
A Virtual Lab in Research Methods

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A hands-on lab for a lower division research methods course used an online format with Web page, Web forms, an e-mail listproc, and chat room. The virtual section received a higher rating for overall value than did the in-person labs. Students liked its convenience and flexibility. There were no significant differences in examination performance between students who took the online lab and 12 others who requested it, but could not be accommodated. Compared with the traditional course, more time was required in constructing assignments and communicating with students. A major advantage was eliciting responses from all students in contrast with the usual lab section.

With increasing student numbers and a geographic as well as age-diversified student body, the Internet provides an opportunity for exploring various combinations of traditional and online learning. Dietz-Uhler and Bishop-Clark (2001) described the benefits of both synchronous and asynchronous computer-mediated communication on subsequent face-to-face discussion. Kazmerski and Blasko (1999) showed the advantages of using a computer-based interactive program for learning observational research techniques. Maki, Maki, Patterson, and Whittaker (2000) found that students taking an online version of introductory psychology showed more content knowledge (based on exam performance) than did those in the traditional lecture class, although the latter expressed greater satisfaction with the course.

These positive findings suggest that Web-based learning may be a way of accommodating increasing student enrollments. The development of online materials is likely to involve considerable preparation time and resources. However, offering lab sections for large classes also requires extensive resources. Providing 1-hr per week 20-student lab sections in a class of 300 students means that faculty or teaching assistants are required for 15 hr a week in addition to the lecture time. If online instruction can reduce the number of personnel required, then its development might be worth the start-up cost. There is also a potential savings in classroom space.

This article describes the development and outcome of an online laboratory section for a lower division research methods course. The four-unit course enrolls 250 to 300 students every quarter with 3 hr of lecture and a required 1-hr laboratory per week with section size limited to about 15 students. The goal of the laboratory section is to provide students with hands-on experience in using the methods described in the lectures.

Materials and Procedure

The first author set up and conducted one of the sections as a virtual lab in Spring 2001 to compare with the 15 in-person sections. A Web site delivered content and assignments. The instructor created interactive forms using a Web authoring program (Adobe GoLive). Other suitable software packages include Macromedia, Dreamweaver, and Microsoft FrontPage. Course management software such as WebCT, Blackboard, and eCollege could also be used. The materials for the online lab are available at <http://psychology.ucdavis.edu/sommerb/vlab/>.

The underlying rationale was one of active learning and a multimethod approach. Students did both individual and group work, with an emphasis on the latter. The laboratory assignments covered the following topics: ethics, observation, library search, experimentation, interviewing, questionnaire construction, descriptive statistics, inferential statistics, and writing a report in the style prescribed by the American Psychological Association. The instructor provided clear and highly structured lab assignments. In the traditional format, these exercises occurred in sections that met 1 hr a week under the supervision of a graduate teaching assistant (TA) with some individual and group work done outside of class.

The TAs met weekly with the instructor and received instructions for implementing the assignments. The online section assignments were as much like the in-class ones as possible within the constraints of the Internet environment.

At the beginning of the course, students had the option of signing up for a virtual rather than an actual laboratory section. As we were unable to accommodate all of the students, we randomly selected 15 from the 27 who requested the virtual option.

To facilitate collaborative work, students in the virtual lab used a chat room provided by the local campus system. The chat room was for student use only; the instructor did not participate. The aim was for the chat room to provide an analog of the outside-class meetings of students in the other sections. (If not available on a campus system, chat room space can be found at commercial sites such as Yahoo!; see <http://chat.yahoo.com/>.)

The section instructor set up a listproc—an e-mail list for group communication. For example, after collecting the personal space experiment data, the section instructor posted the results and asked that each student comment to the e-mail list. The e-mail list also provided an opportunity for further online discussion.

All interactions between students and section instructor took place online. Table 1 lists the manner in which students completed assignments and communicated with the instructor. Some of the assignments required collaboration (see Table 1).

The e-mail burden was manageable. Messages ranged from a high of 53 the first week (mostly concerning admission into the online section) to lows of 8 and 7 in Weeks 6 and 8, respectively, when students turned in assignments via electronic form rather than e-mail. With regard to individual e-mail activity, the mean number of e-mail messages from the 15 students for the quarter was 16.5 with a median of 14. Two students produced the maximum of 32, and the low end was 6 messages.

As the students attended lecture 3 hr a week, they had the opportunity for face-to-face contact with each other. The instructor's reading of the e-mail and chat room records suggested that much of their contact was made online.

Evaluation and Discussion

Student Perspective

At the end of the quarter students in the lab sections connected with the course filled out anonymous evaluation forms. The results provided an overall rating of the (a) section leader, (b) value of the exercises, and (c) value of the section.

Table 2 shows the mean ratings of the section leader, value of the exercises, and value of the section. There were significant differences across the mean ratings of the section leaders—the virtual section instructor plus five TAs (multiple sections combined for each TA), $F(5, 185) = 5.81, p < .0001$.

As the rating of the section leader might have a halo effect on the ratings of the value of the exercises and the sections, we included leader rating as a covariate in subsequent analyses. The ratings of the section leader were correlated with the both the exercise ratings, $r(191) = .37, p < .0001$, and section ratings, $r(191) = .46, p < .0001$.

The differences in ratings of the exercises across sections were not statistically significant, $F(5, 184) = 1.12, p = .35$. The differences in ratings of the value of the section did vary significantly, $F(5, 184) = 5.54, p < .0001$. Taking into account the ratings of the section leaders, the mean for the value of the virtual lab section was significantly higher than each of the other sections ($p < .05$, least significant difference test).

