A PERSONAL JOURNEY TOWARD A VIRTUAL INTRODUCTORY STATISTICS COURSE: NOT (QUITE) READY FOR PRIME TIME

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Drawing from web-based materials previously developed to supplement on-campus sections of an introductory statistics course for graduate students in education, the author started offering an on-line virtual class in the fall of 2001. The course, designed for doctoral students already participating in a program making extensive use of web-based materials, relied on students working independently with the on-line material (that included course lectures and notes) supported by access to the instructor using e-mail and the telephone. End of course performance was lower and much more variable than had been expected. Many students expressed the need for much more organization and contact with the instructor. Comparisons are made with reports of more successful virtual courses suggesting the need for a much greater degree of instructor supplied organization and direction.

BACKGROUND

Starting from very modest beginnings, the web sites associated with the statistics courses I have taught have evolved into something that many students have come to use extensively. At the same time, the site content has continued to evolve as my own circumstances and interests permitted. One point that must be emphasized, however, is that my motivation in putting materials on-line was initially to supplement what I already did and not to create a computer enhanced environment that would provide materials uniquely suited to computer mediated learning. Attempting to apply that material in support of a virtual course in introductory statistics was motivated by special demands that could not be met through a "normal" course given departmental resource levels.

DEVELOPMENT OF WEB PAGES TO SUPPORT A REAL CLASS

In 1997 my university adopted a single system to support on-line course materials: WebCT. Begun as a faculty effort in the Computer Science Department at the University of British Columbia, WebCT has evolved into the centerpiece of a privately funded company that claims to be "the world's leading provider of e-Learning solutions for higher education." The system offers a broad array of tools to support on-line learning including within class e-mailing, discussion thread support, and the relatively easy creation of customized pages.

My first foray into providing course materials on-line started with my syllabus and homework assignments. As such the material was rarely accessed being used only by students who had lost their handouts. At that point what I was doing hardly qualified as "on-line" even though it satisfied my university's request for courses having an on-line presence.

With the addition of an image capturing and display system in my classroom I rapidly abandoned the use of the virtually unreadable dry erasable white board at the front of the room in favor of using a stack of copier paper on which I wrote the material previously committed to a traditional chalk board. After a term of making those notes available for copying by students who had to miss a given lecture, I acquired an inexpensive scanner and began posting those lectures through WebCT.

The next term I started learning a bit about RealAudio production and server software, the basic versions of which proved to be free of charge. Armed with an inexpensive tape recorder and a wireless microphone, I began creating an audio track of my daily lectures. An hour of so of replaying that tape through my desktop computer's audio input port allowed me to create streaming media files that were linked to my on-line lecture note pages. Soon after that I abandoned my trusty tape recorder in favor of running the digital encoder software from RealAudio on the in-class PC and capturing my lecture soundtrack live. It was but a matter of a few post-class minutes to upload the resulting file to my own computer thereby eliminating the time needed to replay the lecture.

Additional materials have been added to my sites to enhance their value to my students. A grant funded by the University System of Georgia made it possible to create a small collection of research and evaluation papers focusing on educational research in my own state illustrating the actual application of various statistical concepts and techniques. An invitation to do a guest lecture in a research methods course focusing on statistical power led me to create a web page with links to a variety of on-line materials from other universities and governmental agencies. Old exams and answers were also posted there.

Along the way, a handful of students have opted to complete the requirements for several of my live courses using only the on-line materials. Located at some distance from the university, those students simply faxed me homework assignments and completed exams. While reporting that keeping to a schedule for working with the on-line materials required considerable self-discipline on their part, those students were just as successful in being able to respond to final exam questions as were students who regularly attend class meetings on campus.

MOVING TO A VIRTUAL CLASS

Responding to demands from one of our departments for an "extra" section of our introductory class to serve a cohort of students who could only physically appear on campus once or twice a month, we opted to create a virtual section of the class. It would feature access to class materials through WebCT with the only lectures available being those that were already posted from the previous fall. Because the students to be enrolled had taken a number of courses making extensive use of WebCT (though with about 5 face-to-face half-day meetings per course), we felt that there was a sufficient level of "community" among the students and experience in dealing with course materials over the internet. Students would have access to the instructors to get answers to their questions via e-mail or telephone and could post messages to the course discussion pages for broader interaction involving instructors and students.

