus  $68.10 \pm 8.30$ ), with all  $p < 0.001$ . The final examination pass rate was also higher in the intervention group (93.0% versus 76.2%;  $p = 0.031$ ). Immediate feedback produced a large effect on final performance (Cohen's  $d = 1.19$ ). Most students reported improved understanding, motivation, confidence and recognition of learning gaps. **Conclusion:** Formative assessment accompanied by immediate feedback significantly improved medical students' academic achievement and was highly acceptable to learners. Its structured integration into undergraduate medical curricula may strengthen learning and examination performance.

## INTRODUCTION

Assessment is a key part of medical education as it affects the learning, study organization and success level of acquiring the needed competencies. Summative assessment at the end of a course is often the focus of traditional assessment systems. While

examinations can help to identify progression and certification, they offer little opportunity for students to identify and correct learning problems while being taught. This limitation is overcome by a formative assessment approach, which gathers information about student learning during the learning activities and uses that information to enhance learning. There

is new research that supports the idea that effective formative assessment positively affects student learning and can be used to help professionals determine students who need extra educational support.<sup>[1-3]</sup>

Feedback is the main way in which formative assessment impacts on learning. Repeated testing without feedback about their performance to the student may not be very educational. Effective feedback provides information about what is being done well, what was not done well, the why and how, and provides instruction about what to do differently to improve. Feedback that is timely, specific, understandable and linked to clear learning goals is most helpful. Immediate feedback may be especially beneficial as students can check their own reasoning while the content being assessed is still fresh. Explanatory and individual feedback has been found to increase understanding and subsequent examination performance in studies with medical students.<sup>[4-6]</sup>

Medical education is based on vast amount of scientific information which needs to be memorized and utilized in the clinical environment. It is possible for students to have gaps in knowledge in a course without being aware of their weakness until they fail a summative assessment. Formative assessments are repeated on a regular basis, allowing for information to be retrieved, reinforced and corrected as needed. They also enable faculty to identify and adjust to commonly misconceived topics. Structured formative assessment and feedback have been shown to enhance performance in clinical and final exams through research in anatomy, physiology and clinical-skill education.<sup>[7-9]</sup>

The advantages of instant feedback can go beyond test results. Constructive feedback can help students take charge of their learning, study methods and progress in a positive way. It can also enhance self-assurance and motivation, assuring students that lack of can be addressed with purposeful work. Student engagement is still vital since you don't get feedback to impact performance if it is not understood, accepted or used to inform future learning. Student involvement, receptivity for feedback, and fostering a positive classroom culture, therefore, have been the focus of previous studies. Self-efficacy, intrinsic motivation, self-regulated learning and the well-being of medical students have also been linked to formative assessment.<sup>[10,11]</sup>

Despite growing international evidence, structured formative assessment with immediate feedback has not been consistently incorporated into undergraduate medical teaching in Pakistan. Differences in class size, curriculum organization, faculty workload and assessment culture may influence its feasibility and effectiveness. Local evidence is therefore required before recommending its wider implementation. The present study was conducted to evaluate the impact of formative assessment accompanied by immediate feedback on immediate learning, knowledge retention, final

examination performance and pass rates among medical students. It also assessed students' perceptions regarding the usefulness, acceptability and motivational effects of immediate feedback.

## MATERIALS AND METHODS

A quasi-experimental comparative study was conducted at the Rawal Institute of Health Sciences, Islamabad, from January 2025 to June 2025. The study evaluated the effect of formative assessment accompanied by immediate feedback on the academic performance of undergraduate medical students. Written informed consent was obtained from all participants. Students were informed that participation was voluntary, their responses would remain confidential and their decision to participate would not influence their academic grades.

Before the intervention, both groups completed a baseline knowledge test consisting of structured multiple-choice questions related to the instructional content. Both groups subsequently received the same learning objectives, course content, teaching hours and instructional material from the same faculty members. A non-probability consecutive sampling of 85 medical students was used for the study. The sample was split into two parts: conventional-feedback group (N = 42) and immediate-feedback group (N = 43). The sample size was determined to compare two independent means, with a 2-sided significance level of 5%, a desired level of statistical power of 80% and an estimated standardized effect size of ~0.62. Eligibility was students from selected MBBS class, who were attending regular teaching sessions and gave informed consent. Students who previously attended a comparable educational intervention, failed to attend more than 20% of the teaching and/or assessment sessions, withdrew consent to participate or did not have complete assessment records were excluded. To evaluate the comparability of the two groups at the start, previous academic scores were taken, along with baseline tests.