Students in the virtual lab responded to open-ended questions about the section. Asked what they liked best, all commented on its convenience and flexibility with regard to time. Two students mentioned the advantage of more equal participation in discussion, "great for shy people like me." The appreciation of flexibility and convenience echoes findings from other studies of online courses (Maki et al., 2000; Pear & Novak, 1996).

On the negative side, two students commented on the "coldness" or impersonality of the Internet interaction: "Since I could never see or speak to the instructor, there was a very impersonal, and almost unfriendly environment which made it difficult to speak up." The theme of impersonality has come up in informal discussion with students on our campus. Many of the students have traditional views of the university and believe that they deserve the opportunity to attend formal classroom lectures given by professors. The belief persists even among those who acknowledge that they cut class on occasion, sit in the back row of the lecture hall, and rarely ask questions. Some view alternative class arrangements as less worthy of the elite institution.

With regard to overall performance in the course, the students in the virtual class did not differ from the rest of the class, nor did their scores differ significantly from those of 12 students who had requested the section but could not be accommodated. The fact that the students chose to take the online section could be a factor in the favorable evaluation. When comparing traditional and online versions of an introductory psychology course, Waschull (2001) received higher ratings from students who chose the online section versus those in the traditional one. Compared with students in the traditional section, those assigned to an online section gave her a slightly lower rating on each of the nine items on the evaluation form. We were not able to test the effect of random assignment versus choice.

Instructor's Evaluation

In contrast with the general classroom situation, in which a few students can dominate the discussion and others do not participate, the online response either in the form of an e-mail list or bulletin board elicits greater participation. The second author has been using a personal space demonstration in classes for several decades (Sommer, 1999). The electronic feedback provided in the e-mail exchange following the personal space experiment was the most detailed and perceptive that he has ever received. The feedback becomes an archival record that has potential for providing insight into student learning.

Unlike the usual face-to-face interaction of groups working outside of class, students' use of the chat room resulted in a transcript of their discussions. In one instance, a group had

Table 1. Lab Assignments Listed by Telecommunication Type

Online Form	Listproc	E-Mail to Instructor
Memory Ethics 1	Ethics 2 Experiment 2	Attitude scaling 2 Descriptive statistics 2 (pair assignment)
Observation 1 Observation 2 (group assignment)		
Library Experiment 1 Interviewing 1 Interviewing 2 Attitude scaling 1 Descriptive statistics 1 Inferential statistics		

Note. Listproc = E-mail discussion.

Table 2. Mean Ratings and Standard Deviations of Value of the Section Leader and Adjusted Mean Ratings of the Overall Value of the Exercises and of the Section

Section(s)	Rating of Section Leader ^a		Value of Exercises ^b		Value of Section ^b		N
	M	SD	M	SD	M	SD	
Virtual lab	1.71	.91	1.79	.80	1.29	.47	14
TA 1	1.88	.61	2.33	.56	1.96	.55	24
TA 2	1.34	.57	2.10	.66	1.63	.54	41
TA 3	2.01	.74	2.29	.76	2.24	.65	34
TA 4	1.53	.64	2.09	.85	1.80	.69	40
TA 5	1.37	.63	2.11	.80	1.95	.70	38

Note. TAs taught multiple sections. TA = teaching assistant.

^aScores ranging from 1 (*excellent*) to 5 (*terrible*). ^bScores ranging from 1 (*very valuable*) to 4 (*not valuable*).

come up with the wrong solution to a problem in data analysis. By examining the transcript of their discussion, the instructor was able to see where their reasoning went awry.

On the negative side, there was a considerable amount of preparation time for the instructor—more than would be the case if one simply had to show up for an hour-long section meeting. This was the first time we offered the virtual lab and subsequent preparation time would be considerably less, depending on the degree to which we modified assignments.

There is also the time demand of e-mail. We do not know how often students contacted their section leaders by e-mail, but there certainly was more contact from the virtual lab students than had been the case when the instructor was lecturing to the class of 300. Managing queries from 15 students was not onerous, but it would be challenging with 150.

An e-mail filter can reduce the time load by directing the class-related e-mail messages to a single folder or directory where the instructor can handle them at a convenient time. Using a database for downloading student responses is another way of saving time. Our institution has a database program that saves the results from Web forms (e.g., students' responses) in tab-delimited files. These files are downloaded and read into a database or spreadsheet program such as Microsoft Excel. (See <http://webtools.ucdavis.edu/dbtool/> for information. The program can be made available to interested institutions.)

As did some students, some instructors will find online communication to be cold and impersonal. On the other hand, here are two quotations from the e-mail listproc discussion of the ethics assignment:

It's such an eye opener to hear all the other responses. People brought up some excellent points that I would have never thought of myself, I guess that's why there are many people on IRB's [sic] and not just one. I also think that maybe if I would have heard other people's opinions and concerns before I sent my ideas, then my answers may have been different. Hearing other people's point of view puts a new perspective on my own.

To put my two cents in here, I agree that it was really interesting to get the opportunity to read everyone else's case responses. I think this virtual section will provide an opportunity to hear more differing points of view. In a physical discussion section, there is so often 3–4 people with strong

(and loud) opinions that end up dominating the hour while the quieter people may never share. I appreciate the democracy of this format.

An instructor can take steps to reduce the impersonality, for example, by scheduling a face-to-face meeting at the beginning of the course, putting photographs of the instructor and students online, and personalizing Web materials and e-mail messages. A discussion about the perceived impersonality of online communication may head off potential alienation. Presenting the lab online was successful and can be replicated with easily made modifications to suit a particular curriculum.

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Note

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