Electronic Flashcards as a Tool to Improve Exam Readiness

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Abstract

Many college classes have basic information that must be learned before students can master the more complex application and analysis of advanced ideas in the class. Students often struggle with identifying and learning these facts, terms, and principles. This paper reports on a project that evaluated the use of electronic flashcards in two undergraduate engineering classes. The study materials (online flashcards) were developed in conjunction with the university's Educational Technology Office.

Introduction

For the first class a student worker from the Educational Technology Office who was also a student in the human factors class worked with the instructor to develop a set of electronic flashcards. As a faculty member and student working together, we were able to make sure the flashcards would be clear to the students. For the second class, operations management, all of the students were able to make flashcards for extra credit. The majority of the class members (91%) chose to participant. Prior research (Schmidmaier, et. al. 2011) considered the effectiveness of electronic flashcards (retesting) vs. restudying for medical students. In this project we explore engineering students' willingness and interest in using electronic flashcards.

For each class, the resulting flashcards were embedded in the class's Blackboard page. Students could choose to review the cards in a variety of formats and from different devices. Figure 1 is a screenshot of two electronic flashcards. The top card displays the term and its definition at the same time (for initial study). The lower card is showing just one side, allowing the students to test themselves. After answering the question, the student can electronically "flip" to the see the correct answer. The card sets from each chapter can be combined and shuffled. The material can be presented in a random matching exercise as well. The electronic flashcards were built using a free Web tool, Quizlet (http://quizlet.com/).

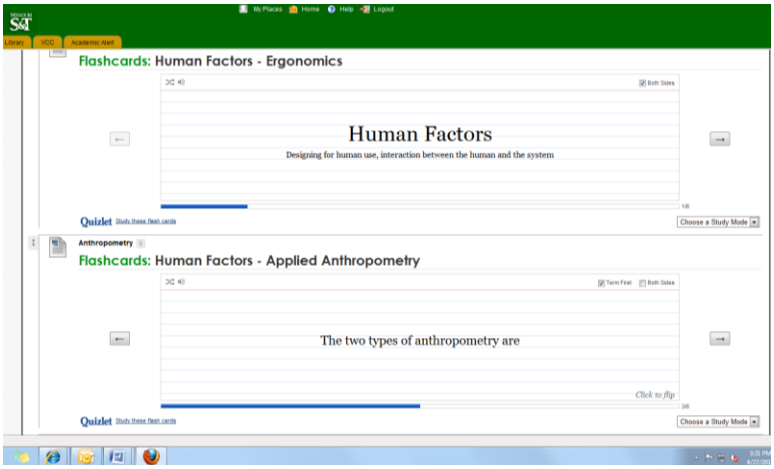

Figure 1. Screenshot of Electronic Flashcards

Survey Results

Students in an undergraduate operations management class were given the option of creating flashcards for extra credit. They worked individually or in pairs to create questions for a chapter from the course textbook. The majority of students (21 out of 23) choose to complete the assignment. All of the students were anonymously surveyed after the final exam to gather their perspective on creating and using electronic flashcards.

The survey began with background information about how the students typically studied. They self-reported that they studied an average of 5.8 hours with a mode of 4 hours for an exam. They also selected the different method(s) they used to study for an exam. Figure 2 summarizes their responses. The results concerning studying for a typical class and the instructor's class were similar. It was the first semester the instructor taught this class, so no old exams were available to the students when they were preparing for the exams.

Study Method	Typical Class	This Specific Class
Read textbook	12 (52%)	12 (52%)
Make sample questions	1 (4%)	1 (4%)
Make your own notes/flashcards	12 (52%)	9 (39%)
Review homework assignments	21 (91%)	17 (74%)
Review PPT slides or class notes	23 (100%)	21 (91%)
Study with classmates	12 (52%)	7 (30%)
Other (old exams)	3 (13%)	0 (0%)

Figure 2. How Students Study for Exams

The students who made electronic flashcards were asked "how useful was **making** a set of cards for learning the material in the chapter?" on a five point Likert scale. They were also asked "how useful was reviewing the sets of cards for **learning** the material in the chapter?" The results are reported in Figure 3. It can be seen that both making and reviewing the electronic flashcards was considered "helpful" or "very helpful" by the majority of students.

