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Open Book Testing in Health Science Education: Student Perceptions and Outcomes in Ultrasound Physics

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ABSTRACT
Objectives: The purpose of this study was to investigate the use of open book exams (OBE) in the education of imaging students and to assess the beliefs and perceptions of the students in regard to the use of open book testing.

Subjects & Methods: Study participants included twenty-seven sonography students enrolled in an academic health sciences center. OBE was implemented in two ultrasound physics courses. Data was collected through focus groups & exam outcomes. Creswell’s procedure for data analysis & representation was followed.

Results: Overall outcomes showed no statistically significant difference between exam grades for the different cohorts with the exception of one exam. A 100% pass rate on the American Registry for Diagnostic Medical Sonography’s (ARDMS) Sonographic Principles and Instrumentation (SPI) exam was noted for all groups. For the majority of students, exam tension & stress was not reduced on the first exam, but was reduced for the remainder of the exams. Overall, students had a positive perception of OBE.

Conclusion: Study findings support open book testing data reported in the literature. Although there was no effect on exam grades, the reduction in anxiety and stress supports the continued use of open book testing in the sonography curriculum.

LITERATURE REVIEW
In 1994 Feller, an educator, wrote about the future of education and the need to move from closed-book testing to open-book exams (OBE). Open-book exams allow students to use notes, textbooks and other resources within the testing environment. Feller believed that this form of testing more closely matched the “real-world” environment of using information to solve problems and promoted problem solving and reasoning instead of memorization of facts. Since then, others have reported additional benefits of open-booking exams including increased engagement in the classroom, improved study habits and skills, reduced testing anxiety, and in some cases, better retention of information. These benefits may potentially help students enrolled in health care education programs be successful in the classroom, in the patient care setting, and in passing national credentialing exams.

Although the research highlights many benefits to open booking exams, the majority of the literature shows no improvement in student exam scores. These outcomes are most likely attributed to students failure to prepare for the exam, over confidence in using the book during the exam, or due to the fact that exam questions are written at a higher level when OBE is utilized. To optimize the learning experience in the OBE environment, instructors must provide students with tips to be successful. Figure 2 highlights recommendations for students when an open book testing format is utilized (as adapted from Broyles, Cyr & Korsen).²

MATERIALS & METHODS
Twenty-seven sonography students enrolled in Ultrasound Physics I and II courses were part of the OBE study (10 in Academic Year (AY) 2015-16, 8 in AY 2016-17 & 9 in AY 2017-18). Students in the 2015-16 cohort utilized a closed book exam format and students in the 2016-17 and 2017-18 cohorts utilized an open book testing format. All students had similar educational backgrounds completing at least one year of college physics. The course was conducted in the fall and spring semester and assessment in each course consisted of three unit exams and one comprehensive final. All exams were administered through Examplify software, proctored and timed at a total of one question/minute. Students were allowed to bring their textbook, but no other resources. Students were encouraged to modify their textbook with handwritten notes, sticky pads, and color-coded tabs (Fig. 1).

Figure 1. Resources used during open book testing.

Figure 2. Recommendations for Open Book Testing.²
* Use sticky notes to flag important pages
* Use different colored tabs for different subject matter.
* To avoid distraction, highlight sparingly.
* Be familiar with the Table of Contents & the index of the book.
* Be familiar with the organization of the chapters.
* Understand the information in text boxes, graphs & case studies.
* During the exam:
  * Keep an eye on the clock.
  * Don’t rely on the book for every answer.
  * Flag questions that you are 60-70% sure of, return to those questions for confirmation at the end of the exam.
  * Do not spend too much time on answers that you are unsure of, do a brief search & flag these questions to return to as time allows.

RESULTS
Although not statistically significant, exam scores were slightly lower in the open book exam group when compared to scores from the previous year’s closed book group (Figure 3). Further analysis of question type missed and understanding versus application will be beneficial. All groups had a 100% pass rate on the SPI exam.

In the OBE group, for the majority of students, exam tension and stress was not reduced on the first exam of the fall semester, but was reduced for the remainder of the exams. One student commented “open book testing produces a different type of anxiety, the need to try and look up all answers during the exam”. This type of testing did promote increased textbook use for exam preparation by addition of notes, drawings and color-coded tabs to the pages. During the exams, most students completed the entire exam and then looked up flagged questions at the end, using only the time allowed time to complete the exams. Overall, students liked the open book format commenting “it was reassuring to know I could look up information if needed” and “this was a good way to learn physics”.

Figure 3. Overall Exam Outcomes.

CONCLUSION
Results of this study were positive and support the continued use of open book testing for the ultrasound physics courses. In terms of students’ grades, the use of OBEs did not result in higher exam scores when compared to those testing in the closed book exam setting. However, the majority of the students consistently expressed a preference for the open book format. Based on these outcomes, the faculty plan to continue to expand the use of open book testing within both the sonography and medical imaging and therapeutic sciences curriculum.

References

Sprout Simulink FHIR