

Research Article

Comparison of Open-Book versus Closed-Book Assessments in Medical Students

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Received: 06.03.2026, Revised: 10.06.2026, Accepted: 17.06.2026

ABSTRACT

Background: In medical education, assessment is crucial as it quantifies student learning and helps direct their future academic growth. Closed-book assessment is typically used to evaluate memory and recall, and open-book assessment gives students access to the learning materials they will be studying, which may lead to understanding, application, and clinical reasoning among students. A comparison of both assessments can be used to determine the better approach to support medical student learning.

Objective: To compare open-book and closed-book assessments in medical students in terms of academic performance, cognitive-level performance, stress, satisfaction, and perceived usefulness for learning.

Methodology: The cross sectional comparative study was carried out from January 2025 to June 2025 at Frontier Medical and Dental College Abbottabad. The selection of the medical students was not random, but rather done through non-probability sampling that employed convenience sampling, which included a total of 75 students. The students were split into two groups as per the type of assessment - open-book assessment and closed-book assessment. The two groups were tested on the same academic content and a structured paper was used containing recall, concept, application and clinical reasoning questions. Academic performance was evaluated using mean score, pass/fail and performance categories. A structured questionnaire was used to collect students' perceptions about stress, fairness, satisfaction, difficulty, usefulness for learning and preference for future use. Data were analyzed based on SPSS, and p-value < 0.05 were regarded as statistically significant.

Results: The open-book assessment group achieved a higher mean score than the closed-book assessment group. Students in the open-book group performed better in conceptual understanding, application-based questions, and clinical reasoning questions, while the closed-book group showed slightly better performance in recall-based questions. Open-book assessment was also associated with lower stress, higher satisfaction, and greater perceived usefulness for learning. A higher proportion of students preferred open-book assessment for future examinations.

Conclusion: Open-book assessment was associated with better academic performance, improved higher-order cognitive performance, reduced stress, and greater student satisfaction compared with closed-book assessment. Closed-book assessment remained useful for evaluating recall-based knowledge. A balanced assessment strategy using both formats may provide a more comprehensive evaluation of medical students' learning.

Keywords: Open-Book Assessment, Closed-Book Assessment, Medical Students, Academic Performance, Medical Education, Clinical Reasoning.

INTRODUCTION

Assessment plays a fundamental role in medical education, and it is fundamental to determining

the extent to which medical students have realized the learning goals. Assessment is not only employed to determine knowledge, but also aids in learning, thinking, and clinical decision-making in medical training. Typical examinations in medical colleges are typically closed book with students expected to respond to questions without the help of learning resources. This approach primarily measures memory, recall and retention of factual information. While knowledge of facts is required in medicine, medical students need to be able to analyse and interpret information, make applications and solve clinical problems (1-3).

Closed book assessment has been employed for many years as it is viewed as being easy, controlled and useful in testing core knowledge. It helps students to recall essential facts and concepts that are essential for safe clinical practice. This approach can also foster superficial learning, however, if students remember information only for testing rather than learning it. Furthermore, closed-book tests tend to be stressful and anxiety-producing, particularly if the test taker has to recall extensive material. Examination stress can impact on performance and diminish quality of learning (4-6).

An alternative approach is 'Open book assessment' where students may use approved learning materials during the assessment. This is not to say that the examination will be easier but rather the emphasis will shift from recall to understanding, interpretation, application and problem-solving. In open-book assessment, students are expected to be able to find the information that they need, to interpret it accurately and to use it for the purposes of the question. This method might be more appropriate for medical education, as physicians, in actual clinical practice, may be consulting guidelines, books, electronic resources, and clinical protocols to make the decision (7, 8).

With the growing focus on competency-based medical education, a new demand has emerged for the development and use of assessments designed to measure higher-order thinking skills. It is not sufficient for medical students to recite information; they must also be able to apply it to real-life situations. These skills could be fostered using open-book assessment, which could enhance deep learning and eliminate the need for memorization. It can also enhance student satisfaction, and alleviate the stress in the examination process. There are a

few issues about open book assessment that are not addressed, however, including lack of preparation, reliance on resources and providing the right questions (9, 10).

Both open-book and closed-book assessments have advantages and limitations. Closed-book assessment is useful for testing essential recall-based knowledge, while open-book assessment may be more effective for evaluating application and clinical reasoning. Therefore, it is important to compare these two methods in medical students to understand their effect on academic performance and student perception. Limited local data are available regarding the use of open-book assessment in medical education. This study was therefore conducted to compare open-book and closed-book assessments among medical students in terms of academic performance, cognitive-level performance, stress, satisfaction, and perceived usefulness for learning.

