SESSION IV

SYMPOSIUM

MICROCOMPUTERS IN INSTRUCTION: PROJECTS FUNDED BY NSF COLLEGE SCIENCE INSTRUMENTATION PROGRAM

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A microcomputer lab for psychology based on a hierarchical learning model

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This paper describes a psychology laboratory based on a CORVUS-networked system of Apple IIe microcomputers. It also describes the specific software applications used in each of a range of psychology courses, and the skills developed through each of the specific applications. While no empirical data is yet available to support formal evaluation of this type of instruction, initial student and faculty responses to its implementation have been very favorable. The model described here may be useful to other psychologists who are interested in providing microcomputer experiences for their students.

Our microcomputer lab for psychology instruction and research represents the current phase of a 6-year evolutionary process. In 1982, St. Norbert College owned one microcomputer, an Apple II+, which was used to demonstrate an early version of the APT package (Poltrick & Foltz, 1982, 1988) to students in our principles of research course. Although it was clear at the time that students needed to acquire psychology-related microcomputer experience, that goal was unattainable with only one machine.

During the following 4 years, in response to growing faculty requests for microcomputers, the college acquired six Apple IIe machines. This made it possible to begin to use the machines in two psychology courses: the principles of research and the memory and cognition courses. As more students in psychology and other departments began to use the machines, it became clear that those few, generally shared machines were not enough to accomplish

the instructional goals that the members of our department thought were essential. Last year, an NSF grant made it possible to acquire additional machines and software, and to develop the laboratory which is described in the remainder of this paper.

GOALS OF THE LAB DESIGN

Two major goals guided the design plan. The first goal came from pedagogical theory. Most contemporary models of the learning process are founded, at least in part, on Piaget's model of cognitive development. Briefly, this model emphasizes the importance of the learner's interaction with concrete materials in order to develop a conceptual basis to support and facilitate later understanding of more abstract concepts. We wanted to provide such active learning experiences for our undergraduate students, and microcomputers offered an excellent mechanism for doing so.

Our second goal was to familiarize our undergraduates with some of the current technology available for collecting and analyzing data in the field of psychology. In many areas of our field, microcomputers provide almost essential instrumentation for the accurate collection of a variety of kinds of behavioral data. Whether or not our stu-

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dents choose to pursue postgraduate work in the field, we thought that it was an essential part of their undergraduate experience for them to be able to use microcomputers comfortably in order to ask questions and to analyze the answers.

HARDWARE CONSIDERATIONS

We decided to base the lab on a system of CORVUS-networked Apple IIe machines, and to purchase six additional Apple IIe computers to link with the existing machines. While these machines are not on the cutting edge of technology, they were selected as the best way to comply with the requirements of the granting agency and to fulfill our own curricular needs.

First, this particular grant program required that the funds be used to expand existing facilities, rather than to provide start-up funding. The college had already provided limited funds for some software purchases for the existing machines, and I had developed curricular materials using that software. Thus, both the existing software and the related curricula could be used more widely with the advent of additional machines, printers, and the network system. Furthermore, the college administration had agreed to allocate the existing Apple IIe computers for the sole use of psychology department faculty and students. We were, therefore, able to move the machines into a physical space that was more appropriate for our instructional needs, and this enabled us to regulate the use of machines and software more effectively. Thus, expanding the lab based on the existing Apple foundation seemed to meet the NSF criterion.

The second set of requirements centered on our goals for the lab and the resources that were available to accomplish those goals. We wished to introduce elements of microcomputer use across our curriculum, in courses ranging from introductory psychology to a variety of intermediate and advanced topical and methodological classes, and applications would vary, depending on the level and nature of each specific course.

A considerable range of software was required to accomplish these objectives. All software selected for the new lab was required to meet several criteria. First, we wanted software that students could use relatively easily, and that did not require prior programming experience (or, for that matter, prior computer experience). Most of our students did not have these skills, and it was difficult for them to obtain such skills in other (nonpsychology) courses. We also needed software that required minimal supervision for successful use. Approximately 325 students per year complete the introductory psychology course, with an additional 25–40 students per year in each of the other courses that would use the lab. Therefore, it was essential that software be well documented, and relatively user-friendly.

Second, and more important, we wanted software that required some level of intellectual involvement from the students. We rejected much software because, although

the programs appeared to be enjoyable and amusing, we believed that students could run them with very little cognitive involvement or growth. Although the software selected for lower-level courses clearly provided a lower level of intellectual challenge than that selected for upper-level courses, all the software that we chose required some active cognitive engagement on the part of the student.

