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AUTHOR Hornby, Peter A.
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ABSTRACT

In 1987, a computerized laboratory component was incorporated into a traditional lower division, lecture-oriented, cognitive psychology course at State University of New York College at Plattsburgh. At first, eight computerized experiments were available for students to participate in as subjects, while students were simply assigned the activities to complete individually. Currently, however, one class period per week is dedicated to a laboratory/recitation session, with groups of six students discussing their experiences with the assigned experiments. Part of the next class session is then devoted to discussing the aggregated results of the experiment and critiquing its design. Because of the addition of the laboratory component, the course is now focused on understanding the process of doing cognitive psychology rather than simply learning about the products of previous research. The laboratory sessions provide increased active learning, increased peer interaction, more informal student and instructor roles, and additional methods of student evaluation. A description of 10 computerized laboratory activities used in the course is appended. (BCY)

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Peter A. Hornby

Psychology Department
SUNY College at Plattsburgh
Plattsburgh, NY 12901

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Peter A. Hornby
Department of Psychology
SUNY College at Plattsburgh
Plattsburgh, NY 12901
hornbypa@splava.cc.plattsburgh.edu

ABSTRACT

This paper describes how incorporating a computerized laboratory component into a traditional lower division, lecture oriented, cognitive psychology course has fundamentally transformed the way the course is being taught. The new laboratory-based course is motivated by different instructional goals, provides more active/constructive learning experiences, produces greater peer interaction, leads to more informal student teacher roles, and supports more diverse methods of evaluation. All of these changes have been evaluated positively by the students and appear to have contributed to an overall improvement of the course. Although achieving these modifications might have been possible without the addition of a computerized laboratory, it is clear that the addition of the laboratory has been a pivotal factor in leading to these changes.

Cognitive psychology deals with the scientific study of mental processes. This includes attention, perception, memory, reasoning, decision making, problem solving and language behavior. It is an area of psychology that uses fairly abstract theoretical concepts and employs fairly technical and sophisticated research procedures. Despite the difficulty of the material, most undergraduate psychology programs have at least one course in cognitive psychology as core component of their major requirements. At SUNY Plattsburgh, a freshman/sophomore level cognitive psychology course has been taught for the past 14 years and is taken by most psychology students as an elective part of their major requirements. One section is offered every semester and has an enrollment limit of 60 students. It is almost always fully enrolled.

For a number of years, the cognitive psychology course was taught without any hands on laboratory experiences. The class met three times a week in a small lecture hall, and class activities consisted primarily of lectures, student questions and occasional classroom demonstrations. The major instructional goal of the course was to provide students with an understanding of the theoretical and empirical foundations of current work in cognitive psychology. Presentation and discussion of the results of past research represented a core part of the material covered in the course. Students were assigned readings from a textbook, attended lectures which reviewed and supplemented the text, and were evaluated primarily by means of objective exams. Students also prepared a term paper dealing with a topic of their choice from within the field

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of cognitive psychology. These papers generally consisted of a review of several research studies related to a particular question. The focus of the course was on mastering basic content. In its original form, the cognitive psychology course can probably be considered to have employed a fairly traditional format for a large, lower division college class.

THE ADDITION OF COMPUTERIZED LABORATORY ACTIVITIES

In 1987, the availability of a small number of MS-DOS based microcomputers within the Psychology Department made possible the introduction of computerized laboratory activities as a component of the cognitive psychology course. Since many of the research techniques that are used in studying mental processes involve fairly abstract reasoning and are therefore potentially confusing, the opportunity for students to have some direct concrete experience with these methods suggested itself as a useful addition to the course. It was also believed that by engaging students in simulations of the research process, they would become more highly motivated to understand the theoretical foundations and to generate alternative explanations for the findings. To achieve this goal, packages of commercial software were purchased that contained a number of simulations of classic experiments in cognitive psychology. From this material, it was possible to identify a total of eight experiments that students could participate in as subjects.

Initial Use of Computers

In the early stages of the use of the computers, students were simply given an assignment to complete the series of activities at specified times throughout the semester. Since the department facility consisted of five MS DOS based machines, each located in an individual room, students worked on the activities alone under the supervision of an undergraduate teaching assistant. Students in the course came to the laboratory at an assigned time and obtained a disk and a prepared handout from the TA. The handouts contains instructions for completing the activity and a set of questions to be answered as a homework assignment. The computer activities themselves took 15 to 20 minutes to complete. After all students had completed the activity out of class, another 15 to 20 minutes of class time was allocated to presenting the aggregated class results and answering student questions prior to their completing the homework assignment. In this approach, which was used for two semesters, the computerized activities can best be considered to represent a small modification to the course. They did not play a particularly central role in terms of course time, course objectives, or course design. Questions about the laboratory activities were, however, included on the standard objective exams, and homework grades were factored in as a part of the students final course grade.