METHODOLOGY

This study was conducted at Frontier Medical and Dental College Abbottabad from January 2025 to June 2025. The study was designed to compare the academic performance and perceptions of medical students regarding open-book and closed-book assessment methods. A comparative cross-sectional study design was used, as the objective was to assess and compare outcomes between two different assessment approaches at a single point during the academic session. A total of 75 medical students were included in the study.

Non-probability convenience sampling technique was used to select the participants. Students who were enrolled in the selected academic session, were present at the time of assessment, and gave consent to participate were included in the study. Students that were absent when being assessed, who did not submit to all parts of the assessment and who did not participate were excluded. This was done by splitting the students into two groups based on the type of assessment. One group appeared in open book assessment and other group appeared in closed book assessment. The assessments made on both groups were of the same academic topic for a comparison of results.

The permission was taken from the institutional authorities before the data were collected. All participants were informed about the purpose of the study and informed consent was obtained. It was explained to the students that their answers would be confidential and would

be for research only. This was a voluntary study with no obligation for students to continue if they chose to drop out. Confidentiality, privacy and voluntary participation were adhered to throughout the study in an ethical manner.

A well-organised assessment paper was prepared by the subject faculty. The test contained with recall, concept, application and clinical reasoning questions. The difficulty and content presentation remained the same for both groups. For the open-book assessment group, students could use the approved learning materials (textbooks, lecture notes, handouts) during the assessment. However, discussion with other students or use of mobile phones for communication was not allowed. The students in the closed book assessment group were not permitted to use any learning material during the test.

All the marks of the assessment were transformed into percentages for analysis. The indicators of academic performance were measured by mean score, pass/fail, and performance categories. Students with 80% or more, indicated excellent performance, those who scored from 70% to 79% indicated good performance, those who scored from 50% to 69% indicated average performance and those who scored less than 50% indicated poor performance. The performance of the cognitive level was also evaluated independently in the following manners: Recall-based questions, Conceptual understanding, Application-based questions, and Clinical reasoning questions.

Students' perceptions about the assessment method were also collected through a structured questionnaire and besides academic performance. Items on the questionnaire addressed perceived stress, satisfaction, fairness, difficulty, learning usefulness, confidence and preference for future

assessment. Responses were noted and later classified to be used in statistical analysis. The questionnaire was pre-tested, using the faculty members for clarity, relevance and content validity.

Data were coded and analyzed using SPSS software. For quantitative measures (age, assessment scores), the data were reported as mean and SD. Qualitative variables including gender, academic year, pass/fail status, level of stress, satisfaction and assessment preference were reported as frequencies and percentages. Mean scores were compared between the open book and closed book assessment groups by using the independent sample t test. In this study associations between categorical variables were determined by applying the chi-square test. The p-value is calculated as <0.05 being statistically significant. Academic performance, with the assessment score and performance category as the primary outcome variable, was the main outcome of the study. The independent variable, which was the main variable, was the type of assessment (open-book and closed-book assessment). The other factors were age, gender, academic year, stress on the job, satisfaction, utility, confidence, and preferred future assessment method.

RESULTS

In total, 75 medical students participated in this study. The average age of the students was 21.3 ± 1.4 years. Most participants were female 43 (57.3%), while males were 32 (42.7%). As far as academic year is concerned, 29 (38.7%) were from third year, 25 (33.3%) from fourth year and 21 (28.0%) from final year MBBS. The students were divided into two assessment groups: open-book assessment group (n=38) and closed-book assessment group (n=37).

Table 1. Baseline characteristics of study participants

Variable	Frequency / Mean	Percentage / SD
Total students	75	100.0
Age, years	21.3	± 1.4
Male	32	42.7
Female	43	57.3
Third year MBBS	29	38.7
Fourth year MBBS	25	33.3
Final year MBBS	21	28.0
Open-book assessment group	38	50.7
Closed-book assessment group	37	49.3

The students' mean scores were higher for the open book assessment than for the closed book

assessment. In the open book group, the mean score was 78.6 ± 8.4 and in the closed book

group, the mean score was 71.2 ± 9.1 . This was statistically different ($p < 0.001$). The pass rate was also found to be higher for the open-

book group (36) (94.7%) compared to the closed book group (30) (81.1%).