Other important criteria stemmed from the overall implementation plan, which was based on a hierarchical model of skills that we wanted students to acquire across a range of psychology courses. Although I had first used microcomputers with students in two advanced courses, it had quickly become clear that earlier exposure to and use of computers by students was desirable. Even though many students today are being exposed to microcomputers in high school or earlier, many undergraduates still suffer from "cyberphobia." Therefore, it seemed wise to introduce students to computer applications as early in their psychology coursework as possible. Additional skills could then be developed sequentially in more advanced courses.

IMPLEMENTATION

The general rationale involved a basic exposure to microcomputers in the introductory psychology course, with additional skills and more sophisticated applications being introduced in the more advanced courses. The microcomputer experiences that have been or are in the process of being implemented in each of the courses involved in the lab-based program are briefly described below.

Introductory Psychology

While a number of very good programs are available for use in this kind of course, we selected the Psychworld software (Hay, 1985) from McGraw-Hill because it offered the most extensive topic coverage of any of the comparable packages. As is the case with many small psychology departments, several different instructors, all of whom emphasize somewhat different material, teach this course. Therefore, we needed software that was flexible enough to meet a range of instructional needs.

A set of ten labs, based primarily on the Psychworld software, is available for instructors. These labs offer simulations of several psychology paradigms, such as evaluating the responses of a split-brain patient to various stimuli, testing short-term memory span, evaluating a child's level of cognitive development, and measuring classical and operant responses of simulated animals. Each paradigm is related to a reading selected from the literature, and we attempt to help students draw conceptual links between that literature and their own activities on the machines. Goals include easing the students' fears of microcomputers, helping them develop a basic understanding of how to read and follow computer menus and on-screen instructions, and teaching them how to collect and transcribe simple data sets.

Early Childhood Activities and Conditioning and Learning

The early childhood course provides an introduction to the principles of behavior analysis, which is expanded upon in the second, more advanced course. In both courses, students complete several modules (written by a colleague) that introduce them to the basic principles of behavior analysis and expand their familiarity with the principles of conditioning. In addition, in the advanced course, students are required to complete research projects, some of which now involve the use of some CONDUIT software (described below), and which may in the future also involve the use of the APT package.

Basic Principles of Psychological Research

In this course on basic methods, students use the microcomputers in a variety of ways. They are required to have completed basic statistics as a prerequisite, and they learn to apply their statistical skills in the context of the research conducted and the data collected in this course.

All students are required to complete an independent research project for this course. While they are free to choose from a variety of paradigms, some elect to design experiments using some of the CONDUIT software, and an increasing number of them are beginning to design experiments using the latest version of APT (since this version is quite user-friendly and much easier than earlier versions for students to learn to use). Therefore, the students are using the microcomputer as a true research tool.

In addition, students are required to master a set of pragmatic use skills. They must learn to use a word processing package; surprisingly, many of them have not acquired this skill, in spite of the growing popularity of word processing among students and faculty in general. We are introducing Manuscript Manager (Pergamon Software, 1987) since it helps students learn American Psychological Association (APA) formats at the same time that they are learning word processing skills.

Students must also learn to use a graphing package (we use PFS: GRAPH; Kirvay & McCarley, 1985), and two data analysis packages, one which is a general analysis package and another which performs fairly sophisticated analyses of variance (ANOVA). We have found the ANOVA II and STATSPLUS (Human Systems Dynamics, 1986a, 1986b) packages to be very suitable. While not as user-friendly as some software, they can be mastered with effort, and permit a considerably more extensive set of data analyses than most comparable software. Thus, students learn to use the microcomputer to accomplish a variety of goals, from data collection to analysis to presentation in finished form.

Memory and Cognition

This course was one of the two in which I originally introduced microcomputer use, and in which I continue to use two packages from CONDUIT (Keenan & Keller, 1982; Levy, Fischler, & Griggs, 1979) successfully. Overall, CONDUIT software is exceptional because it is

well designed, easy to use, and well documented. Students are required to complete five labs during the semester which involve data collection in several of the classic paradigms in cognitive psychology (e.g., levels of processing, construction of inferences from prose, and encoding specificity).

Student preparation for each lab involves reading the original journal article(s) upon which the experiment is based and the lab introduction and methods sections that we prepared. Students then complete the data collection portion of the lab, after which the class data is pooled and analyzed. Thus, they are adding new data collection skills, as well as using the analytical skills developed in the earlier basic principles course. Finally, students are required to prepare a brief APA-style report on the full experiment, including a discussion of the class results and a comparison of those results with the original findings.

