Equitable Impacts of Coaching Reports on Pre-PharmD Students Self-Directed Learning and Pharmaceutical Science Exam Performance

Hannah Hoffmann | Nicholas Denton, PhD*

INTRODUCTION

Learning and retaining upper-level pharmaceutical science concepts remains a challenge for pre-PharmD students. Additional challenges to exam performance include identity threat in black, indigenous people of color (BIPOC) and lack of exposure to metacognitive skills in first generation students. These challenges result in assessment gaps in the pharmaceutical science and NAPLEX exams as well as disproportionate attrition of underrepresented groups in both pre-PharmD and PharmD programs. One potential solution to this injustice is to utilize metacognitive coaching reports that leverage scaffolded, semi-cumulative exam design.

AIMS

To promote persistence in pre-health professionals by guiding learning in the pharmaceutical sciences

To promote self-directed learning with metacognitive coaching reports after semi-cumulative and scaffolded exams

To provide individualized evidence-based study methods through insights on Bloom's Taxonomy

METHODS

Investigators captured exam performance and exit survey data from BSPS students enrolled in a pharmaceutical sciences course from AU19-SP22. AU19-SP20 served as historic controls with 3 mid-stakes (each 33% total exam grade), non-cumulative exams. From AU20-SP21, investigators implemented 3 scaffolded (ranging from 17%-42%) semi-cumulative exams with metacognitive coaching reports providing individual content and Bloom's Taxonomy scores. The final iteration then implemented 6 scaffolded low-stakes (7%-27%) semi-cumulative exams with metacognitive coaching reports with incorrect question rationales added. Self-reported student demographic data was provided along with learning strategies used after the first module exam. Performance scores were compared using unpaired student t-test with Welch's correction for individual variances.

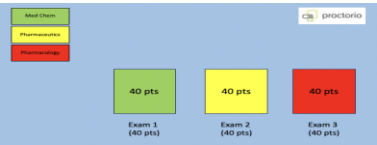Figure 1 (Above): Metacognitive Coaching Reports Examples

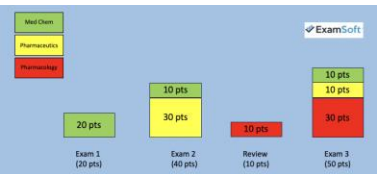Figure 2 (Above): Iteration 1 (3 Non-SC Exams, No report)

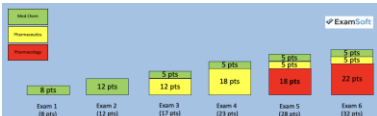Figure 3 (Above): Iteration 2 (3 SC Exams, report)

Figure 4 (Above): Iteration 3 (6 SC Exams, report)

RESULTS

Fig. 5: Metacognitive coaching reports combined with scaffolded semi-cumulative exams enhances content knowledge retention and acquisition of Bloom's taxonomy hierarchy of learning. A) Metacognitive coaching reports categorized questions requiring remembering, analyzing, and evaluating from Bloom's Taxonomy to solve. B) Total scores, C) Foundation scores, and D) Bloom's Taxonomy scores from all exams given throughout the semester during the three iterations of metacognitive coaching reports and Scaffolded semi-Cumulative (SC) exams.
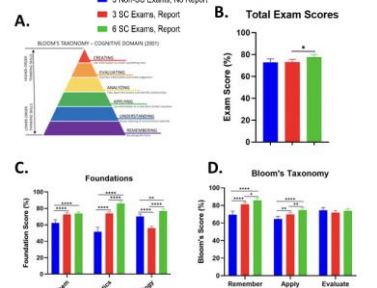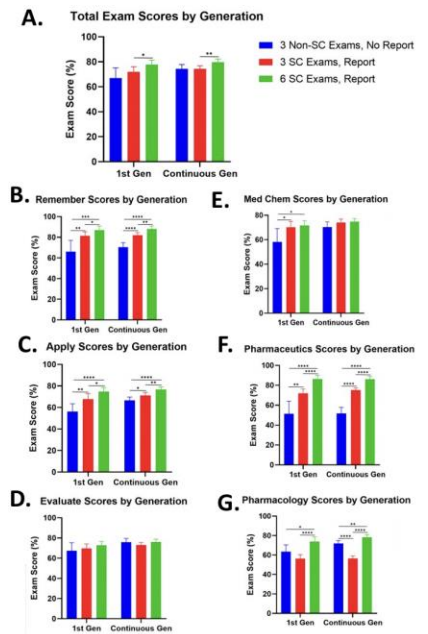

Fig. 6: Reports combined with SC exams close opportunity gaps in first generation metacognition. A) Total exam scores, B-D) Bloom's Taxonomy scores, and E-G) Foundation's scores compared between first generation and continuous generation students within three iterations

Fig. 7: Reports combined with SC exams alleviate identity threat and inequities across racial demographics. A) Total exam scores, B-D) Bloom's Taxonomy scores, and E-G) Foundation's scores compared between White, BIPOC and Asian students within three iterations.