Response	Making the Cards	Reviewing the Cards
1 – Not at all	0 (0%)	0 (0%)
2 – Somewhat helpful	1 (5%)	2 (9%)
3 – Neutral	2 (10%)	2 (9%)
4 – Helpful	13 (62%)	14 (61%)
5 – Very helpful	5 (24%)	5 (22%)

Figure 3. Rating of Flashcard Usefulness

The students were also asked about how they used the electronic flashcards and how easy the technology was to use. They students had the option of viewing the flashcard in three locations. They were imbedded in the course's Blackboard website. This is a course management software program and is where students accessed the class notes, assignments, and their grades. The second choice was Quizlet.com, the website that is used to create the flashcards. The final option was to download a free application to their iPhone and review the cards directly on their phone. Students were asked to mark all of the methods they used to access the cards. Eight (35%) reviewed the cards on Blackboard. The typical student is on this website multiple times per week for the class. This may have been considered the easiest and fastest method of access. Seventeen (74%) used the software for creating the cards to also view the cards. Students had to create a free account to make the cards. Since the majority of them had participated in making the cards, they were familiar with the website and had already created an account. The iPhone option was selected by six (26%) of the students. In the written comments, one student said he or she would have used this option if they had the appropriate phone. The percentages in the responses are greater than 100% because some students used more than one method to view the flashcards.

Students were asked "How easy was it to access and use the flashcards?" on a five point scale. Seventeen students rated it "easy" and four rated it "somewhat easy". Only one student rated it as "somewhat difficult". The only written comment that student made was "hard to change sets, would like if they were compiled into one set". The cards were organized by chapter (topic). This allowed flexibility when studying. The mid-term exam covered only some of the chapters, while the final exam was comprehensive over the entire course.

The students were also asked "How many times did you review each set?" in open-ended questions. Their responses are in Figure 4. The most common answer was three times.

1 Time	2 Times	3 Times	4 Times	5 Times
2	7	8	2	3

Figure 4. How Often Students Reviewed the Electronic Flashcards

We were interested in whether the experience of creating and using electronic flashcards would affect how students studied for future classes. The students were asked "How often do you use paper flashcards to study for an exam?" and "How likely are you to use Quizlet (or some other software package) to make electronic flashcards for another class?" The results are presented in Figure 5.

How often do you use paper flashcards to study for an exam?				
Never	Rarely	Depend on Class	Often	Almost Always
6	8	5	2	1
How likely are you to make electronic flashcards for another class?				
Will Not	Not Likely	Don't Know	Somewhat Likely	Very Likely
0	3	2	11	6

Figure 5 – Student Self Reported Use of Flashcards

Several students wrote comments on these questions in the open-ended portion of the questions. Comments included "I found it very helpful as a review tool for the exam and wish I knew about it sooner; much easier than handwriting flashcards." A common response as to why the student did not make traditional flashcards was "takes time to make them". There was at least one student who preferred the traditional paper format, "I like to use paper instead of reading off a screen."

Conclusions

The instructor found this an interesting project. She gained insight into how students study and saw a great interest and appreciation from students for study aids. Comparing the experience of the two classes, the instructor does have some lessons learned for others. The set prepared by a single student with the instructor were better, more consistent cards. There were some concepts selected by the student that the instructor deemed not significant enough to warrant inclusion and a few overlooked by the student. The other students in the class were receptive to using the cards even though they did not prepare them. A different software package (Study Stack) was initially used to prepare the cards, but Quizlet proved easier for exporting and importing flashcards. This package was more difficult to use and did not have the flexibility to export the electronic cards in as many formats.

The cards created by an entire class, varied in quality and format. Some students put an excessive amount of wording on the cards. The instructor reviewed and edited the cards before releasing them to the class members. This approach took less time and created more student interest, but the flashcards were less consistent. Even with these shortcomings, the electronic flashcards were well received by the students. The instructor plans to make some changes to the cards and continue to use them in the future. Textbook authors and publishers could make this type of materials available on a website associated with the text for students nationwide.

References

Schmidmaier, R., Ebersbach, R., Schiller, M., Hege, I., Holzer, M. and Fischer, M. R. (2011), Using electronic flashcards to promote learning in medical students: retesting versus restudying. Medical Education, 45: 1101–1110. doi: 10.1111/j.1365-2923.2011.04043.x