Social Psychology and Physiological Psychology

Because we tried to phase the microcomputer labs into courses in a careful and thoughtful manner, it was impossible to complete all of the planned implementations in the first year of the project. Therefore, neither of these courses presently contain a microcomputer component. However, during the second semester of this year, both of these courses will have microcomputer components added. The goal, as in the memory and cognition course, is to teach students new data acquisition procedures (related to two new conceptual areas), and to expand the analysis and presentation skills acquired in the previous courses.

In the social psychology course, students will use CONDUIT's FIRM software (Elliot, Srull, Durnin, & Levy, 1983; Elliot et al., 1983; Levy & Durnin, 1981) to model various classical social paradigms (e.g., cognitive dissonance and Asch's conformity paradigm). We plan for students to complete labs using a model similar to that described for the memory and cognition course above. In the future, they are also likely to be required to design and run their own experiments using the models provided in the FIRM package.

In the physiological psychology course, physiological instrumentation will be interfaced with the microcomputers using HRM software (Tinker, 1986). This will permit the collection of several physiological measures, including heart rate, respiration rate, and some simple EEG measures. Students will complete a series of labs in which they collect such measures, and will explore the ways in which physiological responses vary in relation to the manipulation of different psychological stimuli.

Independent Research Projects

In addition to the research projects required in some of the courses described above, some senior students also elect to complete projects on an independent study basis. As students gain familiarity with software available for exploring different areas of psychology, we have observed an increasing interest in the use of microcomputers to collect experimental data. In addition, as the APT package

has become easier to use, more students are using it to design their experiments and to collect their data. Students then analyze and present their findings using the analytical software mastered in the basic principles course.

SUMMARY

We believe that the addition of microcomputer experiences has significantly enhanced our curriculum. Our students have gained considerable confidence in their own abilities to use microcomputers in reasonable and efficient ways, and their ability to operate in a psychological environment has grown. Although we have not yet collected empirical data on this curriculum, our observations suggest that students generally enjoy their microcomputer experiences, and we believe these experiences significantly facilitate their understanding of course material.

REFERENCES

- ELLIOT, J. D., SRULL, T. K., DURNIN, M. W., & LEVY, C. M. (1983). *FIRM: Volume I. Nature of attitudes and attitude change*. [Computer program]. Iowa City, IA: CONDUIT.
- ELLIOT, J. D., WALKER, G. R., SRULL, T. K., FROMING, W. J., DURNIN, M. W., & LEVY, C. M. (1983). *FIRM: Volume II. Interpersonal dynamics* [Computer program]. Iowa City, IA: CONDUIT.
- HAY, J. C. (1985). *Psychworld* [Computer program]. New York: McGraw-Hill.
- HUMAN SYSTEMS DYNAMICS (1986a). *ANOVA II* [Computer program]. Northridge, CA: Author.
- HUMAN SYSTEMS DYNAMICS (1986b). *STATS PLUS* [Computer program]. Northridge, CA: Author.
- KEENAN, J. M., & KELLER, R. A. (1982). *Computer lab in memory and cognition* [Computer program]. Iowa City, IA: CONDUIT.
- KIRVAY, L., & MCCARLEY, S. (1985). *PFS: GRAPH* [Computer program]. Mountain View, CA: Software Publishing.
- LEVY, C. M., & DURNIN, M. (1981). *FIRM driver package* [Computer program]. Iowa City, IA: CONDUIT.
- LEVY, C. M., FISCHLER, I. S., & GRIGGS, R. A. (1979). *Laboratory in cognition and perception* [Computer program]. Iowa City, IA: CONDUIT.
- PERGAMON SOFTWARE (1987). *Manuscript manager: APA style* [Computer program]. Elmsford, NY: Author.
- POLTROCK, S. E., & FOLTZ, G. S. (1982). An experimental psychology laboratory system for the Apple II microcomputer. *Behavior Research Methods and Instrumentation*, **14**, 103-108.
- POLTROCK, S. E., & FOLTZ, G. S. (1988). APT PC and APT II: Experiment development systems for the IBM PC and Apple II. *Behavior Research Methods, Instruments, & Computers*, **20**, 201-205.
- TINKER, R. F. (1986). *Experiments in human physiology* [Computer program]. Bridgeport, CT: Queue.