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Perceptions and performance using computer-based testing: One institution's experience

Timothy J. Bloom^a, Wesley D. Rich^{b,*}, Stephanie M. Olson^b, Michael L. Adams^b^a Shenandoah University School of Pharmacy, Winchester, VA, United States^b Campbell University College of Pharmacy & Health Sciences, Buies Creek, NC, United States

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ABSTRACT

Background and purpose: The purpose of this study was to evaluate student and faculty perceptions of the transition to a required computer-based testing format and to identify any impact of this transition on student exam performance.

Educational activity and setting: Separate questionnaires sent to students and faculty asked about perceptions of and problems with computer-based testing. Exam results from program-required courses for two years prior to and two years following the adoption of computer-based testing were compared to determine if this testing format impacted student performance.

Findings: Responses to Likert-type questions about perceived ease of use showed no difference between students with one and three semesters experience with computer-based testing. Of 223 student-reported problems, 23% related to faculty training with the testing software. Students most commonly reported improved feedback (46% of responses) and ease of exam-taking (17% of responses) as benefits to computer-based testing. Faculty-reported difficulties were most commonly related to problems with student computers during an exam (38% of responses) while the most commonly identified benefit was collecting assessment data (32% of responses). Neither faculty nor students perceived an impact on exam performance due to computer-based testing. An analysis of exam grades confirmed there was no consistent performance difference between the paper and computer-based formats.

Discussion and summary: Both faculty and students rapidly adapted to using computer-based testing. There was no evidence that switching to computer-based testing had any impact on student exam performance.

Background and purpose

A 2011 survey by Monaghan et al.¹ found that 80% of US schools and colleges of pharmacy reported using some form of computer-based assessment. In 2013, O'Brocta² advocated the use of computer-based testing (CBT) in doctor of pharmacy programs to improve documentation of student achievement. He argued that this approach would simplify the collection of individual as well as class assessment data and thus help meet the needs of students, the institution, and accreditors. He also suggested that by coupling test questions to classification categories, student performance related to specific program outcomes could be readily analyzed and areas for improvement quickly identified. Pawasauskas et al.³ reported on implementation of CBT at the University of Rhode Island, describing it as a cost-effective approach that reduced cheating and eased faculty workload.

CBT first became widely used in secondary and post-secondary education, and researchers have examined whether students had a

* Corresponding author.

E-mail addresses: tbloom2@su.edu (T.J. Bloom), richw@campbell.edu (W.D. Rich), solson@campbell.edu (S.M. Olson), adamsm@campbell.edu (M.L. Adams).<http://dx.doi.org/10.1016/j.cptl.2017.10.015>

preference for traditional paper-based testing over CBT. Evidence consistently shows that students are quick to accept CBT over paper-based testing. Fluck et al.⁴ reported that prior experience with CBT was associated with a preference for using this format, and others found that after as little as one use, many students indicated that CBT became their preferred format.⁴⁻⁶ Some studies have shown differences in various student sub-populations and their attitudes toward CBT. Howard et al.⁷ found that male doctor of pharmacy students had a higher preference than did female classmates for using computers for assessment in a cardiology rotation, although Dermo⁸ found no difference based on gender for undergraduate students of management, information systems and engineering at a British university.

Researchers have also looked at the impact of CBT on student performance, particularly regarding a phenomenon called mode effect. This describes a situation in which factors related to the testing format, rather than actual content mastery, affect test performance. Hewson⁹ reported that for a low-stakes assessment, format had no impact on undergraduate student performance regardless of whether students were taking the assessment on their preferred format, i.e. computer vs. paper. Familiarity with computers may be an important factor related to student performance on computer-based tests. Deutsch et al.⁶ reported a difference in performance between men and women medical students, but only when self-reported comfort with computers was also taken into account. There may also be an interaction between student performance and content, as Goldberg and Pedulla¹⁰ showed that user-reported familiarity with computers was associated with performance on the quantitative and analytical, but not verbal, sections of a computer-based graduate record examination (GRE).

Campbell University College of Pharmacy and Health Sciences (CPHS) adopted the mandatory use of CBT using the ExamSoft[®] assessment program in all required courses in the doctor of pharmacy program beginning in fall 2013, after a small pilot involving several second-year courses the preceding spring. This change was made for reasons consistent with those advocated by O'Brocta,² namely to improve the collection and use of both formative assessment data for individual student performance and summative data related to program effectiveness. The objective of this article is to report the perceptions of faculty and students regarding the transition to CBT, to identify potential areas for improved training. Exam performance in multiple program-required courses for two years before and after the transition was also analyzed to identify unintended consequences of this change related to student performance.

Educational activity and setting

CPHS is a four-year doctor of pharmacy curriculum with two years of undergraduate course prerequisites. Students are provided a laptop computer upon matriculation and encouraged to use it for CBT, but they are allowed to use any computer they own if they are, for example, more comfortable with a different operating system. Upon receiving institutional review board (IRB) approval from the university, an e-mail containing a link to an online questionnaire was sent to all four student classes in December 2014, with reminder emails sent to non-responders twice before the survey closed in mid-January 2015. The same approach was used to recruit faculty to respond to a separate online questionnaire.

Student perceptions

The first section of the student questionnaire asked about demographic information including age, gender, and graduating class. The next section included questions related to personal experience with computers, including routine use of computers, daily use of social media, and prior experience with CBT. The third section used questions with a Likert-type scale to ask about perceptions of the training provided and comfort with using the testing software. Related questions were combined to form singular variables labeled "preparation," "performance," and "feedback." The fourth section provided space for open-ended responses regarding difficulties experienced while taking exams. Lastly, the questionnaire asked about the feedback provided following exams and provided space for open-ended responses regarding benefits to CBT.

Faculty perceptions

The first section of the faculty questionnaire asked about demographic information including age and gender. The next section included questions related to personal experience with computers, including routine use of computers, daily use of social media, and prior experience with CBT. The third section used questions with a Likert-type scale to ask about perceptions of the training provided and comfort with using the testing software for creating questions and exams. Related questions were combined to form singular variables labeled "preparation" and "performance." The fourth section provided space for open-ended responses regarding difficulties experienced while creating questions or exams and administering exams. Lastly, the questionnaire asked about the feedback provided following exams and provided space for open-ended responses regarding benefits to CBT.

Analysis of survey responses

Demographic and perception variables are reported for both faculty and students using descriptive statistics. Variables created by combining multiple Likert-type scale questions into a single construct were compared using independent samples *t*-tests or one-way analysis of variance (ANOVA) respectively, with significance set at $p < 0.05$ for both. Both questionnaires were analyzed for internal reliability and resulting Cronbach's alphas are reported.

Open-ended responses were analyzed independently by two authors using an iterative, open coding process. Themes were

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