Both groups were given a baseline knowledge test made up of structured multiple choice questions covering the content of instruction prior to the intervention. Both groups subsequently received the same learning objectives, course content, teaching hours and instructional material from the same faculty members. Students in the intervention group took brief formative assessments regularly throughout the teaching time. Correct answers were discussed immediately after each assessment, explanations were offered for each of the answer choices and common misconceptions were addressed. Individual guidance was also provided to students on areas to be improved. Feedback was provided during the same session of teaching, typically within 10 – 15 minutes of the assessment task completion. Conventional feedback group had normal teaching and the same kind of assessment but

they weren't given any structured immediate feedback, rather they were given answers and general feedback at the end of the respective teaching unit. The students' academic performance was measured through an immediate post-test at the end of the intervention, a delayed post-test about 4 weeks later and the final course test. The content blueprint and learning objectives for all assessments were pre-defined. The order of questions was changed between assessments to minimize recall bias. All scores were converted to percentage scores and improvement was determined as post test minus pre test scores. The scores of delayed post test and immediate post test were used to calculate knowledge retention as: (Delayed post test score/Immediate post test score) x 100. The pass status for examinations and percentage of students getting at least 75% marks were also noted. Students in the immediate feedback group filled out a structured questionnaire, which included a five-point Likert scale for the usefulness, clarity and acceptability of the feedback, as well as the impact of the feedback on motivation, confidence, understanding, identification of learning gaps and examination anxiety.

Data were analysed by IBM SPSS Statistics version 26.0. Normality of continuous variables was tested and presented as mean  $\pm$  standard deviation, while categorical variables were presented as frequencies and percentages. Independent-samples t-tests were performed to compare mean scores across the groups

and paired-samples t-tests were used to determine changes within the groups. Categorical outcomes, including the number of students who passed, were compared using the chi-square test or Fisher's exact test, as applicable. Pearson correlation was used to analyze the correlations between formative assessment participation, attendance and final examination scores. The Cohen's d was used to measure the magnitude of the effect of the intervention. Multiple linear regression was performed to assess the independent association between immediate feedback and final examination performance after adjustment for baseline score, age, gender, attendance and previous academic performance. Results were presented as 95% confidence intervals, and a value of  $p < 0.05$  (two-sided) was regarded as statistically significant.

## RESULTS

There were 85 medical students who participated throughout the study and were analyzed in the final analysis. The students were randomly divided into an immediate feedback group ( $n = 43$ ) and a conventional feedback group ( $n = 42$ ). The mean age of the participants was  $21.36 \pm 1.42$  years, and 49 (57.6%) were female. The two groups did not differ in age, gender, attendance or previous academic performance or baseline test scores (all  $p > 0.05$ ).

**Table 1: Baseline characteristics of the participants**

| Variable                   | Immediate-feedback group ( $n = 43$ ) | Conventional-feedback group ( $n = 42$ ) | p-value |
|----------------------------|---------------------------------------|------------------------------------------|---------|
| Age, years                 | $21.28 \pm 1.39$                      | $21.45 \pm 1.46$                         | 0.583   |
| Female gender              | 25 (58.1%)                            | 24 (57.1%)                               | 0.924   |
| Previous academic score, % | $69.72 \pm 7.15$                      | $68.94 \pm 7.48$                         | 0.624   |
| Attendance, %              | $87.16 \pm 6.38$                      | $85.93 \pm 7.04$                         | 0.399   |
| Baseline test score, %     | $61.40 \pm 7.62$                      | $60.80 \pm 8.01$                         | 0.724   |

Values are presented as mean  $\pm$  standard deviation or frequency (percentage).

There was a significant increase in student achievement for those who were receiving formative assessments with immediate feedback. The mean score of their immediate post-test was  $78.60 \pm 7.24$ , which was higher than the baseline score of  $61.40 \pm$

$7.62$ . The conventional-feedback group's score increased from  $60.80 \pm 8.01$  to  $69.70 \pm 8.16$ . Between the groups the difference in immediate post-test scores was statistically significant ( $p < 0.001$ ).

