

Assessing Student Performance on Open- versus Closed-Book Summative Assessments

Nicole Campbell, PharmD, BCPS; Anna Nogid, BS, PharmD, BCPS; Julie Kalabalik-Hoganson, PharmD, BCPS, BCCCP, MPH

Fairleigh Dickinson University, School of Pharmacy, 230 Park Avenue, Florham Park, NJ 07932



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Introduction

Findings from studies in nursing, medical, and general undergraduate education reveal little difference in performance between open-book and closed-book examination formats.^{1,2}

Open-book examinations allow students to use textbooks, online resources, or other reference material during an examination.²

Students find open-book examinations less stressful as they focus less on memorizing.^{1,2}

Traditionally, examinations in an advanced pharmacotherapy elective course were administered in closed-book format. The format of the examinations was changed in Fall 2022 to allow use of limited notes.

Study Objective

To investigate if allowing students to use notes during an examination affects student exam performance in an advanced pharmacotherapy elective course.

Methods

Exam questions from the midterm and final exams from Fall 2021 and Fall 2022 were reviewed and categorized into one of the following levels based on Bloom's taxonomy categories:

- Level 1 = knowledge and comprehension
- Level 2 = analysis and application
- Level 3 = evaluation and synthesis

Performance on midterm and final examinations in an advanced pharmacotherapy elective in Fall 2022 (open-book format) was compared with Fall 2021 (closed-book format). The following comparisons were made:

- Exam grades
- Grades based on Bloom's taxonomy categories
- Exam item response time by Bloom's category

Unpaired t-test was used for statistical comparison of endpoints between cohorts.

This study was determined as non-human subjects research by Fairleigh Dickinson University Institutional Review Board.