The Present Course

Although the introduction of computerized activities began as a relatively small change to the course, it has gradually resulted in a fundamentally different type of course. What follows is a description of the course as it is now being offered. The class still has an enrollment limit of 60 students who attend class three times per week. But what occurs in class as well as out of class is fundamentally different. On Monday and Wednesday, all students meet together for a fifty-minute class session. The remaining class period each week has now been changed into a laboratory/recitation session. From Wednesday to Friday, groups of six students meet together for a one-hour session under the supervision of an undergraduate teaching assistant. A listing of the specific laboratory activities currently being used is included in the Appendix. The laboratory facility has now been modified so that sixteen computers are housed in a single room. Because of the nature of the experiments, students still work individually to complete the activity, but following the activity, they discuss the experience with the other students in their group. These discussions are supervised by a

TA, and are facilitated by discussion questions that are included in a Laboratory Manual (Hornby, 1994) that is now part of the required text material for the course. The Manual, which contains a chapter for each activity, provides historical and theoretical background for the activity, specific instructions for completing the exercise, places for the students to record their results, discussion questions, and questions to be answered in the homework assignments. Individual student data are also stored anonymously on disc. With only six students in each laboratory group, it is possible for all students to become actively involved in discussing the exercise. Since they have just completed an activity that they usually do not completely understand, they are motivated to ask questions and discuss their experiences. The discussion sessions are active and students get to know one another quite well. Following the laboratory sessions, a significant part of the next class meeting is devoted to a presentation and discussion of the aggregated data, as well as a critique of the experimental design and a discussion of alternative interpretations of the data. Students then complete and turn in a written homework assignment from the manual at their next laboratory session. With 60 students in the course, there are 10 laboratory sections. Most semesters, three upper division students who have previously completed the course and done well, serve as TA's. These students meet once a week with the instructor to prepare for the week's laboratory activity, to discuss techniques for facilitating group interaction and to discuss guidelines for homework evaluation. Since approximately one-and-one-half class sessions per week are now devoted to the laboratory component of the course, the opportunity for lecturing has been significantly reduced. Because of this, students are now more dependent on the textbook as a source of learning the basic course content. A new textbook (Ellis & Hunt, 1993) has recently been adopted. This book is explicitly designed to focus in depth on "selected experiments and their implications for the conceptual issues rather than attempt an exhaustive survey of the empirical literature." In order to facilitate student's mastery of the textbook, the are provided with a study guide prepared by the instructor which is included as part of the laboratory manual. A part of the Monday class period is devoted to discussion and clarification of the material in the assigned reading. Explanations and examples are provided in response to questions, but this material is not typically covered in lectures. On Wednesday, a brief quiz on the reading, based heavily on the study guide, is given at the beginning of the class. The remainder of the Wednesday class is devoted to the presentation of a 35 to 40 minute lecture on a supplementary topic. In general, these lectures deal with the presentation and critique of research and theoretical issues related to topics covered in the text. Because about 50% of the course is now devoted to laboratory activities, the requirement of a term paper has been changed to a formal, written, laboratory report based on one of the first eight activities. This is a cooperative learning project with each lab group working together as a team to prepare their report. Guidelines for the preparation of this report as well as rules for the cooperative nature of the assignment are outlined in the Laboratory Manual. Finally, students are still required to take three objective examinations which cover text material, laboratory activities, and lecture presentations.

IMPACT OF COURSE CHANGES

Changes in Instructional Objectives

The course is now focused on understanding the process of doing cognitive psychology rather than simply learning about the products of previous research. There is greater emphasis on research design, interpretation of findings, and consideration of additional research issues. Helping students understand the transition from theory to research and back to theory is now a major goal. The acquisition of a working knowledge of basic concepts, vocabulary, and principles, has become a secondary goal.

Increased Active Learning

The laboratory sessions provide students with hands-on experience with classic research

studies in cognitive psychology. By taking the role of subjects, students are motivated to understand what they have done, what the research results might mean, and what alternative interpretations are possible. Laboratory discussions following the activities are lively, and students come to class primed to discuss the overall results. The homework assignments in the laboratory manual require the students to analyze and evaluate their own experience as well as the research design and the interpretation of the results. In addition, students must rely more heavily on acquiring knowledge from their reading assignments since they can not assume that this material will be presented in lecture.

Increased Peer Interaction

Once a week, students spend an hour in the laboratory in a small group setting. They actively discuss the material with each other and with their teaching assistant, and they often get together outside of class to work on their homework assignments. Students have also indicated that they frequently meet for study sessions to prepare for the weekly quizzes and the exams. The addition of a cooperative learning approach to preparing the formal laboratory report also necessitates peer interaction and results in a series of outside class meetings.

More Informal Student/Instructor Roles

Students learn from their own activities in the laboratory, from discussions with their peers and their teaching assistants and from reading the textbook. The instructor is only one of several sources of information, and appears to be perceived more as a facilitator and clarifier than as the primary source of learning. The decreased use of the lecture format has resulted in more informal class discussions. Students also seem more willing to indicate when they are having difficulties with the material. Perhaps this is because there is an atmosphere of questioning and considering alternatives, rather than learning correct answers.

Additional Methods of Student Evaluation

Student learning and performance are still evaluated by means of objective exams and a written term project. However, students now receive additional grades on twelve weekly quizzes and ten laboratory based homework assignments. They also receive a grade on the cooperatively prepared research report. More than one-third of the final course grade is now based on laboratory related activities.

