PROVISION AND UTILIZATION OF OUTSIDE SOURCES OF ASSISTANCE FOR UNDERGRADUATES

Richard Madsen
University of Missouri-Columbia
U.S.A.

Introduction

As Teachers, most of us encourage the students in our classes to come to us during special office hours if they wish to receive extra help. Many students feel that they should not "waste" the teachers' time with their questions. Others may feel embarrassed to ask questions in a one-to-one setting. Whatever the reason a student may have, we have felt that students who really need help frequently do not get help through the office-hour channel. We have tried to provide a variety of sources of extra help for students. In this paper we will describe the sources of help and summarize how students utilized these sources over the course of the semester.

Service Courses at the University of Missouri-Columbia

By a service course we mean a course offered by the Statistics Department for students majoring in a field other than statistics. We have three courses that fall into this category. elementary Statistics (31) is a freshman-sophomore level course with an algebra prerequisite. Introduction to Probability and Statistics I and II (150-250) is a two-course sequence at a sophomore-junior level with a finite math and elementary calculus prerequisite. Introduction to Mathematical Statistics (320) is a senior-beginning graduate level course with a calculus prerequisite. All of these service courses are taught in relatively small classes. The courses 31, 150, and 250 typically have 25-35 students per section and are taught primarily by graduate teaching assistants under the direction of a faculty course coordinator. The 320 course is taught by faculty members and sections may run to 60-80 students. Typical total enrollment in all sections of 31, 150-250, and 320 would be about 300, 400, and 150 per semester respectively. In this paper we will be addressing sources of help for and utilization by students in Stat 150 and Stat 250 courses. Some of the same sources of help are available to students in other service courses as well.

Sources of Assistance

We will discuss five different sources of assistance that have been available to students in 150 or 250 or both. The sources range from the personal to the impersonal. The descriptions will be roughly in decreasing order of personal contact.

1. Instructor. Obviously this is the most familiar source of assistance. Instructors, whether faculty members or graduate teaching assistants, are asked to keep regular office hours (5-10 hours per week) during which their students may get help.

2. Stat Lab. The Stat Lab is supported financially by the Statistics Department. Statistics graduate students staff the lab which is available to students in any service course. The lab is open afternoons (1-5) and Saturday morning (9-12). Students can ask for help with general concepts or with specific problems (other than homework problems).

3. Learning Center. The Learning Center is supported financially by the University of Missouri. They offer a wide variety of student helps in addition to group tutoring for students in many introductory level courses including Statistics 150. The group format means that students would meet in a classroom setting and would ask questions as a group rather than getting individual attention. This service is available for Statistics 150 students twice a week for one hour.

4. Audio problem sets. The first audio problem sets were developed for Stat 150 in 1975 and were upgraded in 1980. Audio problem sets for Stat 250 were developed in 1983. The purpose of these sets was to provide students with assistance in problem solving. The primary goal was to provide assistance for the struggling student – one who was barely passing the course. A secondary goal was to provide some extra problems for good students who wanted extra practice. We made up sets of problems (generally four to a set) with two or three problems being somewhat easier than the remaining ones so as to accommodate both groups.

   The problems in a set were on specific topics from introductory statistics. Students were told about the audio problem sets at the start of the semester. They could pick up sets of problems at the "audio lab" and work on them at their convenience. Short answers to the problem sets were also made available at the audio lab. Our goal was to provide students who had difficult with solving the problems with a detailed solution to those problems. This was done by tape recording a detailed discussion as to how to solve the problem.

   The tapes, problem sets, and solutions were all available at a centrally located lab. The lab is open 72 hours per week during the semester.

5. Computer problem sets. The computer problem sets were developed in 1982 and 1983. The basic idea was to pattern the problems after those of the audio problems, but to trade the personal touch provided by a person discussing the problem on tape for some flexibility provided by the computer.

   The problems were made up similar to the audio problems and short answers were made available. The solutions were programmed to be used by students interactively. We used an Apple II+ computer with Apple Pilot as the software. (PILOT stands for Programmed Inquiry, Learning or Teaching.)

The features of PILOT that were most important in programming the solutions were the lesson text editor and the graphics editor. Of lesser importance were the character set editor and the sound effects editor. The lesson editor will print text on the screen, jump to various parts of the program, accept answers from the keyboard, and provide some appropriate response based on the answer. Since the lesson editor has the capability of jumping to different parts of the program depending on the response, it is sometimes possible to suggest reasons for getting the wrong answer in addition to giving the right one.

The graphics editor has features common to many graphics programs. It is quite easy, for example, to show a Venn diagram with some relevant region shaded in. It is also possible to give a graph of a normal curve with some tail or central area shaded in. Bar graphs can also be drawn.

The character set editor allows the construction and use of special symbols such as μ, σ, and ρ as well as integral signs, Σ, etc. The sound editor can add some variety.

The biggest problem with the computer problem sets is that they are very labor intensive. Further, to make them most helpful to the student I felt that the program should encourage the students to refer to their textbook. Hence in appropriate places page, equation, or table references were given. This obviously requires that all programs be updated whenever the textbook is changed.

Utilization of Sources of Assistance

We have tried to keep the use of these sources of assistance by students strictly optional. The students in the service courses were given a handout during the first week of the semester in which the sources of assistance were briefly described. As a general rule the classes were given no further encouragement about using the sources.