**Table 2: Comparison of academic performance between the groups**

| Assessment outcome                           | Immediate-feedback group ( $n = 43$ ) | Conventional-feedback group ( $n = 42$ ) | Mean difference | p-value   |
|----------------------------------------------|---------------------------------------|------------------------------------------|-----------------|-----------|
| Baseline test score, %                       | $61.40 \pm 7.62$                      | $60.80 \pm 8.01$                         | 0.60            | 0.724     |
| Immediate post-test score, %                 | $78.60 \pm 7.24$                      | $69.70 \pm 8.16$                         | 8.90            | $< 0.001$ |
| Delayed post-test score, %                   | $75.20 \pm 7.51$                      | $66.50 \pm 8.27$                         | 8.70            | $< 0.001$ |
| Final examination score, %                   | $77.30 \pm 7.10$                      | $68.10 \pm 8.30$                         | 9.20            | $< 0.001$ |
| Improvement from baseline, percentage points | $17.20 \pm 6.48$                      | $8.90 \pm 6.93$                          | 8.30            | $< 0.001$ |
| Knowledge-retention rate, %                  | $95.67 \pm 5.22$                      | $95.41 \pm 6.08$                         | 0.26            | 0.833     |

There was a significant difference between the two groups in the improvement achieved ( $p < 0.001$ ), with the immediate-feedback group showing a mean improvement of  $17.20 \pm 6.48$  percentage points and the conventional-feedback group showing a mean improvement of  $8.90 \pm 6.93$  percentage points. Immediately fed-back students also showed better retention of the knowledge acquired as scores

remained significantly higher on the delayed post-test. But there was no significant difference comparing the proportions between the groups ( $p = 0.833$ ). The mean final exam score for the immediate feedback group was  $77.30 \pm 7.10$ , for the conventional feedback group was  $68.10 \pm 8.30$ . The mean difference was 9.20 percentage points (95% CI:

5.91–12.49;  $p < 0.001$ ), with a large effect size (Cohen's  $d = 1.19$ ).

**Table 3: Examination outcomes according to feedback method**

| Outcome                    | Immediate-feedback group (n = 43) | Conventional-feedback group (n = 42) | p-value |
|----------------------------|-----------------------------------|--------------------------------------|---------|
| Passed final examination   | 40 (93.0%)                        | 32 (76.2%)                           | 0.031   |
| Failed final examination   | 3 (7.0%)                          | 10 (23.8%)                           | 0.031   |
| Achieved $\geq 75\%$ marks | 29 (67.4%)                        | 13 (31.0%)                           | 0.001   |

The final exam pass rate was 93.0% vs 76.2% ( $p = 0.031$ ) between the immediate feedback group and the conventional feedback group. In addition, 67.4% of the students who received immediate feedback scored 75% or more, while 31.0% of the students in the conventional feedback group did the same ( $p = 0.001$ ). The students in the intervention group took an

average of  $7.42 \pm 1.36$  formative assessments. There was a moderate positive relationship between the number of formative assessments and the results of the final exams ( $r = 0.58$ ,  $p < 0.001$ ). There was also a positive correlation with final examination performance ( $r = 0.34$ ,  $p = 0.002$ ).

**Table 4: Perceptions of students receiving immediate feedback**

| Perception statement                           | Mean score $\pm$ SD | Agreed/strongly agreed |
|------------------------------------------------|---------------------|------------------------|
| Feedback helped identify learning gaps         | $4.47 \pm 0.59$     | 40 (93.0%)             |
| Feedback improved understanding of the subject | $4.40 \pm 0.62$     | 39 (90.7%)             |
| Formative assessments increased motivation     | $4.21 \pm 0.71$     | 36 (83.7%)             |
| Feedback improved examination confidence       | $4.28 \pm 0.67$     | 38 (88.4%)             |
| Feedback reduced examination anxiety           | $3.91 \pm 0.83$     | 32 (74.4%)             |
| The approach should be used in other courses   | $4.49 \pm 0.55$     | 41 (95.3%)             |

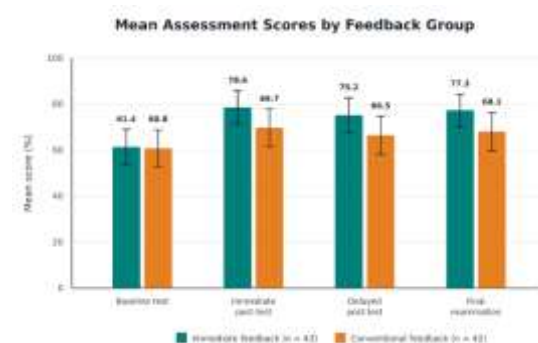
Responses were recorded on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Student perceptions of immediate feedback were favourable. The majority of participants indicated that it enabled them to identify areas of their learning that were lacking, and that it made their learning and confidence in examinations better. The overall (sum of all groups) recommendation for using formative assessment with immediate feedback in other medical courses was 41 of 43 students (95.3%). The participation in the immediate feedback group was independently associated with the final examination score after adjustment for baseline score, attendance, age, gender and previous academic performance (adjusted  $\beta = 8.41$ ; 95% CI: 5.12–11.70;  $p < 0.001$ ). The results suggest that the use of formative assessment with prompt feedback had resulted in a significant improvement in students' academic outcomes.