Table 2. Comparison of academic performance between open-book and closed-book assessments

Performance variable	Open-book assessment n=38	Closed-book assessment n=37	p-value
Mean score	78.6 ± 8.4	71.2 ± 9.1	<0.001
Passed students	36 (94.7%)	30 (81.1%)	0.067
Failed students	2 (5.3%)	7 (18.9%)	0.067
Excellent performance	14 (36.8%)	7 (18.9%)	0.041
Good performance	18 (47.4%)	17 (45.9%)	0.899
Average performance	6 (15.8%)	13 (35.1%)	0.048

Students who were evaluated based on various cognitive levels showed slight differences in performance with closed book assessment in recall questions. The students of the open book assessment were, however, more successful in application based and clinical reasoning

questions. This difference was found to be significant for questions of both application and clinical reasoning, suggesting that open-book assessment could facilitate deeper learning and problem solving.

Table 3. Cognitive-Level Performance of Students in Both Assessment Groups

Cognitive domain	Open-book assessment n=38	Closed-book assessment n=37	p-value
Recall-based questions	72.4 ± 9.6	75.8 ± 8.9	0.116
Conceptual understanding	77.9 ± 8.7	71.6 ± 9.4	0.004
Application-based questions	80.5 ± 7.9	69.8 ± 10.2	<0.001
Clinical reasoning questions	82.1 ± 8.2	70.4 ± 9.8	<0.001

There was clear difference in students' perception for the two assessment methods. The students who were in the open-book group reported reduced stress and increased satisfaction. Students in the closed book group,

however, reported higher stress and difficulty when taking the assessment more often. A much greater percentage of students in the open book group found the assessment method useful in learning.

Table 4. Students' Perceptions Regarding Assessment Methods

Perception variable	Open-book assessment n=38	Closed-book assessment n=37	p-value
Reported high stress	9 (23.7%)	24 (64.9%)	<0.001
Considered assessment fair	31 (81.6%)	23 (62.2%)	0.061
Reported high satisfaction	32 (84.2%)	20 (54.1%)	0.005
Found assessment useful for learning	34 (89.5%)	22 (59.5%)	0.003
Reported high difficulty	11 (28.9%)	21 (56.8%)	0.015
Preferred same method in future	33 (86.8%)	18 (48.6%)	<0.001

It was also analyzed whether factors which are associated with better performance exist. Students with good preparation, less stress and higher self-confidence were more likely to perform well in their studies. Assessment type

was also significantly correlated with performance, with students in the open-book group more likely to fall in the good/excellent category than students in the closed-book group.

Table 5. Factors Associated with Good Academic Performance

Factor	Good performance n=56	Poor/Average performance n=19	p-value
Open-book assessment	32 (57.1%)	6 (31.6%)	0.049
Closed-book assessment	24 (42.9%)	13 (68.4%)	0.049
Adequate preparation	45 (80.4%)	9 (47.4%)	0.006
High confidence before assessment	41 (73.2%)	7 (36.8%)	0.004
High stress during assessment	18 (32.1%)	15 (78.9%)	<0.001
Study time ≥ 3 hours/day	39 (69.6%)	8 (42.1%)	0.031

Overall, the results indicated that open-book assessment was positively correlated with higher mean scores, improved performance on the application and clinical reasoning questions, decreased stress, and increased student

satisfaction. The closed book assessment revealed slightly higher performance in the recall-based questions but students experienced high stress and less preference for this type of assessment.