Results

Figure 1: Exam breakdown by Bloom's Taxonomy

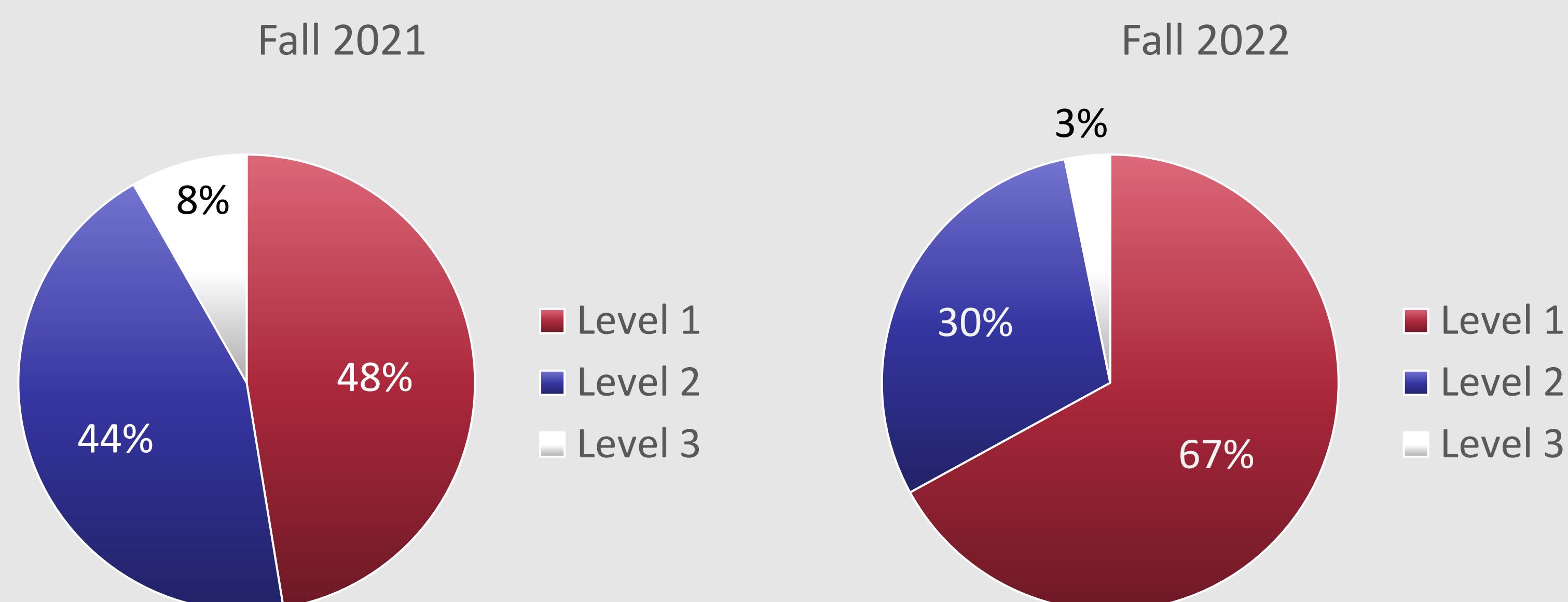


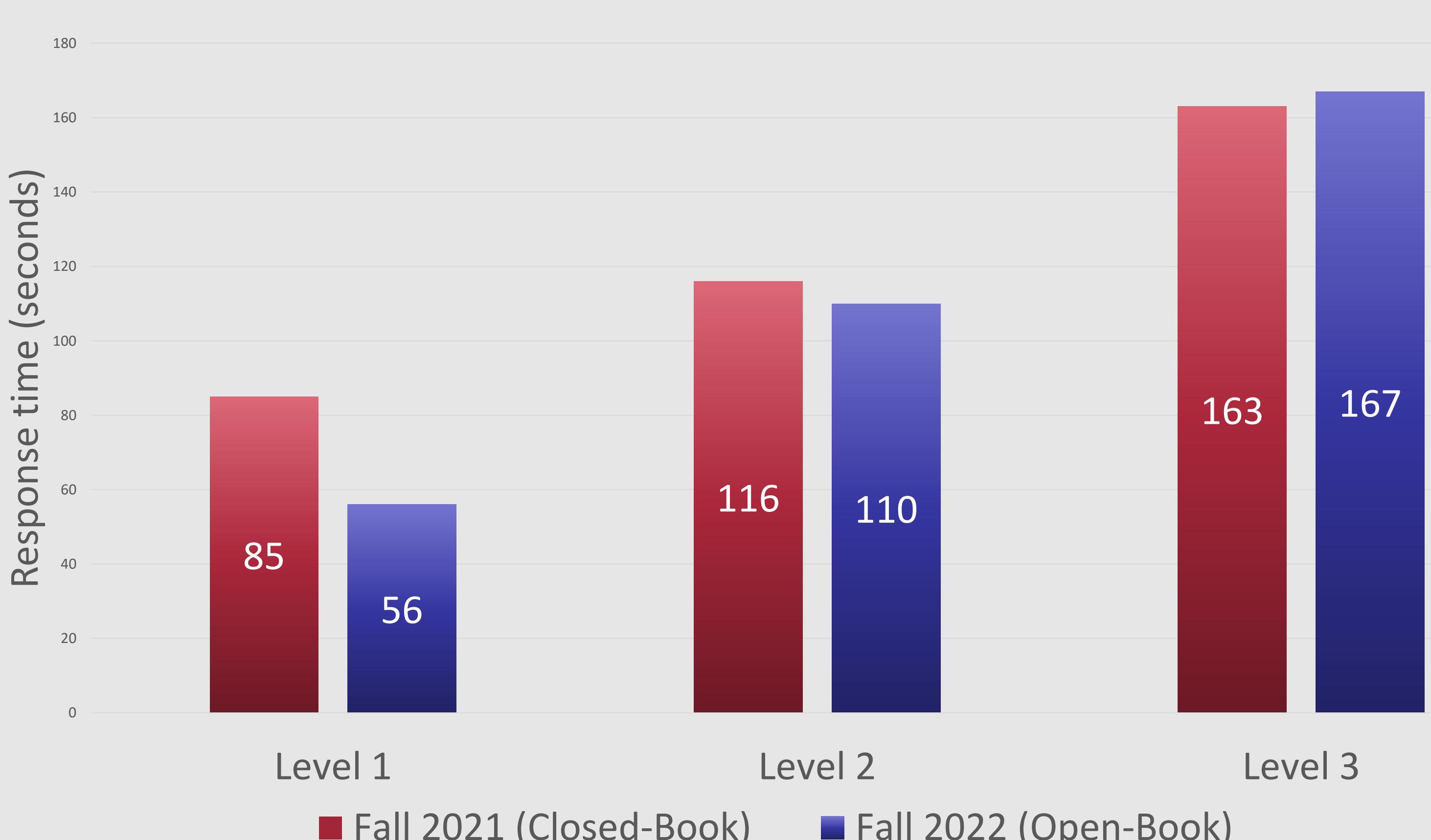
Table 1: Average exam score by semester

	Fall 2021 (Closed-book)	Fall 2022 (Open-book)	P-value
Average Exam Score	74%	82%	<0.05

Table 2: Exam performance by Bloom's level

Bloom's Level	Fall 2021 (Closed-book)	Fall 2022 (Open-book)	P-value
Level 1	74.6%	83.2%	<0.05
Level 2	69.5%	79.9%	<0.05
Level 3	74.9%	69.7%	0.67

Figure 2: Exam response time by Bloom's taxonomy level



Discussion

Students performed better on open-book examinations, particularly on level 1 and level 2 questions

- The open-book exam had more level 1 Bloom's taxonomy questions, making it difficult to determine if improvement in exam scores were due to differences in difficulty or examination format
- Response times were lowest for Level 1 questions and highest for Level 3 questions
- Average response time was significantly shorter for Level 1 questions for students who took open-book examinations as compared to closed-book examinations

Limitations:

- Retrospective analysis
- Different difficulty level between closed-book and open-book exams
- Faculty changes for individual lectures between Fall 2021 and Fall 2022 semesters may affect topic delivery and exam structure
- Decision to implement open-book format made immediately prior to midterm allowed students time to study

Conclusion

Utilization of an open-book exam format was correlated with improved performance on examinations and on Bloom's taxonomy Level 1 and Level 2 questions. Students used less time to answer Level 1 questions on the open-book examination. Differences in exam difficulty between formats pose a challenge to interpreting the results.

Future directions include comparing cohorts that have taken identical examinations based on Bloom's taxonomy categories, performing individual item analysis based on the question writer, and incorporating more Level 3 questions to better evaluate correct response rates and response times.

References

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2. Ramamurthy S, Meng H, Nadarajah VD, Pook PCK. Study on the impact of open and closed book formative examinations on pharmacy students' performance, perception, and learning approach. *Curr Pharm Teach Learn.* 2016;8:364-374.

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