CONCLUSIONS

The incorporation of a computerized laboratory component has resulted in a variety of course modifications. Although the extent to which the course would be reshaped by the addition of the computer-based activities was not originally foreseen, it is felt that the overall course has been improved by these changes. Course evaluations conducted throughout the period of change reflect positively on the directions that the course has taken. Although several of the changes that have occurred could have been implemented without the addition of computerized activities, it was this addition that served as the initial impetus. All of the subsequent changes can be considered accommodations that were necessary in order to allow the students to fully benefit from the learning experience available from the computer exercises. The potential for the utilization of computerized learning experiences is certainly not unique to psychology courses, and definitely not unique to cognitive psychology. The opportunity to use computers to provide hands-on activities, to support cooperative learning, and to provide active learning exercises is available in most disciplines. It is suggested, however, that simply adding these activities to a traditional course will not be as effective as allowing them to be a springboard for a major course overhaul. It is hoped that the example described in this paper will be instructive to faculty in who are considering the incorporation of computerized activities into a traditional lecture course.

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APPENDIX

Computerized Laboratory Activities

Lab #1 - Sensory Storage (Iconic Memory, COMPSYCH, Department of Psychology, SUNY, Plattsburgh, NY).
Subjects attempt to recall up to eight letters that are presented on the computer screen for 50 msec. Independent variables are whole vs. partial report, and immediate vs. delayed cue. Dependent variable is recall accuracy.

Lab #2 - Prototype Formation (Visual Memory, COMPSYCH, Department of Psychology, SUNY, Plattsburgh, NY).
Subjects attempt to discriminate between faces (and triangles) that were either included or not included in an array of 15 that were previously presented one at a time. Independent variables include type of stimulus (faces vs. triangles), whether the face (or triangle) was in the array, serial position for stimuli that were present, and type of prototype (attribute frequency or central tendency). Dependent variable is discrimination accuracy.

Lab #3 - Mental Imagery (Mental Rotation, Discovery Psychology, Life Science Associates, Bayshore, NY). Subjects are presented with a series of capital letter R's at each of 8 angles of rotation from the vertical. They must judge whether the R is normal or a mirror image of an R. Independent variable is angle of rotation of the stimulus. Dependent variable is median response time for accurate judgments.

Lab #4 - Levels of Processing (Levels of Processing I, Laboratory in Memory & Cognition, CONDUIT, The University of Iowa, Iowa City, IA). Subjects are presented with a series of words and asked to make judgments about physical letter patterns, sound patterns (rhyming) or meaning (category membership). They are subsequently given a surprise recognition test. Independent variable is the type of processing task (shallow, intermediate, deep). Dependent variable is recognition accuracy.

Lab #5 - Encoding Specificity (Encoding Specificity II, Laboratory in Memory & Cognition, CONDUIT, The University of Iowa, Iowa City, IA). Subjects are presented with word pairs that are remotely associated. They are instructed that the first word will be presented later as a recall cue for the second word. Using a between subjects design, subjects are subsequently, presented either with the initial cue words, a different set of cue words that are strongly associated with the target words, or no recall cues. The independent variable is the type of cue. The dependent variable is recall accuracy.

Lab #6 - Semantic Memory (Semantic Memory, Laboratory in Memory & Cognition, CONDUIT, The University of Iowa, Iowa City, IA). Subjects judge the truth value of simple statements about category membership (e.g. A parrot is a bird). The independent variables are whether the statement is true or false, the hierarchical relationship between the words, and the judged similarity between the concepts. The dependent variables are accuracy and response time.

Lab #7 - Concept Formation (Concept Formation, COMPSYCH, Dept. of Psychology, SUNY, Plattsburgh, NY).
Subjects are presented with a series of differently colored and sized geometric shapes and must attempt to determine which are instances of a concept. Independent variables include two vs. three dimensions of variation,

and (for a second experiment) whether the rule involved in conjunctive or disjunctive.

Lab #8 - Text Comprehension (Constructive Processes III, Laboratory in Memory & Cognition, CONDUIT, The University of Iowa, Iowa City, IA). Subjects read a series of fictitious advertisements that include claims about the products described. The independent variables are whether the statement was actually stated or pragmatically implied. The dependent variable is accuracy of discrimination between statements and implications.

Lab #9 - Problem Solving (River Crossing, COMPSYCH, Department of Psychology, SUNY, Plattsburgh, NY). Subjects must generate the necessary moves to transport 5 Hobbits and 5 Orcs across a river in a boat that has a capacity of 3. They can not violate the constraint that Orcs can never outnumber Hobbits in any location, and the boat must contain at least one individual. The independent variable is whether subjects are presented with a subgoal or not. The dependent variable is the number of trips required.

Lab #10 - Language Processing (Reading, Laboratory in Cognition & Perception, CONDUIT, The University of Iowa, Iowa City, IA). Subjects read a series of sentences presented one word at a time on the screen. Subjects are instructed to read as fast as they can but to achieve comprehension. They are tested for comprehension after each sentence. Independent variables include part of speech, voice (active/passive), practice, and position of phrase boundary. The dependent variable is reading time per word.