Given the circumstances surrounding the course, the two "in-class" exams were reconfigured as open-book tests and the final, while to be held on-campus, would be administered permitting students access to their text and notes. In previous sections of the course none of the exams were open-book. Instead, students had been allowed access to self-generated "guides" on which they were encouraged to include formulas they deemed important, examples of worked problems, or other material they wanted to include. In those classes students were allowed access to their text only for tables they might need. Prompted by student requests, a live review session for the course was held on a Saturday afternoon about three weeks ahead of the final exam. Nearly all of the students attended with questions focusing on the circumstances of the final exam and specific problems with assigned homework exercises.

COURSE OUTCOMES

Because of major differences between the real and virtual versions of the course in the administration of "in-class" exams, performance on the final exam was the primary course outcome of interest. Since the exam questions used were unchanged from the ones administered to students in the on-campus version of the course offered the previous year, performance for that class was compared to that from the virtual version of the course. As the virtual course allowed for student use of their text on the final, I anticipated that the final would prove to be easier for students in the virtual section. That proved to be an incorrect assumption. The students in the on-campus section (n=23) had a mean proportion correct of .81 with a standard deviation of .07 while the virtual class (n=26) had a mean of only .64 with a standard deviation of .21. Even with these small sample sizes, the means were "statistically significantly" different (t=2.67, p=.01) as were the standard deviations (F=7.85, p<.01).

Looking at a breakdown of performance in greater detail, 42.9% of the students in the virtual section obtained scores less than .70 compared to only 4.3% of the students in the comparison section. On the other end, 25% of the students in the virtual section had scores greater than .90 while only 17.4% of the students in the comparison section did so. Thus while a far greater proportion of the students in the virtual section performed quite poorly on the final compared to what might otherwise be expected, a greater than expected number did quite well indeed.

USE OF WEBCT MATERIALS

One of the interesting features of WebCT is that it tracks student hits on course material and posts to the discussion page. It was noted that while most students made considerable use of the web material (mean hits = 430), there was but a weak correlation between the number of hits and performance on the final (r=.20, p=.33). At the same time, there was a weak but negative relationship between posts to the discussion page and performance on the final (r=-.36, p=.07).

The content of the discussion messages (of which there were 140) mostly revolved around social interchanges among the students (focusing on concerns for ill family members, sharing news about grandchildren, planning for a post-course social). Only 27 of the messages actually focused on the course itself (mostly dealing with anxiety about learning the material or dissatisfaction about the way in which the course was being offered) with but 2 of them actually relating to some particular assigned problem.

END OF COURSE QUESTIONNAIRE

At the end of the course students were asked to provide specific feedback on how the course might be improved. Of those who responded (n=21), almost 62% indicated a desire for there to be a large number of on-campus class meetings with specific attention to working problems, illustrating the use of statistical software and responding to student questions about specific problems. The overall theme underlying their responses seemed to be a clear statement of their need for a greater degree of structure and support with regularly scheduled interactions via the Internet if not in person.

DISCUSSION AND OBSERVATIONS

The outcomes, both cognitive and affective, from my initial efforts to create a virtual version of an introductory statistics course were not what I wanted them to be. While there were some students for whom the organization of the virtual section of my course was entirely functional, there were a great many for whom the experience was less than pleasant and, most importantly, resulted in an unacceptable degree of mastery of the concepts.

There is ample evidence that virtual courses do not need to offer less to students. In a major review of course outcomes comparing campus-based and internet-based courses, Fredda (2000) found graduate students' course performance to be quite similar (with a slight advantage for students taking courses via the internet). In looking at the performance of students taking an introductory statistics course, Kennedy and McCallister (2000) found no difference in outcomes between students enrolled in an on-campus section and students taking an internet-based section. Dereshiwsky (1998) even reports favorable affective responses from students under such circumstances provided that there are ample opportunities for interaction with the instructor through multiple avenues (e-mail, structured and regularly scheduled on-line discussions, etc.).

Virtual courses, to be done well, should not become a technologically sophisticated form of independent study unless that is something that students have real choice in. In the studies I reviewed, self-selection of mode of instruction was a key feature and may account for much of the less than desirable outcomes that I saw from my course. Likewise, success seems to require more, not less, engagement on the part of the instructor and more attention to providing a carefully arranged timetable to help students to structure their own work. These are all lessons I will need to take to heart the next time I try to venture into a virtual classroom.

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