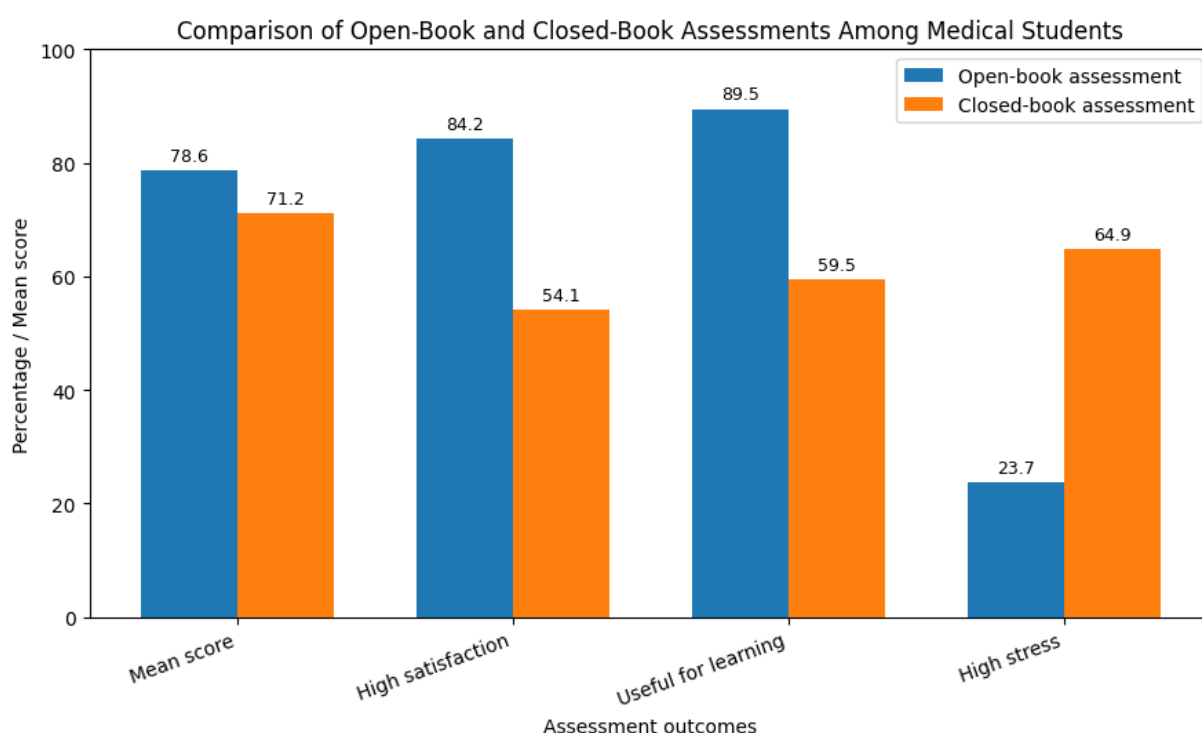


Figure 1. Comparison of Open-Book and Closed-Book Assessments among Medical Students

The graph shows that open-book assessment had higher mean score, satisfaction, and perceived usefulness for learning, while closed-book assessment was associated with higher stress.

DISCUSSION

The present study compared open-book and closed-book assessments among medical students and found that students in the open-book assessment group achieved higher mean scores than those in the closed-book assessment group. The open-book group also showed better performance in concept-based, application-based, and clinical reasoning questions. These findings suggest that open-

book assessment may encourage students to focus on understanding, interpretation, and practical application of knowledge rather than memorization alone. In medical education, where students are expected to apply theoretical knowledge to clinical situations, this type of assessment may be more useful for promoting higher-order learning (11, 12). In this study, closed book assessment was correlated with marginally higher performance in recall based questions. This is not surprising since closed-book exams generally assess memory, recall, and the ability to regurgitate what one has learned without any help. The use of memorisation has an important role in medical learning, however it is not enough for

clinical decision making. Medical students should also be taught the ability to analyze information, utilize the resources available in an appropriate manner and to solve patient related problems. Hence open book assessment could be more realistic since students are permitted to refer books but have to think about and answer the questions correctly (13, 14).

The other significant result of the research was that students in the open book group indicated that they had less stress than students in the closed book group. A high examination stress is known to have an adverse impact on student performance, confidence and learning experience. Closed book examinations tend to make students anxiety as they have to remember a lot of information. Open-book assessment on the other hand, can help to alleviate unnecessary stress and focus on students to think more about knowledge and skills. However, open-book exams should not be seen as easier as well-formulated open-book question demands careful reading, reasoning and correct utilisation of learning resources (15-17).

The students' satisfaction and learning usefulness were also higher in the open book assessment group. The students' preference for future assessment of an open book type shows that they were more supportive and learner centered. This could be because, with open book assessment, the student is able to use the book or notes in the exam. It can also motivate students to prepare regularly, to organize their study materials, and to study deeply. To gain these advantages, however, open book examinations should be appropriately designed, and the questions should assess understanding, the application of that understanding and clinical reasoning not just recall of information (18-20).

The results of this research are significant for assessment in medical education. Open-book assessment might be used as an effective alternative or as part of a mix with closed-book assessment, particularly in the case of topics where the application of knowledge and clinical reasoning are relevant. But the value of closed book assessment does not end there: It is also useful for assessing basic facts and concepts that students must retain, and that are essential for their understanding. It may therefore be most suitable to have a balanced assessment strategy, using open book and closed book methods as needed by the learning objectives. This study had some limitations, such as a small sample size and a single-center

design. More research with larger samples, multi-institutional, and with more follow-up is recommended to assess the impact of OBE on retention of knowledge and clinical performance.

CONCLUSION

The study concluded that open-book assessment was associated with higher academic scores, better performance in application-based and clinical reasoning questions, lower stress, and greater student satisfaction compared with closed-book assessment. Closed-book assessment remained useful for evaluating recall-based knowledge, but it was linked with higher stress and lower student preference. These findings suggest that open-book assessment can be an effective and student-friendly method in medical education, particularly when the aim is to assess understanding, problem-solving, and clinical reasoning. A combined assessment approach using both open-book and closed-book formats may provide a more comprehensive evaluation of medical students' learning.

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