Fig. 8: Reports provide students with evidence-based solutions to learning challenges. Students surveyed after the first module exam on their learning method with incidence of study method compared as A) ratio between incidence in top and bottom quartile students in each Bloom's category and overall exam score, B) incidence among racial demographics, and C) incidence among generation status.
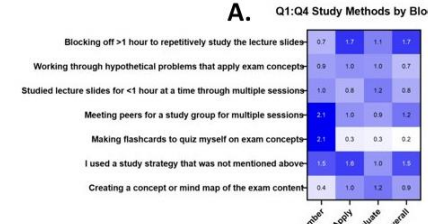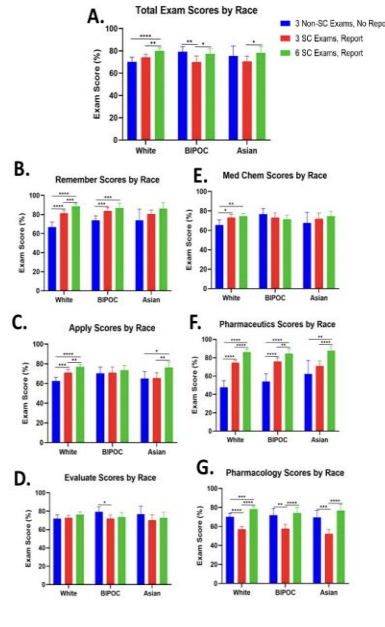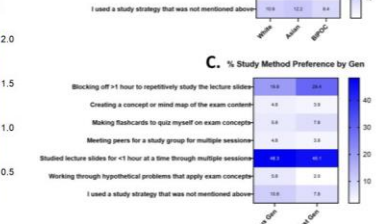

CONCLUSION

Our research has demonstrated that individualized coaching reports that include both content and Bloom's categories combined with a scaffolded semi-cumulative exam design equitably improves student learning across multiple demographics.

Semi-cumulative exams allow more opportunities for students to apply formative feedback from the coaching reports as well as enforce spaced practice of fundamental concepts as demonstrated by the increase in student Bloom's performance through iterations 1-3, particularly in first generation students with less exposure to metacognition. However, it is notable that adding more content to final exams may inadvertently raise the stakes on a single exam to the point of diverting student learning away from the final content area in addition to exacerbating identity threat that negatively impacts assessment on the highest levels of learning as seen in the 2nd iteration student pharmacology scores and racial Bloom's scores.

Scaffolding exams into lower stakes in the beginning to mid stakes near the end not only mitigates this high stakes exam disparity but also enhances all student learning by leveraging more spaced practice and opportunity for growth in the final content areas using the coaching reports. Again, it is notable that there are diminishing returns as seen in a lack of med chem improvement going from iteration 2 to 3.

Coaching reports have also provided students with insights into the most effective learning methods particularly for the remember and apply level of Bloom's taxonomy. Strategies match much of the literature demonstrating flashcards and quizzing groups are highly effective for fostering remembering, while reviewing equations from notes and working through practice quizzes better fosters application questions. While gains in evaluate question performance was limited, having coaching reports that cover the foundational levels of learning will potentially free instructors' formative feedback time to focus on higher levels of learning. We conclude with recommendations for:

Providing coaching reports on 3 levels of Bloom's Taxonomy along with a single metacognition lecture helps students identify limitations to their current learning strategies along with guidance to optimize learning.

Providing coaching reports on subject content helps students identify topics that need 2-3X more reviewing than others.

Scaffolding exams to low stakes at the start (7%) and mid stakes (27%) at the end promotes growth mindset assessments are more weighed toward final learning.

Assessing a topic 4-6 times throughout a semester provides repeat practice in addition to providing opportunity for students to respond to formative feedback.

ACKNOWLEDGEMENTS

THE OHIO STATE UNIVERSITY
COLLEGE OF PHARMACY

*Corresponding Author: Denton.58@osu.edu