Information about utilization was obtained through either a question at the end of the final exam given to all Stat 150 students or through a separate question sheet handed out during a regular class period. In this way we were able to get information from 80-90% of the students.

In Table 1 is a summary of results for Statistics 150 from Fall 1982. The questions related to frequency of use of various sources. No distinction was made between simply using the audio problem sets alone and using the sets in conjunction with the tapes. The same was true for the computer problem sets. The 300 respondents came from 12 different sections taught by seven different instructors. Chi-square tests for homogenity indicate no highly significant differences among instructors relative to frequency of use of the different sources. Table 2 gives a summary of Winter 1983 data which is for 11 different instructors covering 17 sections. It is interesting to note that the frequency of use in both cases decreases as the source of assistance goes from the personal to the impersonal. It is also true, however, that the instructor and Stat Lab assistant can answer general questions about general lecture material and required homework problems

whereas the audio tapes and computer programs can only help with specific supplemental material. It is reasonable to assume that differences in utilization relates to substance and not just form.

Table 1. Utilization in Fall 1982 – Statistics 150

	Never	1-2 times	3 or more times	total
Instructor	114 (38%)*	118 (39%)	67 (22%)	299
Stat Lab	196 (66%)	61 (20%)	42 (14%)	299
Audio problems	208 (69%)	42 (14%)	50 (17%)	300
Computer problems	223 (77%)	41 (14%)	27 (9%)	291

* % of total respondents to a given question.

Table 2. Utilization in Winter 1983 – Statistics 150

	Frequency of Use				
	Never	1-2	3-4	5 or more	total
Instructor	145 (37%)*	142 (37%)	59 (15%)	41 (11%)	387
Stat Lab	204 (52%)	105 (27%)	39 (10%)	41 (11%)	389
Audio problems	222 (58%)	90 (24%)	40 (10%)	29 (8%)	381
Computer problems	334 (87%)	35 (9%)	8 (2%)	6 (2%)	383

* % of total respondents to a given question.

In Fall 1984 there was a textbook change in Stat 150 in all except two sections. Consequently there are only 68 responses for that semester (see Table 3). However, Statistics 250 still used the original text so there were 270 responses for Fall 1984 (see Table 4). This semester we asked more detailed questions about utilization of audio and computer problem sets. We suspected that some students used the problems themselves for practice and checked their answers with the short answers that were made available but did not use the tapes or computer to find the correct answers. This does seem to have happened.

Table 3. Utilization in Fall 1984 – Statistics 150

	Frequency of Use				
	Never	1-2	3-4	5 or more	total
Instructor	30 (44%)*	20 (29%)	12 (18%)	6 (9%)	68
Learning Center	57 (84%)	9 (13%)	0 (*)	2 (*)	68
Stat Lab	63 (93%)	2 (*)	2 (*)	1 (*)	68
Audio problems	58 (87%)	2 (*)	6 (9%)	1 (*)	67
Audio tapes	5 (56%)	3 (33%)	0 (*)	1 (11%)	9**
Computer problems	32 (47%)	18 (26%)	16 (24%)	2 (*)	68
Computer solutions	29 (81%)	4 (11%)	3 (8%)	0 (*)	36**

* % of total respondents to a given question. Values under 5% not shown.

** Based on those who made use of audio or computer problem sets.

Table 4. Utilization in Fall 1984 – Statistics 250

	Frequency of Use				
	Never	1-2	3-4	5 or more	total
Instructor	129 (48%)	78 (29%)	42 (16%)	20 (7%)	269
Stat Lab	196 (73%)	29 (11%)	17 (6%)	26 (10%)	268
Audio problems	221 (82%)	28 (10%)	12 (*)	8 (*)	269
Audio tapes	20 (42%)	20 (42%)	5 (10%)	3 (6%)	48**

* % of total respondents to a given question. Values under 5% not shown.

** Based on those who made use of audio problem sets

In comparing the utilization of computer problem sets as shown in Tables 1 and 2 (1982-83) with that shown in Table 3 (1984) we see a considerably higher percentage of use in Table 3. One difference in procedure is that in 1982-83 students were told where the problem sets were available on campus, but they had to go out of their way to get them. In 1984 (when the enrollment was smaller) the problem sets were automatically given out in class. This suggests that when the students have extra problems in their hands they are more apt to use them than if they have to get them themselves.

We mentioned in earlier discussion that in 1983 (Table 1) there did not appear to be differences in instructors relative to frequency of use. That is not the case in Table 4 (1984 – Statistics 250) as one of the five different instructors stood out as having significantly more utilization than the others.

Summary

The most frequently utilized source (used about 50-65% of the students) was consultation with the instructor during office hours. The next most frequently used source was the Stat Lab assistant. This may indicate that students are interested in getting answers to general questions on concepts or specific problems.

The supplemental problems with audio-taped solutions or computer solutions were provided as special materials for students wanting extra help in problem solving. They were not intended for use by all students. We found that students tended to use the problems (and the short answers provided with them) without using the detailed solutions provided. They were also more apt to use the problems if they were given directly to them rather than having to go out of their way to get them. The percentage of students using the problem sets was somewhat smaller (10 to 40%) than the percentage getting personal help, but the total number of students who used them over the years has been large, due to the large enrollments in service courses.