## DISCUSSION

The present study demonstrated that formative assessment accompanied by immediate feedback was associated with a substantial improvement in medical students' academic performance. Although baseline scores were comparable between the groups, students receiving immediate feedback obtained significantly higher immediate post-test, delayed post-test and final examination scores. The adjusted mean difference in final examination performance remained 8.41 percentage points after controlling for baseline score, attendance, age, gender and previous academic performance. The large effect size further indicated that the observed improvement was educationally meaningful rather than merely statistically significant. These results are consistent with Sirianansopa et al., who reported improved post-test performance after incorporating formative assessment and targeted mentoring into undergraduate medical education, and with Zhu et al., who found a significant association between formative assessment and academic achievement in a clinical-skills course.<sup>[12,13]</sup>

The greater score improvement in the intervention group may be explained by the timing and explanatory nature of the feedback. Immediate discussion of correct and incorrect responses allowed students to recognize misconceptions while the assessed material was still fresh in their memory. It also provided an opportunity to understand why an answer was incorrect and how the relevant concept should be applied. Goodwin and Nathaniel similarly found that individualized, in-person formative feedback produced better academic outcomes than feedback limited to the provision of grades. Lertsakulbunlue and Kantiwong further observed



**Figure 1: Comparison of mean baseline, immediate post-test, delayed post-test and final examination scores between students receiving formative assessment with immediate feedback and those receiving conventional feedback. Error bars represent standard deviations**

that immediate self-feedback assessments helped students identify areas requiring improvement and supported subsequent examination performance.<sup>[14,15]</sup> Therefore, the value of formative assessment appears to depend not only on administering repeated tests but also on providing timely, specific and actionable explanations.

Students receiving immediate feedback also maintained significantly higher scores on the delayed post-test. However, the proportional knowledge-retention rate was similar between the groups, suggesting that immediate feedback raised the level of learning achieved initially but did not markedly alter the subsequent rate of knowledge loss. The positive correlation between the number of completed formative assessments and final examination scores indicates that repeated opportunities for retrieval, correction and reinforcement may have produced cumulative benefits. Atwa et al. reported a positive relationship between formative assessment participation and final practical examination performance in anatomy, while Shinde et al. documented significant improvement in physiology practical scores after introducing structured formative feedback.<sup>[16,17]</sup> Regular formative assessments may therefore promote continuous learning and reduce dependence on intensive preparation immediately before summative examinations.

Student perceptions of the intervention were also favourable. Most participants reported that immediate feedback helped identify learning gaps, improved subject understanding and increased examination confidence. More than 95% recommended extending the approach to other courses. These responses are consistent with research showing that students value feedback when it is clear, individualized and connected to specific performance criteria. Ma et al. emphasized the importance of student participation and responsiveness to learner needs when designing formative assessment, while Ngim et al. found that most medical students considered both immediate face-to-face and detailed written feedback beneficial to their performance.<sup>[11,18]</sup> The reported increases in motivation and confidence may also have encouraged students to engage more actively with the course material. This interpretation is supported by evidence that formative assessment can strengthen self-efficacy, intrinsic motivation and self-regulated learning while reducing test anxiety.<sup>[19]</sup> Several limitations should be considered when interpreting the findings. The quasi-experimental design did not involve complete randomization and therefore cannot exclude the influence of unmeasured differences between the groups. The study was conducted at a single medical institution with a relatively small sample, limiting generalizability to other medical schools, academic years and subjects. Participants and faculty members could not be blinded, and students' perceptions were based on self-reported responses that may have been influenced by social desirability. The follow-up

period was also short and did not determine whether the observed benefits persisted into later academic years or improved clinical performance. Contamination between groups was possible because students could have discussed assessment content outside teaching sessions. Future multicentre randomized studies should compare immediate, delayed, written, verbal and technology-assisted feedback; include longer follow-up; and assess clinical reasoning, practical competence and long-term knowledge retention. The workload and feasibility of providing repeated individualized feedback should also be evaluated before widespread curricular implementation.

## CONCLUSION

Formative assessment with immediate feedback was associated with significantly better immediate learning, delayed performance, final examination scores and pass rates among medical students. Students also reported improved understanding, motivation, confidence and recognition of learning gaps. Incorporating structured, timely and explanatory feedback into routine formative assessments may provide an effective approach for strengthening academic performance in undergraduate medical education. Nevertheless, larger randomized and multicentre studies with longer follow-up are required to confirm its long-term educational and clinical benefits.

## REFERENCES

1. Luo, P., et al., Formative objective structured clinical examination with immediate feedback improves surgical clerks' self-confidence and clinical competence. 2023. 45(2): p. 212-218.
2. Zhu, T., et al., Association between formative assessment and academic performance for undergraduate medical students in a Chinese clinical skills training course. 2021. 27: p. e929068-1.
3. Ryan, A., et al., Beyond right or wrong: More effective feedback for formative multiple-choice tests. 2020. 9(5): p. 307-313.
4. Hathila, P.B., et al., Students' reflection on immediate feedback during formative assessment. 2023. 13(3): p. 644-647.
5. Cong, X., et al., The effectiveness of formative assessment in pathophysiology education from students' perspective: a questionnaire study. 2020. 44(4): p. 726-733.
6. Joshi, V., et al., Utilizing formative assessment to encourage study strategy modifications by osteopathic medical students: an observational study. 2021. 23(1): p. 82-86.
7. Baig, M., Z.J. Gazzaz, and M.J.P.j.o.m.s. Farouq, Blended Learning: The impact of blackboard formative assessment on the final marks and students' perception of its effectiveness. 2020. 36(3): p. 327.
8. Goodwin, R.L. and T.I.J.M.S.E. Nathaniel, Effective feedback strategy for formative assessment in an integrated medical neuroscience course. 2023. 33(3): p. 747-753.
9. Morris, R., T. Perry, and L.J.R.o.e. Wardle, Formative assessment and feedback for learning in higher education: A systematic review. 2021. 9(3): p. e3292.
10. Heggarty, P., et al., Role of formative assessment in predicting academic success among GP registrars: a retrospective longitudinal study. *BMJ Open*, 2020. 10(11): p. e040290 DOI: 10.1136/bmjopen-2020-040290.

11. Ma, T., et al., Reflection on the teaching of student-centred formative assessment in medical curricula: an investigation from the perspective of medical students. *BMC Medical Education*, 2023. 23(1): p. 141 DOI: 10.1186/s12909-023-04110-w.
12. Sirianansopa, K., Evaluating students' learning achievements using the formative assessment technique: a retrospective study. *BMC Medical Education*, 2024. 24(1): p. 1373 DOI: 10.1186/s12909-024-06347-5.
13. Zhu, T., et al., Association Between Formative Assessment and Academic Performance for Undergraduate Medical Students in a Chinese Clinical Skills Training Course. *Med Sci Monit*, 2021. 27: p. e929068 DOI: 10.12659/msm.929068.
14. Goodwin, R.L. and T.I. Nathaniel, Effective Feedback Strategy for Formative Assessment in an Integrated Medical Neuroscience Course. *Med Sci Educ*, 2023. 33(3): p. 747-753 DOI: 10.1007/s40670-023-01801-3.
15. Lertsakulbunlue, S. and A. Kantiwong, Development and validation of immediate self-feedback very short answer questions for medical students: practical implementation of generalizability theory to estimate reliability in formative examination designs. *BMC Medical Education*, 2024. 24(1): p. 572 DOI: 10.1186/s12909-024-05569-x.
16. Atwa, H.S., et al., Implementing Formative Assessment in Human Anatomy Practical Sessions: Medical Students' Perception and Effect on Final Exam Performance. *Advances in Medical Education and Practice*, 2024. 15(null): p. 551-563 DOI: 10.2147/AMEP.S465384.
17. Shinde, S.A., et al., Effectiveness of Structured Feedback Training on Student's Performance in Formative Assessment of Physiology Practicals: A Comparative Study. *Cureus*, 2025. 17(3): p. e80176 DOI: 10.7759/cureus.80176.
18. Ngim, C.F., et al., Feedback after OSCE: A comparison of face to face versus an enhanced written feedback. *BMC Medical Education*, 2021. 21(1): p. 180 DOI: 10.1186/s12909-021-02585-z.
19. Yousefi Afrashteh, M. and S. Rezaei, The mediating role of motivated strategies in the relationship between formative classroom assessment and academic well-being in medical students: a path analysis. *BMC Medical Education*, 2022. 22(1): p. 38 DOI: 10.1186/s12909-022-03118-y.